

Technical Note 336

Subject:	Mine working investigation		
Reference:	5041216-REM-TN-000336	Revision:	1
Author:	Alex Mann	Checker:	Howel Morris
Issued to:	Coal Authority, St Modwen Developments and Prosurv	Reviewer:	Michelle Lee
Date:	June 2010	Authoriser:	Mike Poland

Introduction

The former Llandarcy Oil Refinery in Neath, South Wales is currently under redevelopment as Coed Darcy Urban Village by St. Modwen Developments Ltd. At the time of writing, the Masterplanning exercise is being finalised and detailed information on proposed development layouts and levels within the final site are not yet known.

The refinery has been previously investigated on a number occasions by the previous site owners (BP), however, in July, further investigation was carried out by Atkins to further investigate the potential for shallow coal/mineworkings beneath the initial phases of redevelopment at the site, namely the 'Demonstration Village' and the 'Trial Areas/first 600' (refer to Drawing 5041216/REM/DWG/000494 attached).

In order to enable this 'preliminary' investigation to be undertaken, Atkins applied for appropriate Coal Authority Permission (ref. 5041216-REM-OUT-218). Coal Authority permission (ref.4533) was issued on the 21st July 2009.

Due to the need for further investigative works, this document has been prepared as a summary of the works to date. Full details of all assessment relating to the potential for shallow mineworkings and/or recorded mine entries will be documented for each phase of the proposed redevelopment as the works progress.

Background

Geological maps (BGS Sheet 247, 1:50,000 and Sheet 79 NW, 1:10,560) indicate the Hughes and Bodwr seam to subcrop along part of the southern boundary of the former refinery and dipping towards the north (refer to Drawing 5041216/REM/DWG/000494). The Hughes Seam is indicated as being an average thickness of 3ft (approximately 1m) and the overlying Bodwr seam is recorded as being an average of between 3ft and 6ft (approximately 1-2m). Historical maps record a colliery (*cwert y bettws*) to the east of the former refinery, on the opposite side of the B4290.

A Ground Stability report for the former refinery (ref.00056014-08) indicates that the site is in the likely zone of influence from workings in 4 seams of coal at shallow to 180m depth, and last worked in 1914. Within, or within 20 metres of, the boundary of the property there are 25 mine entries highlighted in the report.

A separate Coal Authority Mining Report (ref.00040665-08) obtained prior to demolition of the former Bath House in the eastern part of the former refinery, indicates that the *"property lies within the likely zone of influence from workings in 2 seams of coal at 40m to 90m depth and last worked in 1909"*.

A further Coal Authority Mining Report (ref.00008739-09) obtained as part of the assessment of the proposed 'Demonstration Village' plot does not indicate any recorded workings or mine entries at this location. The nearest subcrop to this location shown on geological maps is the Swansea 3 feet seam which lies to the north, however the geological succession records a series of older seams that could potentially exist at shallow depth beneath this area.

Preliminary Investigation

A total of 11 no. rotary (open) boreholes were drilled to depths of between 24m and 50m bgl, the locations of which are shown on Drawing 5041216/REM/DWG/000494. Copies of relevant borehole logs are attached.

Four of these boreholes (RO1–3 and 12) were installed with gas/groundwater standpipes for subsequent monitoring. Boreholes without installations were grouted on completion. Any groundwater installations will ultimately be grouted up on as the redevelopment of the refinery progresses.

A summary of the coal identified during the works found is presented in Table 1. The name of the likely seams represented is suggested in brackets.

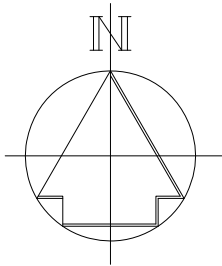
Table 1: Summary of coal identified during the works

Borehole	Approximate Grid Ref		Total Depth (mbgl)	Identified coal (mbgl)
RO1	270182	195275	45	NE
RO2	270271	195345	35	NE
RO3	270272	195166	35	NE
RO4	270971	195620	30	NE
RO5	271092	195549	30	NE
RO6	271450	195592	24	21.60 – 22.00 (Bodwr seam)
RO7	271477	195769	30	26.20 – 26.50 (Bodwr seam)
RO8	271705	195771	25	12.80 – 13.10 (Bodwr seam) 13.70 – 13.90 (Bodwr seam) 14.50 – 14.70 (Bodwr seam/ Hughes seam?)
RO9	271705	195838	40	NE
RO11	271887	195997	50	NE
RO12	271685	196003	50	NE

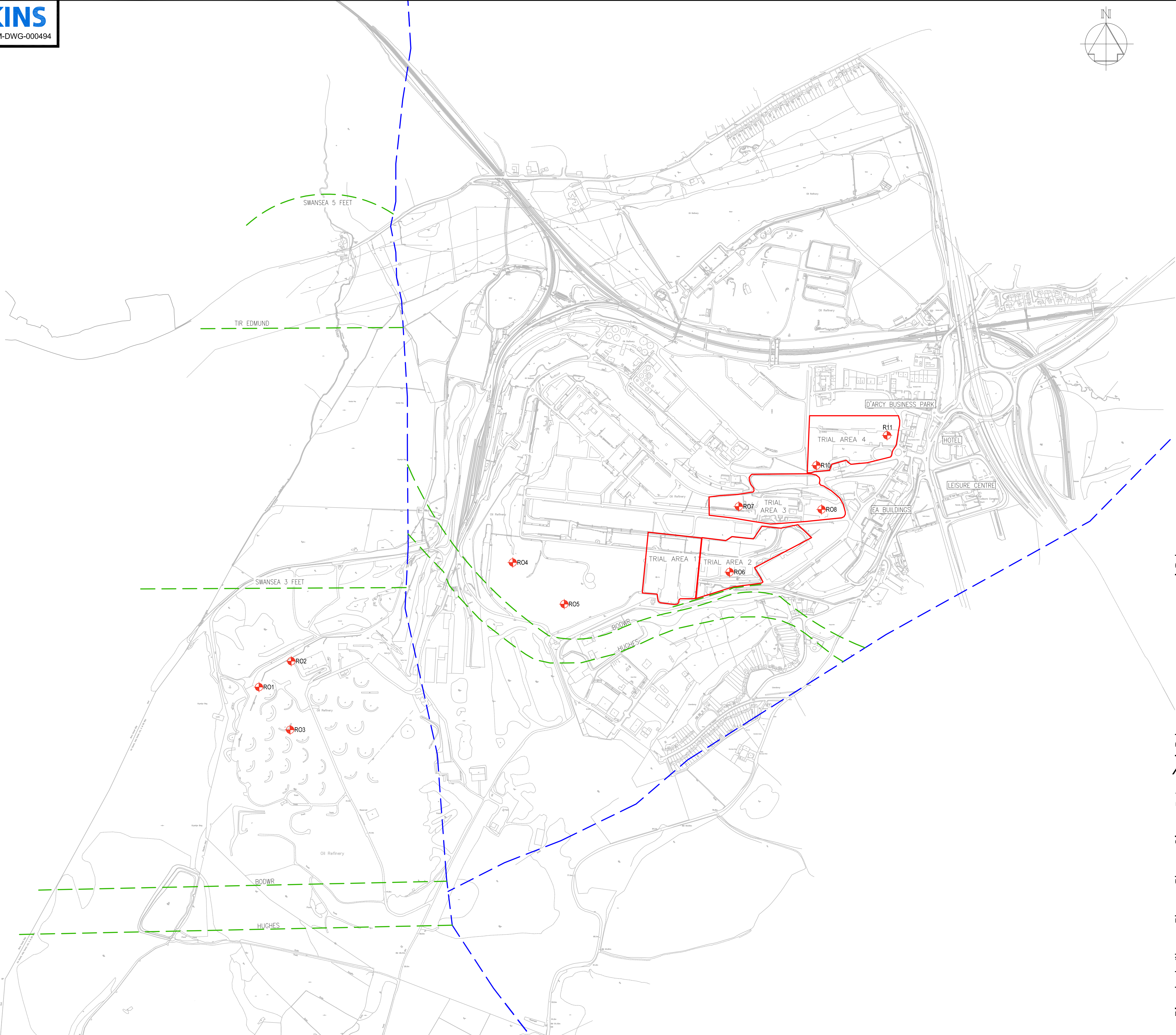
Conclusions and Outstanding Works

Based on the findings of the preliminary investigation, no evidence of any shallow workings has been identified beneath either the top terrace or the Demonstration Village plot. This will be confirmed by further investigation, as necessary.

A number of shafts/adits exist around the site. It is anticipated that these will form the next phase of investigation relating to historical mining beneath the site. Due to the depth to rockhead and the presence of existing infrastructure (roads etc) the potential for geophysical survey surrounding each of the recorded locations is currently being explored. Appropriate permission will be sought prior to the start of any intrusive works at these locations.



- LEGEND:
- PROPOSED TRIAL AREA BOUNDARY
 - BOREHOLE LOCATION POINTS
 - DV DEMONSTRATION VILLAGE
 - RO ROTERY
 - SBH SENTINEL WELLS
 - TA1 TRIAL AREA 1
 - DME D'IME AREA
 - FAULT
 - COAL CROP



REVISIONS	Drawn By	Checked By	Date

CONTRACTORS – FOR PRICING	–	ML	03/06/09
PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

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THIS DRAWING IS NOT TO BE SCALED

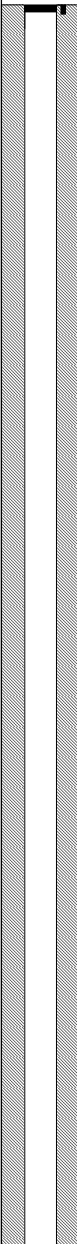
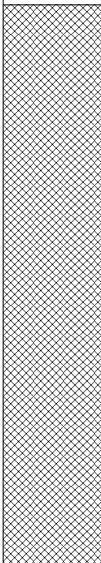
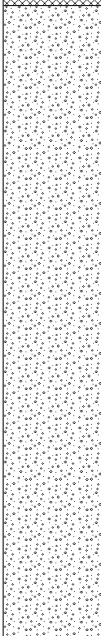
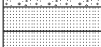
CLIENT

ST.MODWEN

PROJECT

COED DARCY URBAN VILLAGE DEVELOPMENT

DRAWING TITLE			
MINE WORKING BOREHOLE LOCATION PLAN (GI REF 357)			
Scales	DRAWN	CHECKED	CO-ORD CHECK
	JSD	AM	-
1 : 5000	DATE	DATE	DATE
	20/05/09	20/05/09	15/06/09
0		SHEET	PLOT DATE
DRAWING NO		A1	REV
5041216-REM-DWG-000494		-	

REC Geotechnical Log							Borehole: RO1		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 22 & 23/07/09		
Installat ion	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : Compact fill.			1.00	1.00				
				2.00	2.00				
				3.00	3.00				
				4.00	4.00				
		-4.60		5.00	5.00				
	SAND and GRAVEL. (Slow penetration).			6.00	6.00				
				7.00	7.00				
				8.00	8.00				
				9.00	9.00				
		-9.80			10.00				10.00
	Sandstone BOULDER.	-10.00							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 33.00m. Water encountered @ 30.00m. Notes Strong odour of diesel/oil from GL to 4.60m.									Logged by: AD Scale: FIG:

REC Geotechnical Log						Borehole: RO1			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 22 & 23/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Sandstone BOULDER.	-10.50							
	Soft CLAY with bands of grey mudstone.			11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
	Grey SANDSTONE.	-16.30							
		-16.50							
	Hard, grey SANDSTONE. (Slow penetration).			17.00	17.00				
				18.00	18.00				
				19.00	19.00				
				20.00	20.00				
			-20.00						

Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test

Remarks

63mm diameter standpipe installed to 33.00m.
Water encountered @ 30.00m.

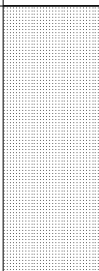
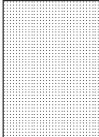
Notes

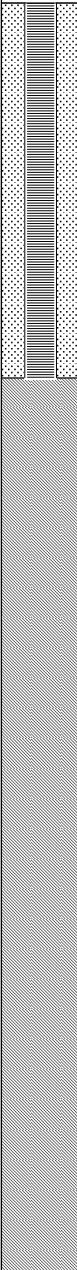
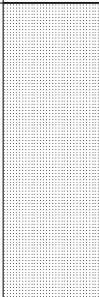
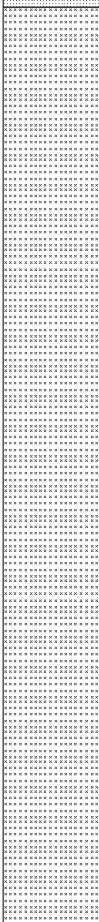
Strong odour of diesel/oil from GL to 4.60m.

Logged by: AD

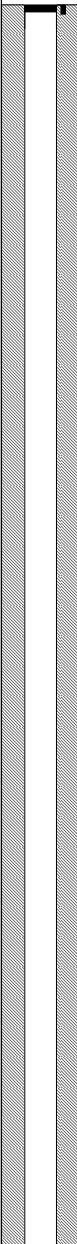
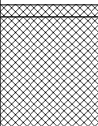
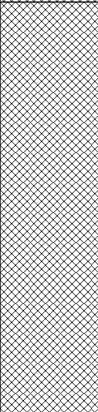
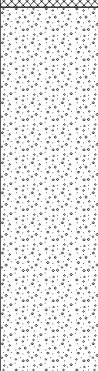
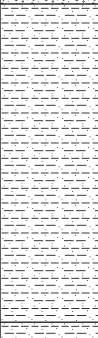
Scale:

FIG:

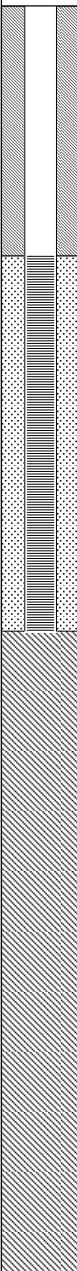
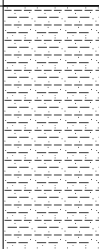
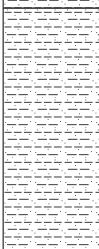
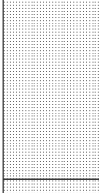
REC Geotechnical Log						Borehole: RO1			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig						
			Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 22 & 23/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Hard, grey SANDSTONE. (Slow penetration).			21.00	21.00				
		-22.30		22.00	22.00				
	Dark grey MUDSTONE.								
		-23.10		23.00	23.00				
	Hard, grey SANDSTONE. (Slow penetration).								
		-24.30		24.00	24.00				
	Grey MUDSTONE.								
		-25.70		25.00	25.00				
	Hard, grey SANDSTONE. (Slow penetration).			26.00	26.00				
		-26.50							
	Grey MUDSTONE.			27.00	27.00				
				28.00	28.00				
		-28.90		29.00	29.00				
	Grey SANDSTONE.								
		-30.00		30.00	30.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 33.00m. Water encountered @ 30.00m. Notes Strong odour of diesel/oil from GL to 4.60m.						Logged by: AD Scale: FIG:			

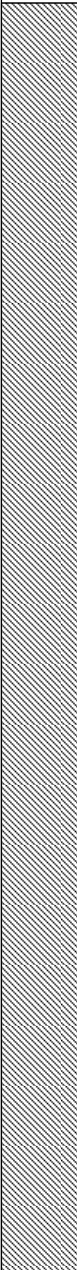
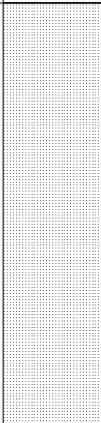
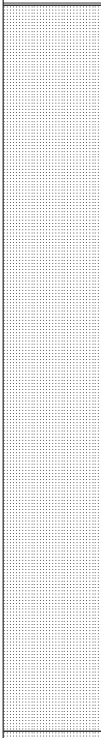
REC Geotechnical Log							Borehole: RO1				
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)								
Client: St Modwen			Ground Level:		Coordinates:		Date: 22 & 23/07/09				
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records			
					Depth	Sample			Test		
						Type	No.				
	Grey SANDSTONE.	-32.40		31.00	31.00						
				32.00	32.00						
	Black SILTSTONE with grey sandstone bands. (Very slow penetration).			33.00	33.00						
				34.00	34.00						
				35.00	35.00						
				36.00	36.00						
				37.00	37.00						
				38.00	38.00						
				39.00	39.00						
				40.00	40.00						
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 33.00m. Water encountered @ 30.00m. Notes Strong odour of diesel/oil from GL to 4.60m.										Logged by: AD	
										Scale:	
										FIG:	

REC Geotechnical Log						Borehole: RO1			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 22 & 23/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Black SILTSTONE with grey sandstone bands. (Very slow penetration).			41.00	41.00				
				42.00	42.00				
				43.00	43.00				
				44.00	44.00				
				-45.00					
	End of Log			45.00	45.00				
				46.00	46.00				
				47.00	47.00				
				48.00	48.00				
				49.00	49.00				
				50.00	50.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 33.00m. Water encountered @ 30.00m. Notes Strong odour of diesel/oil from GL to 4.60m.						Logged by: AD			
						Scale:			
						FIG:			

REC Geotechnical Log							Borehole: RO2		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 20 & 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : Topsoil.								
	MADE GROUND : Concrete.								
		-1.00		1.00	1.00				
	MADE GROUND : Soft, dark brown CLAY. (Poor returns).								
		-4.40		4.00	4.00				
	Brown SAND and GRAVEL. (Slow penetration).								
	-7.40		7.00	7.00					
Soft, sandy CLAY with gravel bands.									
	-10.00		10.00	10.00					

Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test			Logged by: AD		
Remarks			Scale:		
63mm diameter standpipe installed to 15.00m. Water strike @ 22.00m					
Notes			FIG:		
Drill bit damaged on extraction from hole. Strong diesel odour @ 6.90m. Diesel odour @ 13.00m.					

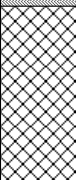
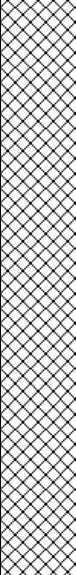
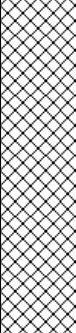
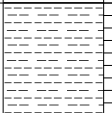
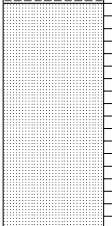
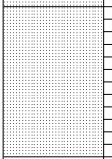
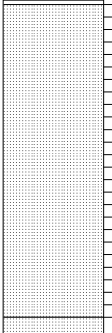
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 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig								
Client: St Modwen			Location: Coed Darcy, Neath (80132)								
			Ground Level:		Coordinates:		Date: 20 & 21/07/09				
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests				Field Records		
					Depth	Sample		Test			
						Type	No.				
	Soft, sandy CLAY with gravel bands.	-12.80		11.00	11.00						
				12.00	12.00						
				13.00	13.00						
				14.00	14.00						
	Brown, sandy CLAY with mudstone bands.			15.00	15.00						
		16.00		16.00							
		17.00		17.00							
		18.00		18.00							
	Grey MUDSTONE.	-17.30		19.00	19.00						
	Grey SILTSTONE/SANDSTONE. (Slow penetration).	-17.80		20.00	20.00						
		-20.00									
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 15.00m. Water strike @ 22.00m Notes Drill bit damaged on extraction from hole. Strong diesel odour @ 6.90m. Diesel odour @ 13.00m.								Logged by: AD			
								Scale:			
								FIG:			

REC Geotechnical Log						Borehole: RO2			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig						
			Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 20 & 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SILTSTONE/SANDSTONE. (Slow penetration).			21.00	21.00				
				22.00	22.00				
				23.00	23.00				
		-23.40							
	Grey MUDSTONE. (Fast penetration).			24.00	24.00				
		-24.20							
	Grey SILTSTONE/SANDSTONE with mudstone bands. (Slow penetration).			25.00	25.00				
				26.00	26.00				
				27.00	27.00				
				28.00	28.00				
				29.00	29.00				
		-30.00		30.00	30.00				

Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test				Logged by: AD	
Remarks 63mm diameter standpipe installed to 15.00m. Water strike @ 22.00m				Scale:	
Notes Drill bit damaged on extraction from hole. Strong diesel odour @ 6.90m. Diesel odour @ 13.00m.				FIG:	

REC Geotechnical Log							Borehole: RO2		
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 20 & 21/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SILTSTONE/SANDSTONE with mudstone bands. (Slow penetration).			31.00	31.00				
				32.00	32.00				
				33.00	33.00				
				34.00	34.00				
				35.00	35.00				
				36.00	36.00				
				37.00	37.00				
				38.00	38.00				
				39.00	39.00				
				40.00	40.00				
	End of Log	-35.00							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test					Logged by: AD				
Remarks 63mm diameter standpipe installed to 15.00m. Water strike @ 22.00m					Scale:				
Notes Drill bit damaged on extraction from hole. Strong diesel odour @ 6.90m. Diesel odour @ 13.00m.					FIG:				

REC Geotechnical Log						Borehole: RO3			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 23/07/09			
Installat ion	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : Compact fill.			1.00	1.00				
				2.00	2.00				
				3.00	3.00				
		-3.40							
	Brown CLAYS.	-3.90		4.00	4.00				
	SILTSTONE boulder. (Slow penetration).			5.00	5.00				
		-5.80		6.00	6.00				
	CLAYS with gravel beds/silts at 9.00m.			7.00	7.00				
				8.00	8.00				
			9.00	9.00					
		-10.00		10.00	10.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 10.50m. Water encountered from 10.00m. Notes						Logged by: AD Scale: FIG:			

REC Geotechnical Log						Borehole: RO3			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig						
			Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 23/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests				Field Records
					Depth	Sample		Test	
						Type	No.		
    	Boulder CLAYS with gravel beds/silts at 9.00m.	-10.90							
	Grey SANDSTONE.			11.00	11.00				
				12.00	12.00				
	Brown SANDSTONE.	-12.90		13.00	13.00				
	MUDSTONE with coal traces. (Fast penetration).	-14.10		14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
	Brown SANDSTONE. (Slow penetration).	-17.50		18.00	18.00				
				19.00	19.00				
		-20.00		20.00	20.00				
Notes: U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test							Logged by: AD		
Remarks 63mm diameter standpipe installed to 10.50m. Water encountered from 10.00m.							Scale:		
Notes							FIG:		

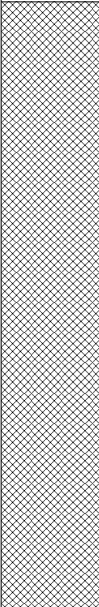
REC Geotechnical Log						Borehole: RO3			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 23/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Brown SANDSTONE. (Slow penetration).	-21.10		21.00	21.00				
	Grey MUDSTONE.			22.00	22.00				
				23.00	23.00				
		Brown SANDSTONE. (Slow penetration).	-23.70		24.00	24.00			
				25.00	25.00				
				26.00	26.00				
				27.00	27.00				
				28.00	28.00				
				29.00	29.00				
				30.00	30.00				
	-30.00								
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 10.50m. Water encountered from 10.00m. Notes						Logged by: AD Scale: FIG:			

REC Geotechnical Log							Borehole: RO3		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 23/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Brown SANDSTONE. (Slow penetration.								
				31.00	31.00				
				32.00	32.00				
				33.00	33.00				
				34.00	34.00				
		-35.00		35.00	35.00				
	End of Log			36.00	36.00				
				37.00	37.00				
				38.00	38.00				
				39.00	39.00				
				40.00	40.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks 63mm diameter standpipe installed to 10.50m. Water encountered from 10.00m. Notes							Logged by: AD		
							Scale:		
							FIG:		

REC Geotechnical Log						Borehole: RO4		
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen		Ground Level:		Coordinates:		Date: 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records
					Depth	Sample Type No.	Test	
	Ground Surface	0.00		0.00	0.00			
	MADE GROUND : GRAVEL/CLAY fill.	-0.50						
	Grey SANDSTONE.							
				1.00	1.00			
				2.00	2.00			
				3.00	3.00			
				4.00	4.00			
				5.00	5.00			
				6.00	6.00			
				7.00	7.00			
			8.00	8.00				
			9.00	9.00				
		-10.10		10.00	10.00			
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes						Logged by: AD		
						Scale:		
						FIG:		

REC Geotechnical Log							Borehole: RO4		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
		-20.20		20.00	20.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes							Logged by: AD		
							Scale:		
							FIG:		

REC Geotechnical Log						Borehole: RO4		
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen		Ground Level:		Coordinates:		Date: 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records
					Depth	Sample Type No.	Test	
	Grey SANDSTONE.	-21.00						
	Grey MUDSTONE with sandstone bands.			21.00	21.00			
				22.00	22.00			
				23.00	23.00			
				24.00	24.00			
				25.00	25.00			
				26.00	26.00			
				27.00	27.00			
				28.00	28.00			
				29.00	29.00			
				30.00	30.00			
		End of Log	-30.00					
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes							Logged by: AD Scale: FIG:	

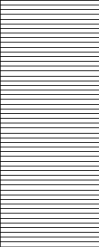
REC Geotechnical Log						Borehole: RO5			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 21/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : GRAVEL/SOIL/CLAY fill.			1.00	1.00				
				2.00	2.00				
				3.00	3.00				
				4.00	4.00				
				5.00	5.00				
	Grey SANDSTONE with mudstone bands.	-5.00		6.00	6.00				
				7.00	7.00				
				8.00	8.00				
				9.00	9.00				
		-10.10	10.00	10.00					
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes						Logged by: AD			
						Scale:			
						FIG:			

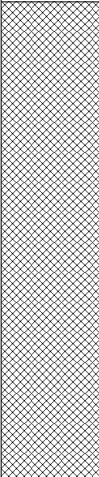
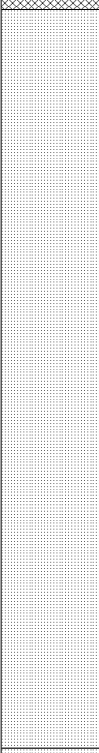
REC Geotechnical Log							Borehole: RO5		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 21/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE with mudstone bands.								
				11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
		-20.20		20.00	20.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes							Logged by: AD		
							Scale:		
							FIG:		

REC Geotechnical Log						Borehole: RO5			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 21/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE with mudstone bands.	-21.00							
	Grey SANDSTONE with mudstone bands.			21.00	21.00				
				22.00	22.00				
				23.00	23.00				
				24.00	24.00				
				25.00	25.00				
				26.00	26.00				
				27.00	27.00				
				28.00	28.00				
				29.00	29.00				
			-30.00		30.00	30.00			
End of Log									
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes						Logged by: AD Scale: FIG:			

REC Geotechnical Log						Borehole: RO6			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 22/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : GRAVEL/STONE/CLAY.			1.00	1.00				
				2.00	2.00				
		-2.50							
	MADE GROUND : SANDSTONE boulder.	-3.00		3.00	3.00				
	MADE GROUND : GRAVEL/CLAY fill.			4.00	4.00				
				5.00	5.00				
		-5.50		6.00	6.00				
	Grey SANDSTONE with mudstone bands.			7.00	7.00				
				8.00	8.00				
			9.00	9.00					
		-10.00		10.00	10.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 24.00m Notes						Logged by: AD Scale: FIG:			

REC Geotechnical Log							Borehole: RO6		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 22/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE with mudstone bands.								
				11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
		-20.00		20.00	20.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 24.00m Notes							Logged by: AD		
							Scale:		
							FIG:		

REC Geotechnical Log						Borehole: RO6								
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)												
Client: St Modwen		Ground Level:		Coordinates:		Date: 22/07/09								
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records						
					Depth	Sample			Test					
						Type	No.							
	Grey SANDSTONE with mudstone bands.	-21.60 -22.00		21.00	21.00									
	COAL with fine mudstone trace.			22.00	22.00									
	Grey MUDSTONE.			23.00	23.00									
	End of Log	-24.00		24.00	24.00									
				25.00	25.00									
				26.00	26.00									
				27.00	27.00									
				28.00	28.00									
				29.00	29.00									
				30.00	30.00									
				Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test					Logged by: AD					
				Remarks Water encountered from 18.00m to 24.00m					Scale:					
Notes					FIG:									

REC Geotechnical Log						Borehole: RO7		
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen		Ground Level:		Coordinates:		Date: 24/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records
					Depth	Sample Type No.	Test	
	Ground Surface	0.00		0.00	0.00			
	MADE GROUND : CLAY/SOIL/GRAVEL fill.			1.00	1.00			
				2.00	2.00			
				3.00	3.00			
				4.00	4.00			
	Grey SANDSTONE.	-4.00		5.00	5.00			
				6.00	6.00			
				7.00	7.00			
				8.00	8.00			
				9.00	9.00			
				10.00	10.00			
		-10.10						
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Hydrocarbon odour in fill to 4.00m. Notes						Logged by: AD		
						Scale:		
						FIG:		

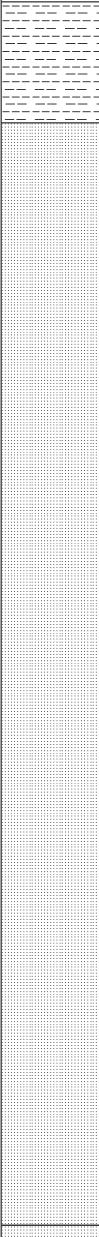
REC Geotechnical Log							Borehole: RO7		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 24/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
		-20.20		20.00	20.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Hydrocarbon odour in fill to 4.00m. Notes							Logged by: AD		
							Scale:		
							FIG:		

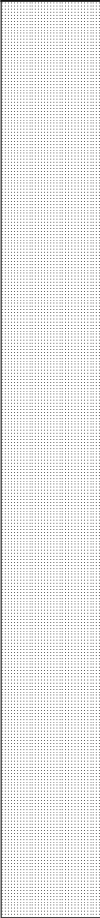
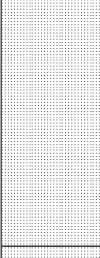
REC Geotechnical Log						Borehole: RO7			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 24/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample Type No.	Test		
	Grey SANDSTONE.				21.00	21.00			
					22.00	22.00			
					23.00	23.00			
					24.00	24.00			
					25.00	25.00			
					26.00	26.00			
	COAL.	-26.20							
	Grey SANDSTONE with mudstone bands.	-26.50							
					27.00	27.00			
					28.00	28.00			
				29.00	29.00				
				30.00	30.00				
	End of Log	-30.00							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test						Logged by: AD			
Remarks Hydrocarbon odour in fill to 4.00m.						Scale:			
Notes						FIG:			

REC Geotechnical Log							Borehole: RO8		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 23/07/09		
Installat ion	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : STONE fill. Brown SANDSTONE.	-0.30							
				1.00	1.00				
				2.00	2.00				
				3.00	3.00				
				4.00	4.00				
	Grey SANDSTONE.	-4.10							
				5.00	5.00				
				6.00	6.00				
				7.00	7.00				
				8.00	8.00				
				9.00	9.00				
		-10.00		10.00	10.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes							Logged by: AD		
							Scale:		
							FIG:		

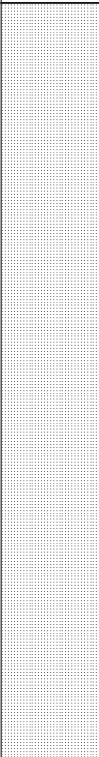
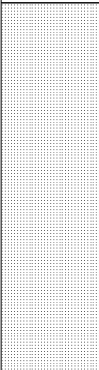
REC Geotechnical Log						Borehole: RO8			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 23/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				11.00	11.00				
				12.00	12.00				
		-12.80							
	COAL.	-13.10		13.00	13.00				
	Grey SANDSTONE.								
		-13.70							
	COAL.	-13.90		14.00	14.00				
	Grey SANDSTONE.								
		-14.50							
	COAL.	-14.70		15.00	15.00				
	Grey SANDSTONE.								
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
			-20.00		20.00	20.00			
	Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Notes								Logged by: AD Scale: FIG:

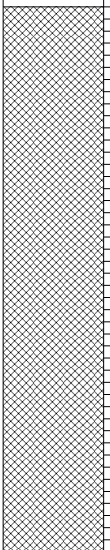
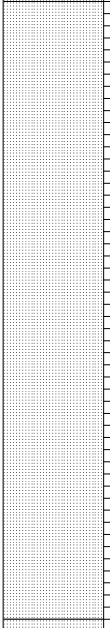
REC Geotechnical Log							Borehole: RO8								
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)												
Client: St Modwen			Ground Level:		Coordinates:		Date: 23/07/09								
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records							
					Depth	Sample Type No.	Test								
	Grey SANDSTONE.	-25.00		21.00	21.00										
	22.00			22.00											
	23.00			23.00											
	24.00			24.00											
	25.00			25.00											
	26.00			26.00											
	27.00			27.00											
	28.00			28.00											
	29.00			29.00											
	30.00			30.00											
	End of Log														
	Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test									Logged by: AD					
	Remarks									Scale:					
Notes								FIG:							

REC Geotechnical Log						Borehole: RO9			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 27/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample Type No.	Test		
	Ground Surface	0.00		0.00	0.00				
	Brown CLAY.								
		-1.00		1.00	1.00				
	Grey SANDSTONE.			2.00	2.00				
				3.00	3.00				
				4.00	4.00				
				5.00	5.00				
				6.00	6.00				
				7.00	7.00				
				8.00	8.00				
		9.00	9.00						
		-10.10		10.00	10.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 19.00m, and from 33.00m to 34.00m Hole backfilled with bentonite on completion. Notes								Logged by: AD Scale: FIG:	

REC Geotechnical Log							Borehole: RO9			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen			Ground Level:		Coordinates:		Date: 27/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records		
					Depth	Sample Type No.	Test			
	Grey SANDSTONE.			11.00	11.00					
				12.00	12.00					
				13.00	13.00					
				14.00	14.00					
				15.00	15.00					
				16.00	16.00					
				17.00	17.00					
		-17.50								
	Grey MUDSTONE.				18.00	18.00				
		-18.20								
Grey SANDSTONE.			19.00	19.00						
			20.00	20.00						
	-20.20									
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 19.00m, and from 33.00m to 34.00m Hole backfilled with bentonite on completion. Notes							Logged by: AD Scale: FIG:			

REC Geotechnical Log							Borehole: RO9		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 27/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				21.00	21.00				
				22.00	22.00				
				23.00	23.00				
				24.00	24.00				
				25.00	25.00				
				26.00	26.00				
				27.00	27.00				
				28.00	28.00				
				29.00	29.00				
				30.00	30.00				
		-30.30							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test							Logged by: AD		
Remarks							Scale:		
Water encountered from 18.00m to 19.00m, and from 33.00m to 34.00m Hole backfilled with bentonite on completion.							FIG:		
Notes									

REC Geotechnical Log						Borehole: RO9			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 27/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.			31.00	31.00				
				32.00	32.00				
				33.00	33.00				
				34.00	34.00				
				35.00	35.00				
				36.00	36.00				
	Grey MUDSTONE.	-36.40							
		-37.00		37.00	37.00				
	Grey SANDSTONE.			38.00	38.00				
				39.00	39.00				
				40.00	40.00				
	End of Log	-40.00							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test						Logged by: AD			
Remarks Water encountered from 18.00m to 19.00m, and from 33.00m to 34.00m Hole backfilled with bentonite on completion.						Scale:			
Notes						FIG:			

REC Geotechnical Log						Borehole: RO11			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 29/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : Sandy CLAY with gravel.			1.00	1.00				
				2.00	2.00				
				3.00	3.00				
				4.00	4.00				
	Grey, weathered SANDSTONE.	-4.50							
	Grey SANDSTONE.	-5.00		5.00	5.00				
				6.00	6.00				
				7.00	7.00				
				8.00	8.00				
				9.00	9.00				
		10.00		10.00					
	-10.10								

Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test

Remarks

Water encountered from 18.00m to 50.00m.
Hole backfilled with bentonite on completion.

Notes

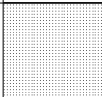
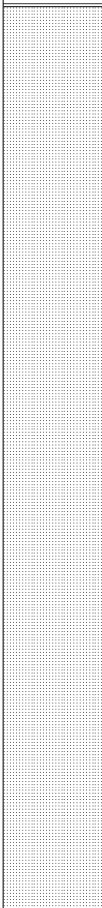
Hydrocarbon odour from 0.50m.

Logged by: AD

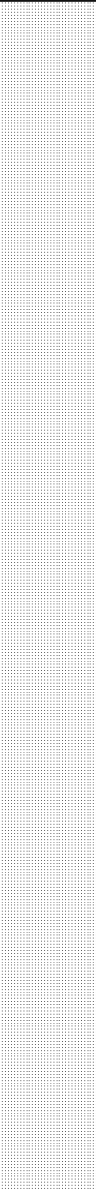
Scale:

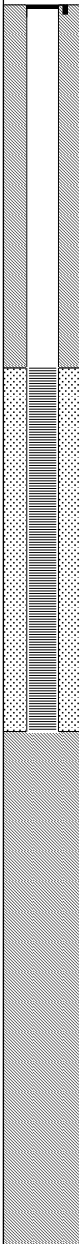
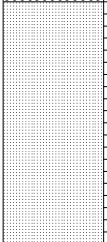
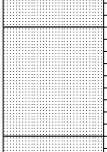
FIG:

REC Geotechnical Log							Borehole: RO11		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 29/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
		-20.20		20.00	20.00				
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 50.00m. Hole backfilled with bentonite on completion. Notes Hydrocarbon odour from 0.50m.							Logged by: AD		
							Scale:		
							FIG:		

REC Geotechnical Log							Borehole: RO11		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 29/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.	-21.00							
	Grey MUDSTONE.								
			-23.00						
	Grey SANDSTONE.								
									
		-30.30							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 50.00m. Hole backfilled with bentonite on completion. Notes Hydrocarbon odour from 0.50m.								Logged by: AD Scale: FIG:	

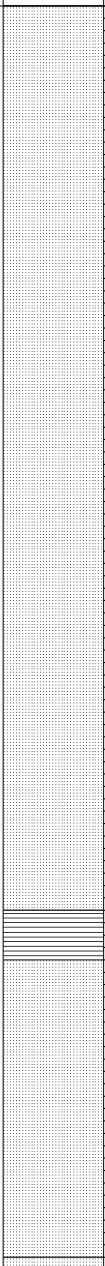
REC Geotechnical Log							Borehole: RO11		
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 29/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.								
				31.00	31.00				
				32.00	32.00				
				33.00	33.00				
				34.00	34.00				
				35.00	35.00				
				36.00	36.00				
				37.00	37.00				
				38.00	38.00				
				39.00	39.00				
				40.00	40.00				
		-40.40							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 18.00m to 50.00m. Hole backfilled with bentonite on completion. Notes Hydrocarbon odour from 0.50m.							Logged by: AD Scale: FIG:		

REC Geotechnical Log						Borehole: RO11					
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)									
Client: St Modwen		Ground Level:		Coordinates:		Date: 29/07/09					
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records			
					Depth	Sample Type No.	Test				
	Grey SANDSTONE.			41.00	41.00						
				42.00	42.00						
				43.00	43.00						
				44.00	44.00						
				45.00	45.00						
				46.00	46.00						
				47.00	47.00						
				48.00	48.00						
				49.00	49.00						
				50.00	50.00						
				End of Log	-50.00					50.00	50.00
				Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test							
	Remarks Water encountered from 18.00m to 50.00m. Hole backfilled with bentonite on completion. Notes Hydrocarbon odour from 0.50m.						Logged by: AD				
Scale:											
FIG:											

REC Geotechnical Log						Borehole: RO12			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 27 & 28/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Ground Surface	0.00		0.00	0.00				
	MADE GROUND : SAND and GRAVEL fill.			1.00	1.00				
				2.00	2.00				
				3.00	3.00				
				4.00	4.00				
				5.00	5.00				
				6.00	6.00				
		-7.00		7.00	7.00				
	Brown SANDSTONE.			8.00	8.00				
				9.00	9.00				
		-9.20		10.00	10.00				
	Grey SANDSTONE.								
		-10.10							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test									Logged by: AD Scale: FIG:
Remarks Water encountered from 1.00m to 50.00m. Strong odour from 1.00m to 7.00m. 63mm diameter standpipe installed to 6.00m									
Notes									

REC Geotechnical Log						Borehole: RO12			
 Resource & Environmental Consultants Ltd.		Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen		Ground Level:		Coordinates:		Date: 27 & 28/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.			11.00	11.00				
				12.00	12.00				
				13.00	13.00				
				14.00	14.00				
				15.00	15.00				
				16.00	16.00				
				17.00	17.00				
				18.00	18.00				
				19.00	19.00				
				20.00	20.00				
				-20.20					
				Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 1.00m to 50.00m. Strong odour from 1.00m to 7.00m. 63mm diameter standpipe installed to 6.00m Notes					

REC Geotechnical Log							Borehole: RO12								
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)												
Client: St Modwen			Ground Level:		Coordinates:		Date: 27 & 28/07/09								
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records							
					Depth	Sample			Test						
						Type	No.								
	Grey SANDSTONE.			21.00	21.00										
				22.00	22.00										
				23.00	23.00										
				24.00	24.00										
				25.00	25.00										
				26.00	26.00										
				27.00	27.00										
				28.00	28.00										
				29.00	29.00										
				30.00	30.00										
					-30.30										
				Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 1.00m to 50.00m. Strong odour from 1.00m to 7.00m. 63mm diameter standpipe installed to 6.00m Notes							Logged by: AD Scale: FIG:				

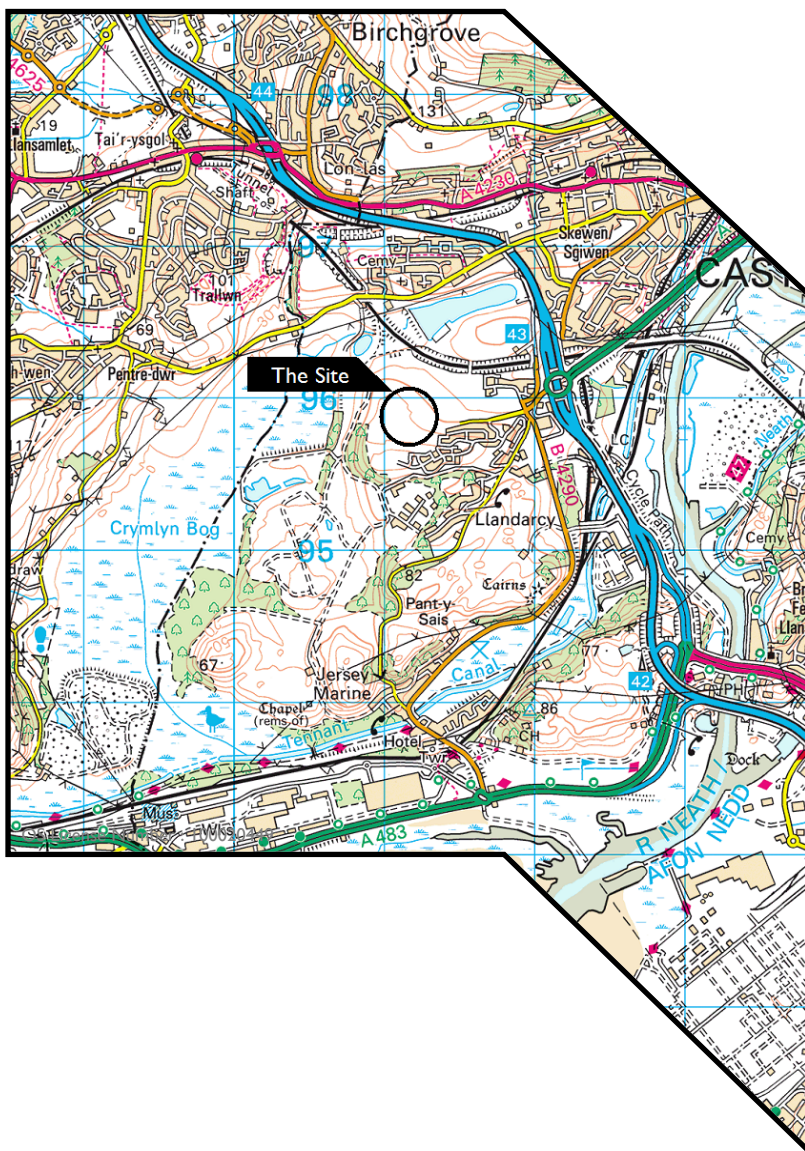
REC Geotechnical Log							Borehole: RO12			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)							
Client: St Modwen			Ground Level:		Coordinates:		Date: 27 & 28/07/09			
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records		
					Depth	Sample			Test	
						Type	No.			
	Grey SANDSTONE.			31.00	31.00					
				32.00	32.00					
				33.00	33.00					
				34.00	34.00					
				35.00	35.00					
				36.00	36.00					
				37.00	37.00					
		-37.60								
	Grey MUDSTONE.	-38.00			38.00	38.00				
	Grey SANDSTONE.				39.00	39.00				
			40.00	40.00						
		-40.40								
Notes: U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test									Logged by: AD	
Remarks Water encountered from 1.00m to 50.00m. Strong odour from 1.00m to 7.00m. 63mm diameter standpipe installed to 6.00m									Scale:	
Notes									FIG:	

REC Geotechnical Log						Borehole: RO12			
 Resource & Environmental Consultants Ltd.			Equipment and Methods: Open Hole Rig Location: Coed Darcy, Neath (80132)						
Client: St Modwen			Ground Level:		Coordinates:		Date: 27 & 28/07/09		
Installation	Description	Reduced	Legend	Depth (m)	Sample/Tests			Field Records	
					Depth	Sample			Test
						Type	No.		
	Grey SANDSTONE.			41.00	41.00				
				42.00	42.00				
				43.00	43.00				
				44.00	44.00				
				45.00	45.00				
				46.00	46.00				
				47.00	47.00				
				48.00	48.00				
				49.00	49.00				
				50.00	50.00				
	Grey MUDSTONE.	-47.00		47.00	47.00				
				48.00	48.00				
				49.00	49.00				
				50.00	50.00				
	End of Log	-50.00							
Notes:U-undisturbed B-bulk D-disturbed SPT-standard penetration test U-U100 CPT-cone penetration test Remarks Water encountered from 1.00m to 50.00m. Strong odour from 1.00m to 7.00m. 63mm diameter standpipe installed to 6.00m Notes						Logged by: AD Scale: FIG:			

Ground Investigation



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Coed Darcy

Factual Report

for
St Modwens Developments Ltd

Engineer : Atkins Ltd

Project Number PC176880

December 2017

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Ground Investigation
at

Coed Darcy
for
St Modwens Developments Ltd

Factual Report

Engineer :
Atkins Ltd

Project No:
PCI76880
December 2017

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APPENDICES

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APPENDIX 2	Site Location Plan
APPENDIX 3	Site Photographs
APPENDIX 4	Combined Dynamic Sample and Rotary Borehole Records
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APPENDIX 7	Exploratory Hole Location Plan
APPENDIX 8	Laboratory Test Results - Geotechnical
APPENDIX 9	ESG Geophysical Report October 2017
APPENDIX 10	Investigation Techniques and General Notes

1.0 INTRODUCTION

A geotechnical investigation was undertaken by Geotechnics Limited at the site of a proposed mixed residential development at Coed Darcy, near Neath in South Wales. The investigation was carried out to the instructions of the Engineer, Atkins Ltd., on behalf of the Client, St Modwen Developments Ltd. This report describes the work undertaken and presents the data obtained.

2.0 OBJECT AND SCOPE OF THE INVESTIGATION

The object of the investigation was to obtain information on the ground and groundwater conditions relating to the design of the proposed works within the limitations posed by exploratory hole numbers, locations, depths, methods adopted and the scope of approved in situ and laboratory testing. Selected pages from the tender for the project are included in Appendix 1. The investigation comprised rotary and dynamic sample boreholes, trial pits and in situ and laboratory testing and reporting. A Factual Report was also commissioned.

3.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 4 to 6. The factual data so obtained are presented in Appendices 2 to 9 of this report. Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 10 to aid an understanding of the procedures followed and the context in which the report should be read.

In addition, data in electronic format in accordance with "The Electronic Transfer of Geotechnical Data from Ground Investigations" published by the AGS (the AGS Format) are presented separately on disk together with a copy of the report in electronic PDF format.

4.0 THE SITE

4.1 Location

The site is located approximately 6km NNW of Port Talbot town centre and 750m WSW of Junction 43 of the M4 Motorway. The approximate Ordnance Survey National Grid Reference for the centre of the site is SS 715 959 and an extract from the relevant 1:50,000 Scale O.S. Map (Sheet No. 170) is included as Appendix 2.

4.2 Description

The site is approximately polygonal in shape and Phase 2, Stage 1, covers an area of about 1.2km², which roughly covers the site of a former BP oil refinery. The area is defined by man-made slopes, embankments and levels composing of fill material, with a general uphill gradient towards the south-east.

Vegetation is generally scarce with some grass and shrubs covering parts of the site with the exception of the northernmost part of the site, which is a SSSI. Boundaries are defined by fences and/or hedgerows with the area being surrounded by housing in the south and farmland in the north.

Photographs of the site taken during the fieldwork and site visits are presented in Appendix 3.

4.3 Site Geology

The British Geological Survey website <http://mapapps2.bgs.ac.uk/geoindex/home.html>, accessed on the 02/11/2017, shows the site to be underlain by the Hughes Member Sandstone of Upper Carboniferous age with superficial deposits of glacial till and occasional peat deposits. The site bedrock is likely to be considered a secondary "A" aquifer due to the presence of sandstone units capable of supporting local water movement. Due to on-going issues with the public hydrological database for Wales, this conclusion cannot currently be officially confirmed at the time of writing.

5.0 PROCEDURE

5.1 Commissioning

The work was awarded following submission of a tender for work designed by the Engineer for ground investigation of the site in accordance with their requirements (see Appendix I).

5.2 General

The procedures followed in this site investigation are based on BS 5930: 2015 – *Code of Practice for Site Investigations*. The soils and rocks encountered have been described in accordance with BS5930:2015 and BS EN ISO 14688-1:2002+A1:2013 and BS EN ISO 14689-1:2003. The Percussive and Rotary Borehole, Trial Pit and Dynamic Cone Penetration Records are included in Appendices 4 to 6 and their approximate positions are shown on the Exploratory Hole Location Plan in Appendix 7.

The Exploratory Hole locations were selected and specified by the Engineer on site. The co-ordinates and levels shown on the Exploratory Hole Records were measured using a GPS survey device and provided by the site contractor. The depths quoted on the exploratory hole records are in metres below existing ground level.

At each exploratory hole location, with the exception of the trial pits and dynamic cone penetration tests, an inspection pit was excavated using hand tools to a depth of 1.20m below ground level to check for the presence of underground services. Prior to and on completion of the excavation, the location was scanned using a cable avoidance tool (CAT).

For reasons of access and safety, it was not possible to undertake certain locations during this investigation. For example in the area of the former colliery to the south of Phase 2, no Coal Authority Licence was available. On the basis that this may be requested during a subsequent phase of investigation and to avoid confusion, no logs have been produced for locations BH16-17 or TP39-41.

5.3 Combined Dynamic Sample and Rotary Boreholes

Twenty Two (22 No.) boreholes (numbered BH01-BH15 and BH18-BH24), up to 105mm in diameter, were sunk utilising a combination of dynamic sampling and rotary coring techniques to depths varying between 4.30m and 25.20m below ground level. The

work was carried out between the 5th and 30th October 2017.

The dynamic sample sections of the boreholes were carried out using a compressed air percussive apparatus fitted to the rotary drilling rig which drives lined steel tubes into the ground in 1-1.5m lengths. Samples are retrieved in plastic liners. The liners are extruded from the sampler and placed into suitable core boxes.

Rotary coring, 92mm diameter, commenced at depths of between 0.50m and 14.50m below ground level. The drilling equipment used in the rotary sections of the boreholes on this particular contract utilised air-mist as the flushing medium as no designated Coal Authority workings were to be entered.

Rock cores were extruded horizontally in transparent liners and placed into suitable core boxes. Photographs of the individual core boxes are included with the logs in Appendix 4.

Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata.

Groundwater observations are included on the Borehole Records where appropriate and any rise in water level was recorded over 20 minutes whilst drilling operations were suspended. It should be noted that the addition of water to the borehole as part of the drilling process may have masked the presence of groundwater in the borehole. Where water was added it has been noted on the Borehole Records.

On completion, standpipes were installed in Boreholes BH05, BH07, BH08, BH15, BH20-24 (see Section 5.6). The remaining boreholes were backfilled with arisings and bentonite. Following completion but prior to installation, BH08 and BH15 were subject to geophysical logging by European Geophysical Services on 19th October 2017. Their report (Ref: OCT 2017GNICS1705_rpt/SS79) is enclosed as Appendix 9.

5.4 Trial Pits

Fifty (50 No.) Trial Pits (numbered TP01-TP38 and TP42-TP53) were excavated to depths varying between 0.50m and 5.00m below ground level using a Hyundai 145 LCR-9a or Kamatchi KX08 excavator between the 3rd to 17th October 2017.

This work was supervised on site by a geotechnical engineer. The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative samples were taken, where appropriate, for laboratory examination and analysis were recovered at the depths indicated on the Trial Pit Records. No environmental samples were requested. Samples were taken directly from excavated materials deposited at the surface. Groundwater observations and trench stability notes are included on the Trial Pit Records. Photographs of the pits are presented in Appendix 5 following the logs.

5.5 Dynamic Cone Penetration Tests

Dynamic Cone Penetration (DCP) Tests were carried out adjacent to each of the Trial Pits at the locations marked on the Exploratory Hole Location Plan (see Appendix 7) and numbered DCP01 to DCP53. Where full depth was not achievable at the first location, an additional location was undertaken and is marked DCPXXA. The tests were commenced from Ground Level and were performed to give an indication of CBR values at shallow depths to aid pavement design.

The test comprises the measurement of increments of penetration of a 60° cone driven into the ground using an 8kg hammer falling a distance of 575mm. The CBR is obtained from the relationship between the CBR and the DCP readings; $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ as defined in Interim Advice Note 73/06 Revision 1 (2009) "Design Guidance for Road Pavement Foundations (Draft HD25)" published by the Highways Agency. The test results are presented in Appendix 6.

5.6 Instrumentation and Monitoring

Long-term monitoring of gas and groundwater levels was made possible by the installation of standpipes as follows:

Exploratory Hole	Standpipe Slotted Pipe & Filter Zone (m)
BH05	3.30 to 5.00
BH07	2.00 to 3.50
BH08	12.70 to 14.00
BH15	3.20 to 6.25
BH20	2.00 to 5.00

BH20	2.00 to 5.00
BH21	2.10 to 8.30
BH22	5.00 to 7.00
BH23	1.00 to 8.20
BH24	4.00 to 6.00

No monitoring was carried out as part of this current Contract.

6.0 LABORATORY TESTING

6.1 Geotechnical

The laboratory testing schedule was formulated and specified by the Engineer. Unless otherwise stated, the tests were carried out in Geotechnics Limited's UKAS accredited Laboratory (Testing No. 1365) and were undertaken in accordance with the appropriate Standards as indicated below and on the Laboratory Summary Sheets in Appendix 8. Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

BS EN ISO 17892-1:2014

64 No. Water Content Determination

BS EN ISO 17892-4:2016

4 No. Particle Size Distribution Determination – Sieving Method

BS 1377:1990

Test No. Test Description

Part 2

4.3 & 5.3 30 No. Liquid and Plastic Limit Determination

Part 4

3.5 17 No. Dry Density/Moisture Content relationship determination. Compaction Test - Modified (4.5 kg Rammer).

The following testing was carried out at the laboratories of Professional Soils Laboratory.

BS 1377:1990

Test No.	Test Description
----------	------------------

Part 2

3	62 No	Water Content Determination
4 & 5	22 No	Liquid & Plastic Limits
9	95 No	Particle Size Distribution – Wet sieving
9	53 No	Particle Size Distribution – Sedimentation

Part 4

3.5 & 3.6	27 No	Dry Density/Moisture Content Relationship determination. Compaction Test Modified (4.5kg Rammer)
-----------	-------	--

The following testing was carried out at the laboratories of MATtest Ltd.

ISRM Testing Methods

51 No.	Point Load Determination
5 No.	Unconfined Compressive Strength Determination

The following testing was carried out at the laboratories of DETS Ltd (UKAS Accredited Laboratory, Number 2139)

BRE Special Digest I Suite

20 No Suites comprising

Soluble Sulphate
Acid Soluble Sulphate
Total Sulphur
pH

The results of these tests are presented in Appendix 8

6.2 Contamination

No samples were taken or scheduled for contamination testing during this investigation.

Signed for and on behalf of Geotechnics Limited.

Prepared by:

C G Swainston
BSc, FGS, CGeol
Principal Geoenvironmental Engineer

Reviewed by:

David Bracegirdle
BSc, MSc, CEng, FIMMM, MICE, MHKIE, CGeol, FGS
Principal Geotechnical Engineer

APPENDIX I

The Brief

Schedule 1: Information and site-specific requirements

S1.1 Name of Contract

Coed Darcy: Phase 2, Stage 1.

S1.2 Investigation Supervisor

The definition of parties within this Specification are:

Contractor/ Investigation Supervisor: To be confirmed

Main Contractor: Hawk Contracts

Client: St. Modwen Developments Ltd

Designer: Atkins Ltd

Contact:

- Natalie Williams, Senior Engineering Geologist, Atkins Ltd – part time site attendance and office based telephone advice;
- Stuart Archer, Engineering Geologist, Atkins Ltd – part time site attendance and office based telephone advice;
- Barney Irlam, Geo-Environmental Engineer, Atkins Ltd – part time site attendance and office based telephone contaminated land advice.

S1.3 Description of site

The site is an irregular shaped portion of land situated within the wider Coed Darcy development. This portion of land has been referred to as 'North Site: Phase 2 Earthworks, Stage 1' (Phase 2, Stage 1) and is approximately 20 hectares (ha) in area. It should not be confused with the contaminated land remediation area known as 'Monitor Phase 54'. The Monitor Phase areas corresponding to the Phase 2, Stage 1 area are; 20, 29, 30, 31, 32, 33, and 70, and parts of phases 22, 28, and 69.

The wider Coed Darcy development site is located at the former Llandarcy Oil Refinery, Skewen, Neath, South Wales. The location is shown on Figure A-1.

Based on the topographic survey dated April 2016, site topography ranges from approximately 25m to 70m above Ordnance Datum (AOD). Indicative cross sections and a plan showing the locations of the section from the topographic survey (April 2016) are included as Figure D-1 and Figure D-2. Within the Phase 2, Stage 1 area the ground level generally increases from southeast at 50m AOD to northwest at 70m AOD.

The site has a complex land use history including recent contamination remediation, but is now free from permanent above ground infrastructure. A brief land use history extracted from the relevant Monitor Phase Validation Reports can be summarised as follows:

- Construction of Llandarcy Oil refinery commenced in 1917 but was temporarily suspended during the war due to the lack of men and resources. Construction started again in 1919 with production beginning in 1921. The refinery was officially opened in 1922.
- The purpose of the refinery was to produce motor spirit, kerosene, gas fuel oil, fuel residue and lubricating oil and wax from imported crude oil. Between the wars, the oil industry developed rapidly. By 1939, the refinery had little of the original plant in operation.
- In the mid 1980's a number of rationalisations occurred with the closure of the refinery being formally announced in 1997.
- A range of infrastructure was historically located in the area including workshops, plant and infrastructure specific to the oil refining process (e.g. 'No.1 LPG Unit and Stabilizer', 'No.2 Crude Distillation Unit' [CDU], condenser), storage tanks, electrical sub-stations, a lime water washer area, and sump separators.

Based on the known site history the Site has been classified as a Red Site.

The site address is Darcy Business Park, Neath SA10 6FG and the Ordnance Survey national grid reference for the centre of the site is 271215, 195825. The site boundaries are provided on the Site Location Plan (Figure A-1) and Investigation Location Plan (Figure B-1).

Under CDM 2015 the Client/Principal Designer is required to provide Pre-Construction Information. The Information received to date is listed below:

- Current Architectural Layout: Coed Darcy, Proving Layout Area 1, Dwg No. 8243-SK501, 23 March 2017
- Atkins Limited (2015): Coed Darcy, Monitor Phase Reports for Phases 20, 29, 30, 31, 32, 33, and 70, and parts of Phases 22, 28, and 69
- Coed Darcy Monitor Phase Plan – Redevelopment Remediation Phase Boundaries, Ref. 5041216-ATK-DR-C-REM-2142, 2 December 2015, Rev. P1
- Topographic Survey – Ref. 5051216-ATK-GM-XX-M3-C-4000 Drone Survey (Apr 2016).dwg
- Mine Entry Investigations:
 - Geophysical Survey: Bentham Geoconsulting Ltd, “Geophysical survey to attempt location of a mine shaft and adit (Ref. BGC372, dated 15 December 2010)”
 - Technical Note 779 – Coed Darcy Urban Village: Intrusive Investigation of Recorded Mine Entries, Ref. 5041216-REM-TN-000779, 23rd April 2012
- Phase 2 Stage 1 Earthworks proposals:
 - 5041216-ATK-GM-NS-DR-C-4028 Base of Excavation
 - 5041216-ATK-GM-NS-DR-C-4029 EGL vs BoE
 - 5041216-ATK-GM-NS-DR-C-4030 Formation
 - 5041216-ATK-GM-NS-DR-C-4031 BoE vs Formation
 - 5041216-ATK-GM-NS-DR-C-4032 Earthworks Sections
 - 5041216-ATK-GM-NS-DR-C-4033 Earthworks Sections
- Historical Ground Investigation Locations:
 - URS Exploratory Hole Location Plan (includes historic investigation locations), Ref. 5041216-OSW-DWG-1244, 14 June 2012
 - Atkins Exploratory Hole Locations – Coed Darcy: GI Locations, 27 March 2017, Rev. P01
- Historical Ground Investigation Reports
 - Dames & Moore, “Draft Report, Phase II, Final Data Assessment: BP Llandarcy Refinery, Neath, West Glamorgan (Ref. 39991-005/DR786R, dated 24 August 1999),”
 - URS Corporation Limited (2003): Final Factual Report: Geotechnical and Contaminant Investigation – Proposed Britannic Business Park and D’Arcy Business Centre Development (Ref. 39991-035-785/FR1163, dated 15 August 2003)
 - URS Corporation Limited, “Final Factual Report for: Whole Site Investigation, BP Llandarcy Refinery (Ref. 39991-044-785, Report No. FR1287, dated 12 August 2005),”
 - Jacobs Babbie, “Urban Village Project, BP Refinery, Llandarcy – Ground Investigation Factual Report (Ref. 06792/R2964/JCO, dated March 2006),”
- Site Constraints Plan (above ground) – 5041216-ATK-GM-NS-DR-C-4027 Phase 2 Constraints _P01.1TM 170526 (Figure D-3)
- Buried Services and Structures – see Monitor Phase Validation Reports
- Coed Darcy Health & Safety File
- Demolition Plans and former site layout details – see Monitor Phase Validation Reports
- Unexploded Ordnance: BACTEC International Limited, “Explosive Ordnance Threat Assessment in respect of Coed Darcy Urban Village, Swansea, Ref. 9741TA (16/01/2009),

Buried structures have largely been removed when encountered during previous ground investigations and recent site remediation works. However, it is still considered possible that unknown buried structures/obstructions may be encountered in areas of Made Ground.

S1.4 Main works proposed and purpose of this contract

It is understood that St. Modwen Developments Ltd wish to develop the site into mixed use residential and commercial land. Atkins Limited (Atkins) have been commissioned to undertake a Phase 1 Geotechnical Desk Study and Ground Investigation. Further ground investigation work is anticipated, but has not been commissioned at this stage.

A significant amount of ground investigation has already been undertaken at the site. A high-level review of the information suggests that the majority of the recent investigations have been scoped to provide environmental information. The environmental information contains useful strata descriptions, but there is an absence of in situ geotechnical testing and no geotechnical samples have been collected.

Data from older ground investigations should be treated with caution due to significant changes in ground conditions and levels as a result of recent contamination remediation activities. The data will be reviewed as part of the Desk Study and will be useful to corroborate the rockhead levels.

Preliminary modelling of the ground profile and stratigraphy (Drawing references 5041216-ATK-GM-NS-DR-C-4028 to 5041216-ATK-GM-NS-DR-C-4033) has been based largely on recent ground investigations by Atkins as part of the contamination remediation. Most of the exploratory holes were trial pits.

Current earthworks cut/fill plans indicate fill thicknesses of up to approximately 3.5m and cut depths of up to approximately 5m. It is likely that shallow foundations will be suitable for typical residential loads. Heavier structures may have to be founded on piles depending on the location on the site, the structural loads and the findings of the ground investigation. Differential settlement may be an issue due to variability in the Made Ground.

The site is in a Coal Mining Reporting Area and two features, an adit and a shaft, are identified on coal Authority plans and located adjacent to the southern margin of the Phase 2, Stage 1 site. Previous investigations including boreholes, trial pitting, geophysics and trial trenching have been undertaken to locate the features. These investigations were inconclusive. Ground levels in the area of the shaft have been reduced to rockhead level without encountering evidence of the features. Based on this the location of the shaft and adit requires further investigation.

The main objectives of this investigation relate to Phase 2, Stage 1 and are as follows:

Phase 2, Stage 1

1. Ground Model: corroborate the existing geological ground model including groundwater levels, depth to rockhead and thickness of Made Ground, and determine the current ground conditions.
2. Material Parameters: obtain a sufficient number of samples of soil and rock for geotechnical testing to allow for the derivation of material parameters for use in geotechnical design. Collect additional rock mapping data to allow for optimisation of rock cutting designs and to perform checks on global stability of slopes.
3. Mining Risk: conduct further investigations to provide data to assess the residual risk from coal mining in and around the identified shaft, adit and mapped coal exposures.
4. Geo-environmental Validation: in addition to the combined geotechnical and geo-environmental investigations identified as objectives 1 to 4 above, geo-environmental validation trial pitting is required across the Phase 2, Stage 1 area. The trial pit locations are shown on Drawings 5041216-ATK-GM-NS-DR-C-4036 & 4037 included as Figure B-3 and Figure B-4 in Appendix B. The requirements for this phase of the investigation are identified in S1.5.

Monitor Phase 52

5. Monitor Phase 52: Additional investigations outside of Phase 2, Stage 1 area. Location shown on Figure B-2.

S1.5 Scope of investigation

This ground investigation has been scoped to validate the preliminary model, provide geotechnical data for earthworks design and accommodate additional contaminated land requirements.

An intrusive ground investigation will be required to provide the following:

- To characterise the ground conditions including engineering properties and groundwater regime;
- Determine the depth to solid geology and rock mass characteristics;

- Determine the aggressivity of the ground to concrete structures;
- Provide input to locating buried structures/foundations that may be present at the site.
- To collect geo-environmental verification samples in accordance with the Section 106 validation procedure to accommodate for the recent change in land use.

The proposed ground investigation is anticipated to comprise the following; however, the scope of works may be revised depending on the findings of the GI as the works proceed:

- Phase 2, Stage 1 (Figure B-1):
 - 5 days of machine excavated trial pitting. Trial pits will be excavated to the maximum reach of the available excavation plant, refusal or collapse. Indicative TP locations and TP areas are shown on Figure B-1. TRL/ DCP testing to a depth equivalent to the base of each trial pit or refusal. This will be undertaken to provide a density/ consistency profile for the ground at each trial pit location. Early refusal may occur due to the presence of gravel to boulder sized particles. Following early refusal, the test should be repeated at least once and at a horizontal distance of >1m.
 - In situ field shear vane testing in any cohesive materials encountered in trial pits.
 - 17 No. boreholes using dynamic sampling methods to refusal with rotary coring follow-on as necessary using a combined multi-purpose rig. In situ Standard Penetration Testing from the base of the inspection pits and at 1m intervals will be required. Schedule 2 provides details of the proposed boreholes including proposed depth, justification for the location and testing requirements. The number and depth of the borehole and method of drilling may be amended as necessary following the trial pitting investigation. The proposed locations at this stage are shown on Figure B-1;
 - Downhole surveys in the form of tri-sonde suite and optical/acoustic televiewer in BH08 and BH15 to also include acoustic and gamma log;
- Mine Workings:
 - 2 days of machine excavated trial trenching to target the coal mining features. Trenches will be excavated at locations identified during earlier investigations. Trenching is proposed assuming that rockhead can be reached using conventional excavation plant. If trial trenching cannot successfully reach rockhead level due to collapse of trench walls then additional boreholes may be required.
 - 2 No. boreholes (BH16 and BH17) using rotary coring methods advanced to depths of 30m below existing ground levels to investigate the presence of mine workings. The proposed locations are shown on Figure B-1;
- Monitor Phase 52 (Figure B-2):
 - 5 No. boreholes (BH20 to BH24) using dynamic sampling methods to refusal with rotary coring follow-on as necessary using a combined multi-purpose rig.
 - In situ Standard Penetration Testing from the base of the inspection pits and at 1m intervals will be required.
 - Schedule 2 provides details of the proposed boreholes including proposed depth, justification for the location and testing requirements.
 - All 5 No. boreholes will be installed with groundwater monitoring apparatus (installation details to be confirmed onsite) and finished with raised top borehole covers.
 - The proposed indicative locations are shown on Figure B-2, but will be confirmed by Atkins on site;
- Geotechnical and Environmental sampling. Geotechnical samples in soils are anticipated to be predominantly bulk and disturbed samples, core samples are anticipated to be recovered from rock;
- Laboratory testing for Geotechnical and Environmental purposes; and
- Electronic Factual Ground Investigation reporting in portable document format (pdf) and AGS format data.

Geoenvironmental Validation Investigation

- 157 trial pits to be excavated at the locations as shown on 5041216-ATK-GM-NS-DR-C-4036 & 4037 (Figure B-3 and Figure B-4, Appendix B). Trial pits will be excavated to the maximum reach of the available excavation plant, refusal or collapse.
- Geo-environmental samples will be collected as specified in section s1.12.12.
- TRL/DCP testing and geotechnical sampling will be required in approximately 10 of these TPs. Locations to be confirmed on site.

Restrictions on the methods of investigation:

- Due to the historical development of the site, involving the construction and demolition of structures, there may be buried foundations and structures within the footprint of the site.

- Superficial geology is mapped as Till and the GI Contractor should consider this when proposing exploratory techniques.
- The GI will focus on the Phase 2, Stage 1 area, but may be extended into the Stage 2 area depending on progress and the client's requirements/ programme. The GI Specification will be updated with further requirements if the Stage 2 area is to be investigated.
- Permission from the Coal Authority will be required prior to any further investigation of the recorded shaft and adit. This will not need to be arranged by the Investigation Supervisor/Contractor.

All exploratory holes, sample descriptions, and in situ / laboratory testing shall be carried out in accordance with BSEN 1997 Eurocode 7 Geotechnical Design, BS5930:2015 Code of Practice for Site Investigation, BS1377 Code of Practice, Testing of soils and BS10175 2011:A1:2013 Investigation of Potentially Contaminated Sites where applicable.

It should be noted that exploratory hole locations are indicative and may be subject to change. The Contractor is to advise of any further constraints not included in this document (reference should be made to Figure D-3) in relation to or due to access restrictions or services etc. Provisional locations are shown on the Investigation Location Plans in Appendix B (Figures B-1 to B-4).

S1.6 Geology and ground conditions

The following general assessment of the geology of the site and ground conditions has been inferred from available information. No assurance is given to its accuracy.

A review of published geological information (BGS map 247, Swansea (1:50,000 scale) indicates the site to be underlain by:

- Till (Diamicton), a heterogeneous deposit of glacial origin; and
- Pennant Sandstone Formation, specifically the Hughes Member which is described by the BGS as 'green-grey, lithic arenites ("Pennant sandstones") with thin mudstone/siltstone and seatearth interbeds and mainly thin coals'.

From recent ground investigations (March 2015) undertaken by Atkins as part of the contamination remediation, the following materials are expected:

- Made Ground: reworked Till (clay, silt, sand, gravel, cobbles) with anthropogenic materials such as brick, clinker, ash, metal, plastic, concrete, wood, etc.
- Till: material described as comprising variable mixtures of clay, silt, sand, gravel and cobbles. Principal soil type more commonly described as sand or gravel than clay or silt.
- Pennant Sandstone Formation: predominantly Hughes Member Sandstone, but this is underlain by or interfingering with Hughes Member Mudstone, Siltstone and Sandstone.

S1.7 Schedule of drawing(s) and documents

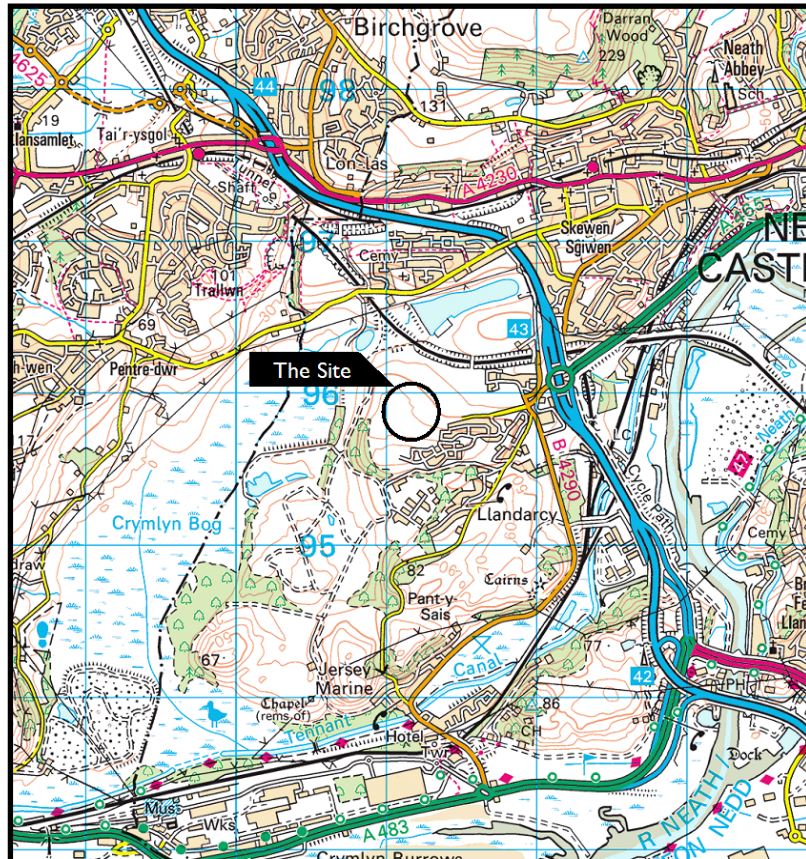
Where required, drawings can be provided in CAD format.

Title	Drawing/Document Number	Revision	Date	Authoring Company	Provided in Appendices
Site Location Plan	Figure A-1	-	May 2017	Atkins	Appendix A
Ground Investigation Location Plan	Figure B-1	-	May 2017	Atkins	Appendix B
Services Information	See Appendix C	A	Feb 2017	Pro-Surv	Appendix C
Phase 2 Area Cross Sections	Figure D-1 and Figure D-2	-	May 2017	Atkins	Appendix D

APPENDIX 2

Site Location Plan

SITE LOCATION PLAN



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Ground Investigation
at
Coed Darcy
for
St Modwens Developments Ltd

GEOTECHNICS
geotechnical and geoenvironmental specialists

APPENDIX 3

Site Photographs

PHOTOGRAPHS

Project Number : PCI76880

Project : Coed Darcy



North site facing N



North site facing NE

PHOTOGRAPHS

Project Number : PCI76880

Project : Coed Darcy



South site facing N facing BH23 & BH22



South site facing SW

APPENDIX 4

Combined Dynamic Sample and Rotary Borehole Records

DATA SHEET - Symbols and Abbreviations used on Records



Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecon Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content
(All other strengths from undrained triaxial testing)	
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
()	Extrapolated value

Groundwater

Water Strike	
Depth Water Rose To	

Instrumentation

Seal

Filter

Seal

Strata

Made Ground Granular
Made Ground Cohesive
Topsoil
Cobbles and Boulders
Gravel
Sand
Silt
Clay
Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD Rock Quality Designation (% of intact core >100mm)

FRACTURE INDEX

Fractures/metre

FRACTURE Maximum

SPACING (m) Minimum

NI Non-intact core

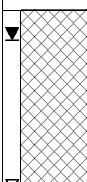
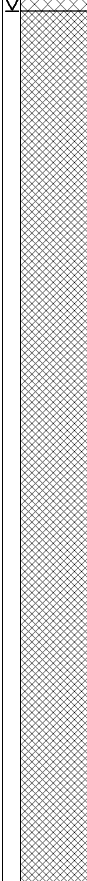
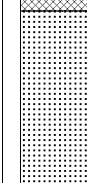
NR No core recovery

AZCL Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH01 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271058.011E 195788.992N	Ground Level	66.85 m OD

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD					
0.00- 1.20	B					MADE GROUND: Dark brown sandy slightly clayey gravel with a low to a medium cobble content of subangular brick, concrete and sandstone. Gravel is angular to subangular fine to coarse brick, concrete and sandstone.		G.L.		66.85					
0.50	D														
1.20- 1.58	D	1.20 (0.20)			S50/225	MADE GROUND: Very stiff dark brown slightly sandy gravelly clay with a low to medium cobble content of subangular brick and sandstone. Gravel is angular to subangular fine to coarse brick, concrete and sandstone.		1.20		65.65					
2.00	D														
2.20- 2.65	D	2.20 (DRY)			S50										
3.20- 3.65	D	3.20 (DRY)			S50										
4.20- 4.65	D	4.20 (DRY)			S38										
5.20- 5.43	D	5.20 (DRY)			S50/75										
7.00- 7.15	D	6.00 (DRY)			S50/75			7.00		59.85					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General		Detail							
7.00- 7.50	6.00 (-)	80 50 C	0.08 0.02	0	(NI)	Strong to very strong dark grey micaceous SANDSTONE with occasional very closely spaced partings of coal silt. Discontinuities are predominantly subhorizontal, very closely spaced and closely spaced, stepped, rough, open with occasional coal dust infill up to 2mm and occasional slight iron oxide staining.		Between 8.50-8.60m, extremely closely to very closely coal partings.							
7.30- 7.50					(NI)										
7.50- 9.00	6.00 (-)	93 60 C	0.19 0.02	33	(9)	Strong to very strong dark grey micaceous SANDSTONE with occasional extremely closely to very		Between 9.70-9.90m, 10.00-10.60m, 10.16-10.47m, 70 degree discontinuity.							
8.40- 8.51															
9.00-10.50	6.00 (-)	99 92 C	0.36 0.06	67											
9.00- 9.36															
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20 7.00 19.50	0.09	Inspection Pit Windowless Sampler Rotary Core		CJ/K0 CJ/KY CJ/KY	G.L. 5.20 5.20 19.50	NIL 4.20 4.20 6.00	DRY DRY 2.15	05/10/17 05/10/17 06/10/17 06/10/17	08:00 18:00 08:00 18:00	1.20		0.20	20		Seepage

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	CJ/KO	G.L.	NIL	DRY	05/10/17	08:00	1.20		0.20	20		Seepage
7.00		Windowless Sampler	CJ/KY	5.20	4.20	DRY	05/10/17	18:00						
19.50	0.09	Rotary Core	CJ/KY	5.20	4.20	2.15	06/10/17	08:00						
				19.50	6.00		06/10/17	18:00						

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 7.00-19.50m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by
Checked by
Figure
SI
DRB
1 of 2
20/02/2018

geotechnics

BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole Project No **BH01**
PC176880
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **271058.011E**
195788.992N Ground Level **66.85** m OD

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
10.50-12.00	6.00 (-)	100 98	0.25 0.06	79	(3)	closely spaced partings of coal dust. Discontinuities are predominantly 70 degrees, undulating, rough, open and iron oxide stained. Subhorizontal are closely spaced and medium spaced, undulating, rough, open and iron oxide stained.	At 10.70m, parting of coal dust. Between 11.50-11.70m, 12.80-12.98m, 70 degree discontinuity.			
12.00-13.50	6.00 (-)	95 94	0.35 0.12	84						
12.47-12.82		C								
13.50-15.00	6.00 (-)	93 90	0.45 0.05	63	(11)		Between 13.60-14.20m, 14.30-14.60m, 15.55-15.80m, and 16.00-17.00m, 70 degree discontinuity. Between 14.80-16.30m, extremely closely and very closely spaced partings of coal dust. At 15.40m and 16.30m, carbonised mudstone 0.3mm thick.			
15.00-16.50	6.00 (-)	100 91	0.19 0.02	21						
16.50-18.00	6.00 (-)	100 95	0.25 0.02	59	(3)		Between 18.00-19.00m, occasional very closely spaced partings of coal dust. Between 19.00-19.50m, 70 degree discontinuity.			
18.00-19.50	6.00 (-)	100 99	0.27 0.08	60						
						End of Borehole		19.50		47.35

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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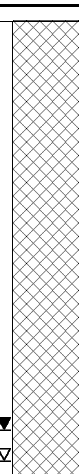


BOREHOLE RECORD - Window Sampler and Rotary

Project		COED DARCY				Engineer		ATKINS LIMITED				Borehole		BH02					
												Project No		PC176880					
Client		ST MODWEN DEVELOPMENTS LIMITED				National Grid		271129.11 E				Ground Level		65.95 m OD					
						Coordinates		195779.243N											
Sampling			Properties			Strata						Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description						Depth	Legend	Level m OD					
0.00- 1.20	B					MADE GROUND: Dark brown slightly sandy clayey gravel with a medium cobble content of subangular concrete and brick. Gravel is angular to subangular fine to coarse brick, concrete and sandstone.						G.L.		65.95					
0.60	D																		
1.20- 1.65	D	1.20 (DRY)			S16	MADE GROUND: Dark brown slightly sandy clayey gravel with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone.						1.20		64.75					
1.50- 1.70	D																		
2.20- 2.65	D	2.20 (2.00)			S27														
2.20- 2.50	D																		
3.00- 3.23	D	3.00 (-)			S50/75							3.00		62.95					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General						Detail							
3.00- 3.70	3.00 (-)	50 36 C	0.18 0.03	26	(NI)	Strong to very strong dark grey micaceous SANDSTONE. Discontinuities are very closely spaced and closely spaced, stepped, rough, iron oxide stained with occasional mudstone infill up to 2mm.						Between 3.00-3.21m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Between 3.70-4.50m, Non-Intact, recovered as slightly clayey angular to subangular gravel.							
3.21- 3.39					(3)														
3.70- 4.50	3.00 (-)	38 6	0.05 0.01	0	(NI)														
4.50- 6.00	4.50 (-)	33 27 D	0.06 0.02	0	S50/225 (12)	Weak to medium strong grey SILTSTONE with frequent carbonised plant remains/ fossils. Discontinuities are predominantly subhorizontal, closely spaced, stepped, rough and iron oxide stained.						At 6.00m, 5mm band of clayey silt.							
4.50- 4.88	4.50 (-)																		
6.00- 7.50	4.50 (-)	67 59 D	0.20 0.06	24	S50/75 (6)							6.00			59.95				
6.00- 6.23	4.50 (-)																		
6.10- 6.30		C																	
6.30- 6.38		C																	
6.75- 6.95		C																	
						End of Borehole						7.50			58.45				

BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH03 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271405.008E 195846.99 N	Ground Level	50.97 m OD

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description		Depth	Legend	Level m OD					
0.00- 1.20	B					MADE GROUND: Dark brown sandy slightly clayey gravel with a low to a medium cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse brick, concrete and sandstone.		G.L.		50.97					
0.60	D														
1.20- 2.00	B	1.20 (DRY)			S49										
1.20- 1.65	D														
2.00- 2.27	D	2.00 (DRY)			S50/115										
3.00- 3.16	D	3.00 (-)			S50/85										
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (F)	Continued by Rotary techniques General									
						Detail									
3.00- 4.00	3.00 (-)	40 9	0.09 0.01	0	(NI)	Medium strong grey discoloured brown micaceous SANDSTONE. Discontinuities are subhorizontal, closely spaced and medium spaced, stepped, rough, open, with iron oxide staining penetrating up to 2mm and with occasional mudstone infill up to 2mm.		Between 3.00-5.10m, Non-Intact, recovered as angular to subangular fine to coarse gravel.							
4.00- 5.50	4.00 (-)	23 3	0.04 0.01	0											
5.50- 7.00	4.50 (-)	89 80	0.09 0.05	31	(5)	Between 5.50-6.00m, subvertical discontinuity, rough, open, iron oxide stained. Between 6.00-6.20m, 70 degree discontinuity, rough, open, iron oxide staining penetrating 2mm. Between 6.20-6.54m, very closely spaced coal partings. At 6.54m, coal infill 3mm, thick. Between 6.76-7.00m, subvertical discontinuity, stepped, rough, open, with iron oxide staining penetrating 2mm. Between 7.40-7.81m, locally Non-Intact. Two subvertical discontinuities 20mm apart. stepped, rough, open, with iron oxide staining penetrating up to 2mm. Between 8.10-8.30m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Between 8.74-9.80m, subvertical discontinuity running along the core axis, undulating, rough, open,									
7.00- 8.50	4.50 (-)	100 63	0.24 0.20	44											
7.00- 7.11		C			(NI)										
8.00- 8.24		C			(NI)										
8.50-10.00	4.50 (-)	100 83	0.14 0.06	23	(5)										
8.50- 8.68		C													
								10.00		40.97					
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.09	Inspection Pit		KO/AJ	G.L.	NIL	DRY	11/10/17	08:00	2.90	2.00	2.70	20		Medium inflow.
3.00		Windowless Sampler		KO/AJ	10.00	4.50	-	11/10/17	18:00						
10.00		Rotary Core		KO/AJ											

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 3.00-10.00m, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH03**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid **271405.008E**
 Coordinates **195846.99 N** Ground Level **50.97 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						End of Borehole	iron oxide stained. At 9.00m, 4mm band of sand.	10.00		40.97

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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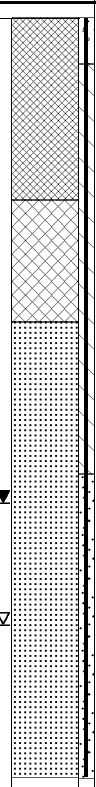


BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY				Engineer ATKINS LIMITED				Borehole Project No BH04 PC176880						
Client ST MODWEN DEVELOPMENTS LIMITED				National Grid Coordinates 271337.001E 195863.984N				Ground Level 52.72 m OD						
Sampling			Properties			Strata			Scale 1:50					
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD					
0.00- 1.20	B					MADE GROUND: Soft greyish brown slightly sandy gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone. Between 1.20-3.00m, stiff to very stiff.	G.L.		52.72					
0.50	D													
1.20- 2.00	B													
1.20- 1.65	D	1.20 (DRY)		S24										
2.00- 2.80	B													
2.00- 2.45	D	2.00 (DRY)		S22										
2.80- 3.00	D													
3.00- 3.20	D	3.00 (-)		S50/50										
4.00- 4.45	D	4.00 (-)		S49		Very stiff greyish brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse sandstone.	4.00		48.72					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail							
4.50- 5.50	4.50 (-)	95 70 C	0.09 0.02	0	(11)	Medium strong to strong grey discoloured brown SANDSTONE.								
4.68- 4.77					(NI)	Discontinuities are subhorizontal, very closely spaced and								
5.50- 6.50	4.50 (-)	100 80	0.14 0.02	14	(13)	rough, open, with iron oxide staining penetrating 2mm and with occasional sand infill (2mm).								
6.36- 6.50		C			(NI)									
					(11)	Weak to medium strong and strong grey discoloured brown SILSTONE, locally grading to MUDSTONE. Discontinuities are predominantly subhorizontal, very closely spaced, stepped, rough, with iron oxide staining penetrating 2mm.	Between 5.50-5.56m, Non-Intact, recovered as sandy gravel of extremely weak mudstone.							
						End of Borehole								
Boring			Progress			Groundwater								
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	KO/AJ	G.L.	4.50	DRY	17/10/17	08:00	2.30	2.00	1.40	20		Fast inflow
4.50		Windowless Sampler	KO/AJ	6.50		-	17/10/17	18:00						
6.50	0.09	Rotary Core	KO/AJ											
Remarks Backfill details from base of hole: bentonite up to ground level. AGS Flush: 4.50-6.50m, 100% returns.														
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.														
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BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY				Engineer ATKINS LIMITED				Borehole Project No BH05 PC176880			
Client ST MODWEN DEVELOPMENTS LIMITED				National Grid Coordinates 271221.003E 195989.031N				Ground Level 53.82 m OD			

Sampling			Properties			Strata		Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD	
0.00- 1.20	B					MADE GROUND: Soft dark brown slightly gravelly very sandy clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone.	G.L.		53.82	
0.50	D									
1.20- 1.65	D	NIL (DRY)			C42		1.20		52.62	
1.80- 2.00 2.00- 2.38 2.00- 2.03	D C D	NIL (DRY)			S50/20		2.00		51.82	
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail			
2.00- 3.00	2.00 (-)	50 38 D D	0.38 0.01	38	(1)	Weak, medium strong and strong grey discoloured brown SANDSTONE. Discontinuities are subhorizontal, very closely spaced and closely spaced, stepped, rough, open, with iron oxide staining penetrating 3mm and with occasional sand infill up to 2mm.	Between 2.00-2.38m, Intact core,			
2.20- 2.40					(NI)		Between 2.28-3.00m, Non-Intact, recovered as angular to subangular fine to coarse gravel.			
2.80- 3.00					(15)		Between 3.25-3.44m, and 4.20-4.40m, Non-Intact, recovered as sandy angular to subangular fine to coarse gravel.			
3.00- 4.00	2.00 (-)	100 85	0.09 0.01	0	(NI)		Between 3.40-3.77m, subvertical discontinuity, undulating, rough, open, with iron oxide staining penetrating 2mm and with occasional sand infill up to 2mm.			
4.00- 5.00	2.00 (-)	100 78	0.16 0.01	16	(NI)		At 3.70m, 4mm sand band. Between 3.81-3.91m, 75 degree discontinuity, stepped, rough, open, with iron oxide staining penetrating up to 2mm.			
4.56- 4.72		C			(7)		Between 3.91-4.00m, frequent carbonised plant fossils. Between 4.20-4.40m, Non-Intact, recovered as sandy angular to subangular fine to coarse gravel. Between 4.40-5.00m, weak sandstone with occasional carbonised plant fossils.			
						End of Borehole				

Boring				Progress				Groundwater						
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.09	Inspection Pit Windowless Sampler Rotary Core	KO/AJ KO/AJ KO/AJ	G.L.			19/10/17	08:00	4.00	2.00	3.20	20		Medium inflow
2.00				4.00	2.00	-	19/10/17	18:00						
5.00				4.00	2.00	-	20/10/17	08:00						
				5.00	2.00	-	20/10/17	18:00						

Remarks

A 50mm standpipe was installed to 5.00m with a geowrapped slotted section from 3.30m to 5.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 3.00m, bentonite up to 0.30m, concrete up to ground level.
 Flush: 2.00-5.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.
 All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH06 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271286.024E 195937.019N	Ground Level	52.46 m OD

Sampling			Properties			Strata	Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
0.00- 1.20	B					MADE GROUND: Soft dark brown slightly sandy gravelly clay with a low cobble content subangular concrete, brick and sandstone. At 1.20m and 3.00m, driller records boulders.	G.L.		52.46
0.50	D								
1.20- 1.45	D	1.20 (DRY)			S50/95				
2.00- 2.38	D	2.00 (DRY)			S50/225				
3.00- 3.30	D	3.00 (DRY)			S50/150	Very stiff dark grey slightly sandy gravelly CLAY with a medium cobble content and a low boulder content of subangular sandstone. Gravel is angular to subrounded fine to coarse sandstone. Between 3.30-8.00m, driller records silty clay with large cobbles and boulders. At 4.00m, driller records a very large sandstone boulder.			
4.00- 5.00	B								
4.00- 4.45	D	4.00 (DRY)			S47		3.30		49.16
5.00- 5.40	D	5.00 (DRY)			S50/245				
5.00	D								
6.50- 6.58		6.50 (DRY)			C50/50	Between 6.50-8.00m, driller records boulders.			
8.00- 8.27		8.00 (DRY)			C50/115	Grey silty CLAY with large sandstone boulders (Driller's Description).			
9.50- 9.61		9.50 (-)			C50/60		8.00		44.46
10.00-10.10		10.00 (-)			C50/60		10.00		42.46

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	K0/AJ	G.L.			18/10/17	08:00	9.80	9.80	7.80	20		Medium inflow
10.00		Windowless Sampler	K0/AJ	8.00	8.00	DRY	18/10/17	18:00						
12.00	0.09	Rotary Core	K0/AJ	8.00	8.00	DRY	19/10/17	08:00						
				12.00	10.00	7.80	19/10/17	18:00						

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 10.00-12.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole Project No **BH06**
PC176880
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **271286.024E**
195937.019N Ground Level **52.46 m OD**

Sampling			Properties			Strata		Scale 1:50						
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD				
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	10.00		42.46				
10.00-11.00	10.00 (-)	100 90	0.22 0.06	60	(4)	Very weak to weak grey discoloured brown SANDSTONE. Discontinuities are subhorizontal and 45 degrees, closely spaced and medium spaced, stepped, rough, with iron oxide staining penetrating up to 3mm and with occasional sand infill up to 2mm.	At 10.50m, 45 degree discontinuity, stepped, rough, open, iron oxide stained.							
11.00-12.00	10.00 (-)	100 70	0.08 0.01	0	(6)									
					(NI)									
						Extremely weak and very weak grey discoloured brown SANDSTONE. Generally Non-Intact, discontinuities are extremely closely spaced and very closely spaced, stepped, rough, open, with iron oxide staining penetrating up to 3mm and with occasional sand infill up to 2mm.	At 11.40m, 60 degree discontinuity, stepped, rough, open, iron oxide staining penetrating 2mm. Between 11.60-12.00m, Non-Intact, recovered as clayey angular to subangular fine to coarse gravel.	12.00		40.46				
						End of Borehole								
Boring						Progress				Groundwater				
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
Remarks														
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.														
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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH07 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271234.357E 196013.702N	Ground Level	48.14 m OD

Sampling			Properties			Strata		Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD
0.00- 1.20 0.00- 1.20 0.50	B B D					MADE GROUND: Brown and grey sandy clayey gravel with a high cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse concrete and sandstone.		G.L.		48.14
1.20- 2.00 1.20- 1.65 1.20- 2.00	B D D	1.20 (DRY)			S20	MADE GROUND: Stiff greyish brown slightly sandy gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone. Slight hydrocarbon odour.		1.20		46.94
2.00- 2.80 2.00- 2.20 2.20- 2.34	B D D	2.20 (0.30)			S50/25			2.20		45.94
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General				
2.20- 3.20 2.30- 2.38 2.80- 3.00	2.20 (-)	65 50 C D	0.09 0.04	0	(NI) (9) (NI)	Weak to medium strong grey discoloured brown micaceous SANDSTONE. Discontinuities are predominantly subhorizontal and 30 degrees, very closely spaced and closely spaced, stepped, rough, open, with iron oxide staining penetrating 2mm and with occasional sand infill up to 2mm.				
3.20- 4.30 4.00- 4.10 4.00- 4.50	2.20 (-)	100 86 C D	0.14 0.04	53	(8)	Between 2.20-2.24m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Between 2.34-3.10m, very weak sandstone, iron oxide staining penetrating 2mm. Between 3.20-3.36m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Between 3.36-4.30m, closely spaced discontinuities, inclined at 30degrees. At 4.26m, 4mm band of extremely weak mudstone.		4.30		43.84
						End of Borehole				

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20 2.20 4.30	0.09	Inspection Pit Windowless Sampler Rotary Core	CJ/KO CJ/KO CJ/KO	G.L. 4.30	1.20	-	23/10/17 23/10/17	08:00 18:00	2.20	1.20	0.30	20		Seepage

Remarks: A 50mm standpipe was installed to 3.50m with a geowrapped slotted section from 2.00m to 3.50m with upright lockable protective cover. Backfill details from base of hole: bentonite up to 3.50m, gravel filter up to 1.20m, bentonite up to 0.20m, concrete up to ground level. Flush: 0.22-4.50m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH08**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **270915.24 E 195808.334 N** Project No **PC176880**
 Ground Level **65.86 m OD**

Sampling			Properties			Strata	Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
0.00- 1.20	B					MADE GROUND: Dark brown sandy slightly clayey gravel with a medium cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse brick, concrete and sandstone. At 1.20m, medium dense.	G.L.		65.86
0.50	D								
1.20- 1.60	D								
1.20- 1.65	D	1.20 (0.60)			S16				
2.20- 2.90	B					MADE GROUND: Firm to soft dark brown slightly sandy gravelly clay with a low to a medium cobble content of subangular sandstone and brick. Gravel is angular to subangular fine to coarse sandstone and brick. Between 3.20-5.20m, strong hydrocarbon odour.	2.20		63.66
2.20- 2.65	D	2.20 (-)			S14				
3.20- 4.00	B								
3.20- 3.65	D	3.20 (DRY)			S6				
4.20- 5.00	B					Below 5.20m, possibly stiff.			
4.20- 4.58	D	3.20 (DRY)			S8				
5.00- 5.20	D								
5.20- 5.65	D	3.20 (DRY)			S29				
6.20- 6.37	D	6.20 (DRY)			S50/30	Partial recovery (recovery is probably in the stronger material with weaker material not recovered). Recovered core comprises GRAVEL and COBBLE size fragments of strong SANDSTONE with occasional sandy clay in parts.	6.20		59.66
8.20- 8.56	D	6.20 (DRY)			S50/205				
10.00-10.45	D	9.00 (DRY)			S32				

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	CJ/KO	G.L.			13/10/01	08:00	0.90	NIL	0.60	20	3.20	Seepage
14.50		Windowless Sampler	CJ/KO	6.20	6.20	-	13/10/01	18:00	13.00	9.00	12.20	20		Seepage
25.20		Rotary Core	CJ/KO	6.20	6.20	DRY	16/10/01	08:00						
				13.00	9.00	-	14/10/01	18:00						
				13.00	9.00	12.20	17/10/01	08:00						
				21.40	14.00	-	17/10/01	18:00						

Remarks A 50mm standpipe was installed to 14.00m with a geowrapped slotted section from 12.70m to 14.00m with upright lockable protective cover. Backfill details from base of hole: bentonite up to 14.00m, gravel filter up to 12.70m, bentonite up to 0.20m, concrete up to ground level.
 Flush: 14.50-25.20m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole Project No **BH08**
PC176880
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **270915.24 E**
195808.334 N Ground Level **65.86 m OD**

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD					
11.50-11.95	D	9.00 (DRY)			S36										
13.00-13.45	D	9.00 (12.20)			S38										
14.50-14.79	D	14.00 (-)			S50/140			14.50		51.36					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General									
14.50-15.20	14.00 (-)	100 91 C	0.30 0.09	76	(3)	Strong to very strong dark grey micaceous SANDSTONE.									
14.90-15.20					(10)	Discontinuities are subhorizontal and 30 degrees, closely spaced and medium spaced, stepped, rough, with occasional iron oxide staining.									
15.20-15.70	14.00 (-)	60 50	0.09 0.02	0		Between 15.80-16.70m, subvertical discontinuity, undulating, rough, iron oxide, stained with silt infill 2mm thick.									
15.70-17.20	14.00 (-)	99 80	0.04 0.25	47											
17.20-18.50	14.00 (-)	100 98	0.20 0.06	57		Between 17.70-17.82m, 60 degree discontinuity, stepped, rough, open, iron oxide stained. Between 17.82-17.84m, extremely closely spaced coal partings inclined at 30 degrees. Between 18.50-19.20m, extremely closely spaced and very closely spaced coal partings inclined at 30 degrees.									
18.50-19.30	14.00 (-)	100 94	0.14 0.04	50	(5)										
19.30-20.10	14.00 (-)	100 38	0.19 0.04	60											
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					21.40 25.20	14.00 14.00	DRY -	18/10/01 18/10/01	08:00 18:00						

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

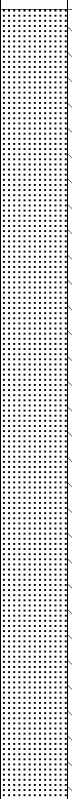
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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH08**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **270915.24 E**
195808.334 N Ground Level **65.86 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50			
Core Run/Depth (Core Dia/Time)		Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
20.10-21.40		14.00 (-)	88 85	0.40 0.09	69	(12)		Between 21.40-23.00m, subvertical discontinuities, undulating, rough, open, iron oxide stained. Between 21.55-22.50m, very closely spaced and closely spaced coal partings.			
21.40-22.90		14.00 (-)	97 93	0.35 0.04	37						
22.90-24.40		14.00 (-)	100 99	0.48 0.09	85						
24.40-25.20		14.00 (-)	100 88	0.24 0.03	30						
						(4)					
							End of Borehole		25.20		40.66

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

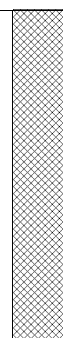
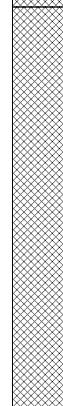
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Remarks		Backfill details from base of hole: bentonite up to ground level. AGS Flush: 0.50-9.50m, Air/Mist, 100% returns.		Logged by Checked by Figure		SI DRB 1 of 1 20/02/2018	
Symbols and abbreviations are explained on the accompanying key sheet.							
All dimensions are in metres. Logged in accordance with BS5930:2015							

BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH10 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271162.535E 195927.529N	Ground Level	60.38 m OD

Sampling			Properties			Strata			Scale 1:50						
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD						
0.00- 1.20	B					MADE GROUND: Soft to firm dark brown slightly sandy slightly gravelly clay with a low cobble content of subrounded sandstone. Gravel is angular and subangular fine to coarse sandstone At 1.20m, possibly very stiff.	G.L.		60.38						
0.50	D														
1.20- 1.65	D	1.20 (DRY)			S33										
1.50	D														
2.00- 4.00	B					MADE GROUND: Very stiff dark grey slightly sandy slightly gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subrounded fine to coarse sandstone.	2.20		58.18						
2.00- 2.45	D	2.00 (DRY)			S26										
3.00- 3.45	D	3.00 (DRY)			S33										
3.00- 3.20	D														
4.00- 4.80	B					Below 4.00m, possibly stiff.									
4.00- 4.45		4.00 (DRY)			S22										
4.80- 5.00	D					Grey silty boulder CLAY (Driller's description)	5.00		55.38						
5.00- 5.45	D	5.00 (DRY)			S27										
6.50- 6.95	D	6.50 (DRY)			S39										
8.00- 8.14		8.00 (DRY)			S50/50										
9.50- 9.95	D	9.50 (DRY)			S30										
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit		KO/AJ	G.L.			20/10/17	08:00	12.00	12.00	11.20	20		Medium inflow
12.00		Windowless Sampler		KO/AJ	5.00	5.00	DRY	20/10/17	18:00						
14.00	0.09	Rotary Core		KO/AJ	5.00	5.00	DRY	23/10/17	08:00						
					12.00	12.00	-	21/10/17	18:00						
					12.00	12.00	-	24/10/17	08:00						
					14.00	12.00	-	24/10/17	18:00						

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 0.12-14.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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BOREHOLE RECORD - Window Sampler and Rotary

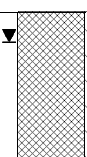
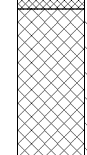
Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH10**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **271162.535E**
195927.529N Project No **PC176880** Ground Level **60.38 m OD**

Sampling			Properties			Strata		Scale 1:50						
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD					
11.00-11.45	D	11.00 (DRY)			S42									
12.00-12.07		12.00 (11.20)			C50/40		12.00		48.38					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General								
12.00-13.00	12.00 (11.20)	68 27 C	0.11 0.01	11	(NI)	Medium strong to strong dark grey SILTSTONE. Discontinuities are subvertical and subhorizontal, closely spaced, stepped, rough, open and iron oxide stained.								
12.39-12.50					(5)									
13.00-14.00	12.00 (-)	100 98	0.19 0.06	32			14.00		46.38					
						End of Borehole								
Boring			Progress			Groundwater								
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
Remarks  Logged by SI Checked by DRB Figure 2 of 2 20/02/2018 														

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres. Logged in accordance with BS5930:2015

BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY			Engineer ATKINS LIMITED			Borehole BH11 Project No PC176880					
Client ST MODWEN DEVELOPMENTS LIMITED			National Grid Coordinates 271129.189E 196042.647N			Ground Level 51.65 m OD					
Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD		
0.00- 1.20	B					MADE GROUND: Soft brownish grey slightly sandy gravelly clay with a medium cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse brick, concrete, mudstone and sandstone.	G.L.		51.65		
1.20- 1.37		1.20 (DRY)			C50/15	MADE GROUND: Very dense grey and brown sandy gravel with a medium to a high cobble content of subangular concrete. Gravel is angular to subangular fine to coarse brick and concrete.	1.20		50.45		
2.20- 2.34		2.20 (DRY)			50/85	Between 2.00-2.20m, becoming slightly clayey gravelly sand.					
						Between 2.60-2.90m, driller records brown clay and cobbles.					
						SANDSTONE (Driller's description)	2.90		48.75		
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	3.20		48.45		
3.20- 4.20	3.20 (DRY)	70 65 C	0.06 0.02	0	(15)	Weak to medium strong dark grey discoloured brown SANDSTONE. Discontinuities are subhorizontal, very closely spaced and					
3.40- 3.48						rough, open, with iron oxide staining					
4.20- 5.30	3.20 (DRY)	100 86	0.09 0.05	0	(NI)	penetrating 2mm and with occasional sand infill up to 2mm.					
						Between 4.20-5.00m, subvertical discontinuity, stepped, rough, open, iron oxide stained.					
						Between 4.85-4.97m, Non-Intact, recovered as clayey sandy gravel.					
5.30- 6.70	3.20 (-)	100 85	0.10 0.03	7	(16)	Between 5.80-6.70m, extremely closely spaced and very closely spaced coal partings.					

Remarks **Backfill details from base of hole: bentonite up to ground level.**
AGS Flush: 3.20-6.70m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

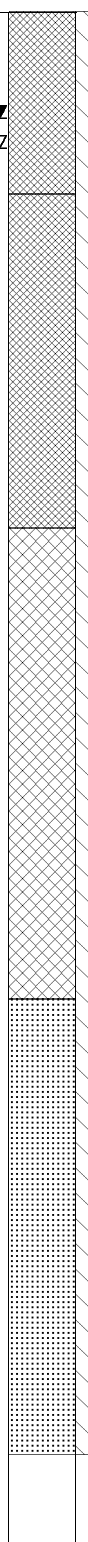
All dimensions are in metres. Logged in accordance with BS5930:2015

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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole	BH12
				Project No	PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid	271387.997E	Ground Level	49.76 m OD
		Coordinates	195882.998N		

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD					
0.00- 1.20	B					MADE GROUND: Soft brownish grey slightly sandy gravelly clay with a medium cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse brick, concrete, mudstone and sandstone.		G.L.		49.76					
0.50	D														
1.20- 1.51	D	1.20 (-)			S50/160	MADE GROUND: Very stiff dark brown slightly sandy gravelly clay with a low to medium cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse brick, concrete, sandstone and mudstone. Slight hydrocarbon odour. Between 2.00-2.20m, becoming slightly clayey gravelly sand.		1.20		48.56					
2.00- 2.45	D	2.00 (-)			S45										
2.00- 2.20	D														
2.20- 3.00	B														
3.00- 3.45	D	3.00 (-)			S34										
3.00	D														
3.40- 4.00	B					MADE GROUND: Dense greyish brown sandy slightly clayey gravel with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone. Slight hydrocarbon odour.		3.40		46.36					
4.00- 4.45	D	4.00 (-)			S50										
5.00- 5.45	D	5.00 (-)			S48										
6.50- 6.82	D	6.50 (-)			S50/170			6.50		43.26					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General									
6.50- 8.00	6.50 (-)	90 77 C	0.13 0.02	9	(15)	Medium strong and strong to very strong dark grey micaceous SANDSTONE. Discontinuities are predominantly subhorizontal, very closely spaced to closely spaced, stepped, rough, open, iron oxide stained with occasional coal dust infill up to 2mm.									
7.43- 7.56															
8.00- 9.50	6.50 (-)	73 65	0.23 0.06	44											
8.57- 8.80		C			(5)										
9.38- 9.46		C						9.50		40.26					
						End of Borehole									
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit		KO/AJ	G.L.	NIL	DRY	10/10/17	08:00	0.90	0.90	0.70	20		Medium inflow
6.50		Windowless Sampler		KO/AJ	9.50	6.50	-	10/10/17	18:00						
9.50	0.09	Rotary Core		KO/AJ											

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 6.50-9.50m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY				Engineer ATKINS LIMITED				Borehole BH13			
								Project No PC176880			
Client ST MODWEN DEVELOPMENTS LIMITED				National Grid Coordinates 271321.019E 195812.013N				Ground Level 56.67 m OD			

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD						
0.00- 1.20	B					MADE GROUND: Soft dark brown slightly sandy gravelly clay with occasional rootlets. Gravel is angular to subangular fine to coarse sandstone. Slight hydrocarbon odour.	G.L.		56.67						
0.50	D														
1.20- 3.00	B	1.20 (DRY)			S35	MADE GROUND: Very stiff dark brown slightly sandy gravelly clay with a low to a medium cobble content of subangular sandstone. Gravel is subangular to subrounded fine to coarse sandstone, brick and concrete.	1.20		55.47						
1.20- 1.65	D														
1.50	D														
2.00- 2.45	D	2.00 (DRY)			S39										
2.00	D														
3.00- 3.45	D	3.00 (2.70)			S44	No Recovery (Driller's description).	3.00		53.67						
4.00- 4.09	D	4.00 (-)			S50/40		4.00		52.67						
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail								
4.00- 5.00	4.00 (-)	60 20	0.05 0.02	0	(NI)	Strong to very strong grey occasionally discoloured brown micaceous SANDSTONE with occasional very closely spaced parting of silt size coal. Discontinuities are subhorizontal, very closely spaced and closely spaced, stepped, rough, open with iron oxide staining up to 1mm.	Between 4.00-5.00m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Possibly drilling induced.								
5.00- 6.50	4.00 (-)	80 53	0.09 0.01	0	(NI)		Between 5.00-5.40m, Non-Intact, recovered as slightly sandy angular to subangular fine to coarse gravel.								
6.50- 8.00	4.00 (-)	100 99 C	0.12 0.04	8	(11)		Between 5.50-6.00m, subvertical discontinuity, undulating, rough, open, iron oxide stained.								
6.60- 6.66							Between 6.30-6.50m, subvertical discontinuity, undulating, rough, open, iron oxide stained.								
							Between 7.30-8.00m, 80 degree discontinuity, undulating, rough, open, iron oxide stained.								
							Between 7.40-7.45m, extremely closely to very closely spaced coal partings.								
						End of Borehole									
Boring						Progress				Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20 4.00 8.00	0.09	Inspection Pit Windowless Sampler Rotary Core		K0/AJ K0/AJ K0/AJ	G.L. 8.00	4.00	-	13/10/17 13/10/17	08:00 18:00	3.00	3.00	2.70	20		Medium inflow

Remarks		Backfill details from base of hole: bentonite up to ground level. AGS Flush: 4.00-8.00m, Air/Mist, 100% returns.	
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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

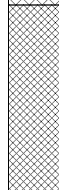
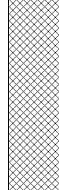
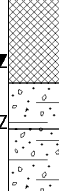
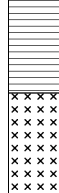
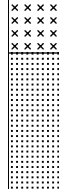
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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH14 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271208.128E 195833.802N	Ground Level	58.00 m OD

Sampling			Properties			Strata		Scale 1:50			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD	
0.00- 1.20	B	1.20 (DRY)			S12	MADE GROUND: Dark brown slightly sandy slightly clayey gravel with a low to a medium cobble content of subangular brick, concrete and sandstone.		G.L.		58.00	
0.50	D										
0.50	D										
1.20- 2.90	B	2.20 (DRY)			S26	MADE GROUND: Firm to stiff dark brown slightly sandy gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse concrete and sandstone.		1.20		56.80	
1.20- 1.65	D										
1.50	D										
2.20- 2.65	D	3.20 (DRY)			S22						
3.20- 3.70	B										
3.20- 3.65	D										
3.50	D	4.20 (DRY)			S50/35						
4.20- 4.33	D										
4.50- 5.30	D										
5.20- 5.58		5.20 (-)			S50/225	Stiff light orangish brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse sandstone and mudstone.					
5.30- 6.00	D										
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General		6.00		52.00	
6.00- 7.50	6.00 (-)	100 80 C	0.12 0.10	8	(NI)	Very weak to weak brownish grey MUDSTONE. Discontinuities are subhorizontal, 0-10degrees, very closely and closely spaced, stepped, rough with occasional silty infill up to 2mm.	Detail	Between 6.00-6.18m, Non-Intact, recovered as slightly sandy clayey angular to subangular gravel. Between 6.54-6.70m, 70 degree discontinuity, stepped, rough with silty infill 1mm thick. Between 7.00-7.20m, Non-Intact, recovered as angular to subangular fine to coarse gravel. Between 7.14-7.20m, very closely spaced, randomly orientated discontinuities, rough, tight. Between 7.40-8.00m, Non-Intact, recovered as angular to subangular fine to coarse gravel of mudstone and sandstone.			50.00
					(10)						
					(NI)						
					(13)						
7.50- 9.00	6.00 (-)	83 47	0.10 0.01	7	(NI)			8.00		49.00	
					(8)						
9.00-10.00	6.00 (-)	100 90	0.29 0.04	85	(4)	Medium to strong dark grey SILTSTONE. Discontinuities are predominantly subhorizontal, stepped, rough and clean.	At 8.10m, strong iron oxide stained nodule.	9.00			
								10.00		48.00	

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	CJ	G.L.	6.00	-	11/10/17	08:00	4.50	3.20	4.10	20		Seepage
4.20	0.12	Window Sampler and	CJ	10.00			11/10/17	18:00						
10.00	0.12	Rotary Open Hole Rotary Core	CJ											

Remarks **Backfill** details from base of hole: bentonite up to ground level.
AGS Flush: 6.00-1.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH14**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid **271208.128E**
 Coordinates **195833.802N** Ground Level **58.00** m OD

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						Strong to very strong dark grey micaceous SANDSTONE. Discontinuities are subhorizontal, closely spaced and medium spaced, stepped, rough with occasional iron oxide staining.		10.00		48.00
						End of Borehole				

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH15 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	270926.469E 195738.94 N	Ground Level	67.06 m OD

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD					
0.00- 1.20	B	1.20 (DRY)			S24	MADE GROUND: Firm dark brown slightly sandy slightly gravelly clay with a low to a medium cobble content of subangular brick and sandstone. Gravel is angular to subrounded fine to coarse brick, concrete and sandstone.		G.L.		67.06					
0.50	D														
1.20- 1.65	D					Below 1.20m, becoming stiff and very stiff.									
2.20- 2.65	D	2.20 (DRY)			S40	Gravelly CLAY and boulders (Drillers description).		2.40		64.66					
3.20- 3.65	D	3.20 (DRY)			S27										
4.20- 5.70 4.20- 4.36	B D	4.20 (DRY)			S50/65	Very dense dark brown slightly sandy clayey GRAVEL with a high cobble content of subangular sandstone. Gravel is angular to subrounded fine to coarse sandstone.		4.20		62.86					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General		5.70		61.36					
5.70- 6.50	5.70 (4.90)	56 23	0.05 0.01	0	(NI)	Medium strong to strong grey occasional discoloured brown micaceous SANDSTONE. Discontinuities are subhorizontal, very closely spaced and stepped, rough with occasional iron oxide staining penetrating up to 2mm.									
6.50- 7.50	5.70 (-)	100 98	0.07 0.02	0	(16)										
7.50- 9.00	5.70 (-)	100 65	0.10 0.02	7											
8.85- 9.00		C													
9.00- 9.50	5.70 (-)	100 96	0.07 0.03	0											
9.50-10.30	5.70 (-)	100 97	0.08 0.04	0											
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit		CJ/KO	G.L.	NIL	DRY	05/10/17	08:00	6.10	5.70	4.90	20		Seepage
5.70	0.10	Window Sampler		CJ/KO	1.20	1.20	DRY	05/10/17	18:00						
11.30	0.10	Rotary Core		CJ/KO	1.20	1.20	DRY	12/10/17	08:00						
					9.50	5.70	4.10	14/10/17	18:00						
					9.50	5.70	4.10	13/10/17	08:00						
					11.30	5.70	-	06/10/17	18:00						

Remarks: A 50mm standpipe was installed to 6.25m with a geowrapped slotted section from 3.20m to 6.25m with upright lockable protective cover. Backfill details from base of hole: bentonite up to 6.25m, gravel filter up to 3.50m, bentonite up to 0.30m, concrete up to ground level. Flush: 5.70-11.30m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH15**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid **270926.469E**
 Coordinates **195738.94 N** Ground Level **67.06 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
10.30-11.30	5.70 (-)	100 80	0.12 0.04	12	(10)		Between 10.70-11.00m, 70 degree discontinuity, straight, open with iron oxide staining up to 1mm. Between 11.00-11.30m, subvertical fracture, undulating, rough, open with iron oxide staining to 1mm.	11.30		55.76
						End of Borehole				

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH18 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	271384.032E 195798.483N	Ground Level	52.87 m OD

Sampling			Properties			Strata		Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD
0.00- 0.50	B					MADE GROUND: Dark brown sandy slightly clayey gravel with a low cobble content of subangular brick and concrete. Gravel is angular to subangular fine to coarse brick, concrete and sandstone.		G.L.		52.87
0.40	D							0.50		52.37
0.50- 0.56		NIL (DRY)			S50/40					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques				
					(NI)	General	Detail			
0.50- 1.50	0.50 (DRY)	47 30 C	0.16 0.02	11	(13)	Medium strong and strong dark grey occasionally discoloured brown micaceous SANDSTONE. Discontinuities are predominantly subhorizontal, very closely and closely spaced, stepped, rough, open with iron oxide staining penetrating up to 2mm and with occasional mudstone infill up to 2mm thick.	Between 0.50-0.70m, non-intact, recovered as angular to subangular fine to coarse gravel. At 2.00m, 70 degree, discontinuity, stepped, rough with iron oxide staining penetrating to 1mm.			
0.70- 0.86										
1.50- 3.00	0.50 (DRY)	93 92	0.09 0.05	0						
2.80- 2.89		C								
3.00- 3.50	0.50 (-)	70 68	0.09 0.04	0						
3.50- 5.00	0.50 (-)	90 87 C	0.15 0.06	24	(12)					
3.70- 3.81										
5.00- 6.00	0.50 (-)	100 85	0.30 0.12	23						
6.00- 7.00	0.50 (-)	100 97	0.21 0.05	23	(4)	Strong to very strong dark grey SANDSTONE. Discontinuities are subhorizontal, stepped, rough, open, iron oxide stained with occasional mudstone infill up to 2mm.		6.00		46.87
7.00- 8.50	0.50 (-)	80 73	0.19 0.04	20						
8.50-10.00	0.50 (-)	100 92	0.31 0.09	67						
								10.00		42.87

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.50		Inspection Pit	KO/AJ	G.L.			12/10/17	08:00	2.40	0.50	2.20	20		Slow inflow
10.00	0.09	Rotary Core	KO/AJ	10.00	0.50	2.20	12/10/17	18:00						

Remarks Backfill details from base of hole: bentonite up to ground level.
 Air/Mist: 0.50-10.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH18**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid **271384.032E**
 Coordinates **195798.483N** Ground Level **52.87 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						End of Borehole		10.00		42.87

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY			Engineer ATKINS LIMITED			Borehole BH19 Project No PC176880									
Client ST MODWEN DEVELOPMENTS LIMITED			National Grid Coordinates 271199.007E 195804.248N			Ground Level 59.59 m OD									
Sampling			Properties			Strata			Scale 1:50						
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description			Depth	Legend	Level m OD				
0.00- 1.20	B					MADE GROUND: Soft dark brown slightly sandy gravelly clay with a low to a medium cobble content of subangular sandstone and concrete. Gravel is angular to subangular fine to coarse brick, sandstone and concrete.			G.L.		59.59				
0.50	D														
1.20- 2.00	B	1.20 (DRY)			S9	MADE GROUND: Soft to firm brown and dark brown slightly sandy gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone.			1.20		58.39				
1.20- 1.65	D														
2.00- 2.20	D	2.20 (DRY)			S44	Below 2.20m, very stiff.									
2.20- 2.65	D														
3.20	D	3.20 (DRY)			C50/140				3.20		56.39				
3.20- 3.49									3.28		56.31				
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General		Detail							
3.20- 4.00	3.20 (DRY)	50 21	0.08 0.01	0	(NI)	Medium strong dark grey MUDSTONE, interlaminated with SILTSTONE. Discontinuities are subhorizontal, very closely spaced and closely spaced, undulating, rough with coal dust infill up 2mm thick.									
4.00- 4.50	3.20 (DRY)	100 84 C	0.22 0.02	44	(5)	Weak to medium strong dark grey discoloured brown micaceous SANDSTONE. Discontinuities are closely spaced and medium spaced, stepped, rough with iron oxide staining penetrating 2mm and with occasional mudstone and clay bands with infill up to 4mm thick.		Between 4.50-4.68m, subvertical discontinuity, stepped, rough, iron oxide stained. At 4.68m, mudstone band 3mm thick. Between 5.40-5.50m, non-intact, recovered as very soft slightly sandy gravelly clay. At 5.50m, 4mm thick extremely weak mudstone band.	6.20		53.39				
4.40- 4.48															
4.50- 6.00	3.20 (DRY)	95 65	0.30 0.01	67	(NI)	Weak to medium dark grey MUDSTONE. Discontinuities are subhorizontal, very closely and closely spaced, stepped, rough with occasional coal dust infill up to 3mm thick.		Between 6.20-6.40m, non-intact, recovered as angular to subangular fine to coarse gravel.	7.30		52.29				
6.00- 7.50	3.20 (DRY)	93 57	0.15 0.01	25	(NI)	Strong to very strong dark grey SANDSTONE. Discontinuity is subvertical, undulating, rough, open and iron oxide stained.		Between 7.30-7.50m, subvertical discontinuity.	7.50		52.09				
					(8)	End of Borehole									
Boring					Progress					Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit		CJ/KO	G.L.										None observed during drilling.
2.20	0.10	Windowless Sampler		CJ/KO	7.50	3.20	DRY	10/10/17	08:00						
3.20	0.10	Rotary Open Hole		CJ/KO				10/10/17	18:00						
7.50	0.10	Rotary Core		CJ/KO											

Remarks **Backfill details from base of hole: bentonite up to ground level.**
AGS Flush: 3.20-7.50m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Rotary Core

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH20**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **270365.24 E**
194749.216 N Ground Level **37.77 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	(FI)	Description General	Description Detail	Depth	Legend	Level m OD
0.00- 0.90		B				MADE GROUND: Brown sandy slightly clayey gravel with a low cobble content of subangular to tabular sandstone. Gravel is angular to subangular fine to coarse sandstone.		G.L.		37.77
0.50		D								
1.00- 2.00	1.00 (DRY)	80 35 C C	0.04 0.01	0	(22)	Weak to medium strong and strong dark grey discoloured brown micaceous SANDSTONE. Discontinuities are subhorizontal, very closely spaced and closely spaced, stepped, rough, open with iron oxide staining penetrating up to 4mm and with occasional sand infill 2mm.	Between 2.00-2.30m, non-intact, recovered as angular to subangular fine to coarse gravel. Between 2.50-3.00m, black oily staining on bedding fractures. Evidence of hydrocarbon contamination.	1.00		36.77
1.16- 1.19										
1.38- 1.42										
2.00- 2.50	1.00 (DRY)	60 22 C	0.07 0.01	0	(NI)					
2.24- 2.30										
2.50- 3.30	1.00 (DRY)	80 65	0.07 0.03	0	(15)					
3.30- 3.80	1.00 (2.90)	90 66	0.08 0.03	0		Strong to very strong dark grey micaceous SANDSTONE. Discontinuities are subhorizontal, very closely spaced and closely spaced, stepped, rough, open and clean.		3.50		34.27
3.80- 4.80	1.00 (-)	90 72	0.11 0.01	11	(11)					
4.80- 5.30	1.00 (-)	78 66	0.06 0.03	0						
						End of Borehole		5.30		32.47

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.09	Inspection Pit	KO/AJ	G.L.	1.00	2.90	30/10/17	08:00	3.30	1.00	2.90	20		Medium inflow
5.30		Rotary Core	KO/AJ	5.30			30/10/17	18:00						

Remarks **DA** 50mm standpipe was installed to 5.00m with a geowrapped slotted section from 2.00m to 5.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 1.80m, bentonite up to 0.31m, concrete up to ground level.
 Flush: 1.00-5.30m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Window Sampler and Rotary

Project COED DARCY				Engineer ATKINS LIMITED				Borehole Project No BH21 PC176880			
Client ST MODWEN DEVELOPMENTS LIMITED				National Grid Coordinates 270478.838E 194796.375N				Ground Level 43.58 m OD			

Sampling			Properties			Strata		Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description	Depth	Legend	Level m OD	
0.00 - 1.20	B					MADE GROUND: Dark brown and brown slightly sandy clayey gravel with a low cobble content of subangular concrete. Gravel is angular to subangular fine to coarse concrete and sandstone.	G.L.		43.58	
1.20 - 1.65	D	1.20 (DRY)			S22	Stiff to very stiff brown slightly gravelly very sandy CLAY. Gravel is angular to subangular fine to coarse sandstone.	1.20		42.38	
1.50 - 1.80	D									
2.20 - 2.50	D	2.20 (DRY)			S50/150		2.20		41.38	
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (F)	Continued by Rotary techniques General	Detail			
2.20 - 2.80	2.20 (DRY)	83 0	- -	0	(NI)	Weak to medium strong dark grey discoloured brown micaceous SANDSTONE. Discontinuities are predominantly 30 degree inclined, very closely spaced and closely spaced, rough with iron oxide staining penetrating 2mm and with occasional sand infill up to 2mm. Slight hydrocarbon odour.	Between 2.20-2.80m, non-intact, recovered as angular to subangular fine to coarse gravel. Between 3.30-4.30m, vertical discontinuity running along the core axis, with sand infill up to 2mm.			
2.80 - 3.80	2.20 (DRY)	100 68	0.07 0.04	0						
3.80 - 4.60	2.20 (DRY)	100 71	0.08 0.04	0	(16)					
4.33 - 4.41		C								
4.60 - 5.80	2.20 (DRY)	67 56	0.09 0.04	0		Strong to very strong dark grey micaceous SANDSTONE. Discontinuities are predominantly 30 degree inclined, very closely spaced and closely spaced, stepped, rough, open with occasional iron oxide staining.	Between 5.20-5.36m, 2 No 60 degree discontinuities, spaced at 30mm apart.			
5.80 - 6.20	2.20 (6.00)	100 73	0.09 0.03	0						
6.20 - 6.90	2.20 (-)	100 97	0.12 0.05	77	(6)					
6.90 - 8.30	2.20 (-)	93 89	0.19 0.06	75						
						End of Borehole	8.30		35.28	

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit Window Sampler Rotary Core	CJ/KO CJ/KO CJ/KO	G.L.	2.20	-	25/10/17	08:00	6.00	2.20				Seepage
2.20	0.10							25/10/17	18:00					
8.30	0.10													

Remarks 50mm standpipe was installed to 8.30m with a geowrapped slotted section from 2.10m to 8.30m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.00m, bentonite up to 0.30m, concrete up to ground level. Flush: 2.20-8.30m, Air/Mist, 100% returns.														
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.														

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BOREHOLE RECORD - Window Sampler and Rotary

Project	COED DARCY	Engineer	ATKINS LIMITED	Borehole Project No	BH22 PC176880
Client	ST MODWEN DEVELOPMENTS LIMITED	National Grid Coordinates	270620.965E 194855.551N	Ground Level	29.77 m OD

Sampling			Properties			Strata		Scale 1:50			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description		Depth	Legend	Level m OD	
0.00- 1.20	B					MADE GROUND: Soft to firm brown slightly sandy gravelly clay with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone.		G.L.		29.77	
1.20- 1.30	D					At 1.20m, possibly stiff.					
1.20- 1.65											
1.30- 2.00	B	1.20 (0.80)			C29						
2.00- 3.00	D					Very stiff brown slightly sandy gravelly CLAY with a low cobble content and a low boulder content of subangular sandstone.		2.00		27.77	
2.00- 2.45											
3.00- 3.45	D	3.00 (DRY)			C27						
4.00- 5.00											
4.00- 4.45	D	3.00 (DRY)			S45						

Remarks: A 50mm standpipe was installed to 7.00m with a geowrapped slotted section from 5.00m to 7.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 4.80m, bentonite up to 0.30m, concrete up to ground level.
 Flush: 5.00-7.00m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Rotary Core

Project **COED DARCY** Engineer **ATKINS LIMITED** Borehole **BH23**
 Project No **PC176880**
 Client **ST MODWEN DEVELOPMENTS LIMITED** National Grid Coordinates **270551.341E**
194770.444N Ground Level **43.10** m OD

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (F)	Description General	Description Detail	Depth	Legend	Level m OD
0.00- 1.20 0.00- 1.20		B B				MADE GROUND: Dark grey sandy slightly clayey gravel with a low to medium cobble content of subangular concrete and sandstone. Gravel is angular to subangular fine to coarse concrete and sandstone. Strong hydrocarbon odour.		G.L.		43.10
1.20- 1.48	1.20 (DRY)	D			S50/ 160	Fractured SANDSTONE (Drillers description).	Between 1.20-1.50m, open hole.	1.20		41.90
1.50- 2.00	1.50 (DRY)	70 12	0.06 0.01	0	(NI)	Medium strong and strong grey discoloured brown SANDSTONE with occasional very closely spaced and extremely closely spaced coal partings. Discontinuities are subhorizontal, extremely closely spaced and very closely spaced, stepped, rough, open, iron oxide stained with occasional coal dust infill to 1mm.	Between 1.50-2.30m, non-intact, recovered as angular to subangular fine to coarse gravel. Between 2.40-3.00m, coal partings are extremely closely spaced and very closely spaced along subhorizontal discontinuities. At 3.20m, 70 degree discontinuity, stepped, rough, open, iron oxide stained. At 3.70m, 45 degree discontinuity, stepped, rough, iron oxide stained.	1.50		41.60
2.00- 3.00	1.50 (DRY)	100 55	0.65 0.01	0	(19)					
3.00- 4.00	1.50 (DRY)	100 70	0.11 0.02	11	(8)					
3.70- 3.80		C			(8)					
4.00- 5.50	1.50 (4.20)	100 67	0.17 0.01	11	(NI)		Between 4.30-5.40m, non-intact, recovered as angular to subangular fine to coarse gravel with frequent coal fragments up to 4mm.			
5.50- 6.70	1.50 (-)	92 69	0.13 0.02	11	(6)	Weak dark brown and black micaceous SANDSTONE with numerous carbonised plant fossils and black coal inclusions. Discontinuities are very closely spaced and closely spaced, stepped, rough, open with coal dust infill to 1mm.	Between 6.00-6.70m, frequent coal fragments up to 3mm.	5.50		37.60
6.70- 8.20	1.50 (-)	100 77	0.17 0.01	27	(7)	Strong dark grey SILTSTONE. Discontinuities are subhorizontal, closely spaced, stepped and rough.		6.70	xxxxx	36.40
					(NI)			7.30	xxxxx	35.80
					(4)	Weak to medium strong dark grey and black micaceous SANDSTONE with frequent carbonised plant fossils and coal inclusions. Discontinuities are closely spaced and medium spaced, undulating, rough, open, iron oxide stained, with occasional coal dust infill up to 1mm.		8.20		34.90
						End of Borehole				

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20 1.50 8.20	0.10 0.10 0.10	Inspection Pit Rotary Open Hole Rotary Core	CJ/KO CJ/KO CJ/KO	G.L. 8.20	1.50	6.20	24/10/17 24/10/17	08:00 18:00	0.90 4.20	NIL 1.50			1.50	Seepage Seepage

Remarks **DA** 50mm standpipe was installed to 8.20m with a geowrapped slotted section from 1.00m to 8.20m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 0.80m, bentonite up to 0.20m, concrete up to ground level.
 Flush: 1.50-8.20m, Air/Mist, 100% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

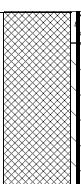
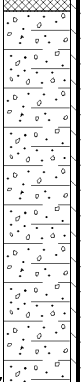
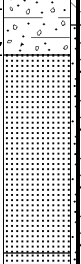
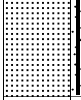
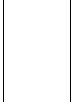
All dimensions are in metres.

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Figure

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DRB
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geotechnics

Sampling			Properties			Strata		Scale 1:50						
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD				
0.00- 1.20	B					MADE GROUND: Soft to firm brown slightly gravelly sandy clay. Gravel is angular to subangular fine to coarse sandstone.		G.L.		35.70				
0.50	D													
1.20- 1.65	D	1.20 (DRY)		S27										
1.30- 2.80	B													
2.00- 2.45	D	2.00 (DRY)		S28	Stiff brown slightly gravelly sandy CLAY with a low cobble content of subangular sandstone. Gravel is angular to subangular fine to coarse sandstone.		1.20		34.50					
2.80- 3.00	D	3.00 (DRY)		S50										
3.00- 3.45														
Core Run/Depth (Core Dia/Time)		Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	4.00		31.70				
4.00- 5.00	4.00 (3.70)	60 28 C	0.10 0.02	10	(19)	Medium strong to strong dark grey micaceous SANDSTONE with numerous carbonised plant fossils. Discontinuities are subhorizontal, very closely and closely spaced, stepped, rough, open, iron oxide stained.								
4.30- 4.35														
4.49- 5.00														
5.00- 5.50	4.00 (-)	100 84 C	0.06 0.02	0	(31)	Very weak and weak dark grey micaceous SANDSTONE with extremely closely spaced coal partings. Discontinuities are predominantly subhorizontal, extremely closely spaced and very closely spaced, stepped, rough with occasional iron oxide staining and coal dust infill to 1mm.	5.30		30.40					
5.00- 5.06														
5.50- 6.00	4.00 (-)	100 76	0.06 0.01	0		Between 5.60-5.68m, subvertical discontinuity, stepped, rough, open, iron oxide stained. Between 5.81-5.92m, medium strong sandstone.	6.00		29.70					
							End of Borehole							
Boring														
Progress					Groundwater									
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	In Mins	Depth Sealed	Remarks on Groundwater
1.20		Inspection Pit	KO/AJ	6.L.			24/10/17	08:00	4.00	4.00	3.70	20		Medium inflow
4.00	0.10	Window Sampler	KO/AJ	3.00	3.00	DRY	24/10/17	18:00						
6.00	0.10	Rotary Core	KO/AJ	3.00	4.00	DRY	25/10/17	08:00						
Remarks														
A 50mm standpipe was installed to 6.00m with a geowrapped slotted section from 4.00m to 6.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 3.80m, bentonite up to 0.20m, concrete up to ground level. Flush: 4.00-6.00m, Air/Mist, 100% returns.														
Symbols and abbreviations are explained on the accompanying key sheet.														
All dimensions are in metres.														
Logged in accordance with BS5930:2015														
Logged by Checked by Figure														
SI DRB 1 of 1 20/02/2018														
geotechnics														

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH01 7.00-9.00m



BH01 9.00-12.00m

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH01 12.00-15.00m



BH01 15.00-18.00m

PHOTOGRAPHS

Project Number : PCI76880

Project : Coed Darcy



BH01 18.00-19.50m



BH02 1.20-3.00m

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH02 3.00-7.50m



BH03 1.20-3.00m

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH03 3.00-7.00m



BH03 7.00-8.50m

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH03 8.50-10.00m



BH04 1.20-4.50m

PHOTOGRAPHS

Project Number : PCI76880

Project : Coed Darcy



BH04 4.00-6.50m



BH05 1.20-3.00m

PHOTOGRAPHS

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BH05 3.00-5.00m



BH06 1.20-6.00m

PHOTOGRAPHS

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BH06 6.00-12.00m



BH07 1.20-3.20m

PHOTOGRAPHS

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BH07 3.20-4.30m



BH08 14.50-15.70m

PHOTOGRAPHS

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BH08 15.70-17.20m



BH08 17.20-19.30m

PHOTOGRAPHS

Project Number : PC176880

Project : Coed Darcy



BH08 19.30-21.40m



BH08 21.40-24.40m

PHOTOGRAPHS

Project Number : PCI76880

Project : Coed Darcy



BH08 24.40-25.20m



BH09 0.50-2.00m