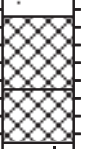


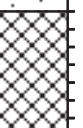
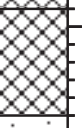
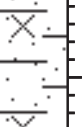
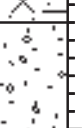
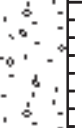
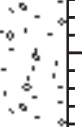
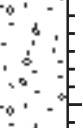
Appendix D

			Project Title: Radcliffe Hub			WS01					
			Project Number: 5238		Client: Bury Council				Sheet 1 Of 1		
			GL (mAOD): 63.98		N Coord: 406933.477		E Coord: 378522.854				
Date: 19/01/2022			Method: Window Sampler		Driller: Earth Engineering		Logged By: MJ				
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe			
			63.79		0.19	CONCRETE hardstanding					
			63.48		0.50	MADE GROUND: Grey to black gravelly sand with brick cobble					
			63.43		0.55	MADE GROUND: Sandstone slab					
						End Of Borehole At 0.55 m					
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS No Groundwater Encountered Hand pit unable to progress deeper than 0.5m due to obstruction Scale: 1:40			Water Strikes					
						Date	Strike	Level	Minutes	Casing	Sealed
						Daily Log Of Depths			Chiselling		
						Date	Casing	Water	From	To	Hours

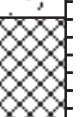
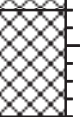
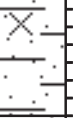
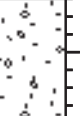
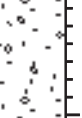
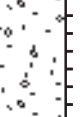
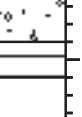
			Project Title: Radcliffe Hub			WS01A																							
			Project Number: 5238		Client: Bury Council				Sheet 1 Of 1																				
			GL (mAOD): 64.09		N Coord: 406929.481		E Coord: 378517.994																						
Date: 19/01/2022			Method: Window Sampler		Driller: Earth Engineering		Logged By: MJ																						
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																					
			63.85		0.24	CONCRETE hardstanding																							
			63.44		0.65	MADE GROUND: Grey to black gravelly sand with much ash and clinker and brick cobble																							
			63.14		0.95	MADE GROUND: Brown sandy gravelly clay with occasional brick cobble.																							
			63.09		1.00	MADE GROUND: Obstruction End Of Borehole At 1.00 m																							
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS No Groundwater Encountered Hand pit unable to progress deeper than 1.0m due to obstruction Scale: 1:40			Water Strikes																							
						<table border="1"> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>						Date	Strike	Level	Minutes	Casing	Sealed												
Date	Strike	Level	Minutes	Casing	Sealed																								
Daily Log Of Depths						Chiselling																							
						<table border="1"> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>						Date	Casing	Water	From	To	Hours												
Date	Casing	Water	From	To	Hours																								

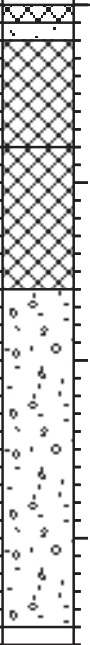
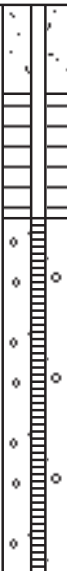
Printed By GeoLogs (www.GeoLogs.com)



 iD GeoEnvironmental Limited			Project Title: Radcliffe Hub				WS02																												
			Project Number: 5238		Client: Bury Council						Sheet 1 Of 1																								
			GL (mAOD): 64.45		N Coord: 406944.129		E Coord: 378514.152																												
Date: 19/01/2022			Method: Window Sampler		Driller: Earth Engineering		Logged By: MJ																												
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																											
0.40 0.40	J T	N=16	64.25		0.20	CONCRETE hardstanding																													
1.00 1.00 1.20 - 1.65	J T SPT		63.55		0.90	MADE GROUND: Brown clayey gravelly sand with brick cobbles.																													
1.50 - 2.00 1.70	B T		62.95		1.50	MADE GROUND: Grey brown sandy gravelly clay with brick cobble. Gravel is of clinker and mudstone.																													
2.00 - 2.45	SPT	N=5	62.05		2.40	Light brown mottled grey sandy CLAY with occasional gravel.																													
2.50 - 3.50	B	N=10				Yellow brown medium to coarse grained SAND with occasional gravel from 3.0m.																													
3.00 - 3.45 3.00	SPT T																																		
3.80 4.00 - 4.45	T SPT		N=17																																
4.50	T	N=50																																	
5.00 - 5.45	SPT																																		
				59.25		5.20			Grey MUDSTONE recovered as clayey gravel																										
			58.65		5.80	End Of Borehole At 5.80 m																													
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS Hand pit excavated to 1.2m bgl before commencement of drilling Scale: 1:40			Water Strikes <table><tr><th>Date</th><th>Strike</th><th>Level</th><th>Minutes</th><th>Casing</th><th>Sealed</th></tr><tr><td>19/01/2022</td><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Date	Strike	Level	Minutes	Casing	Sealed	19/01/2022	4																
						Date	Strike	Level	Minutes	Casing	Sealed																								
						19/01/2022	4																												
Daily Log Of Depths <table><tr><th>Date</th><th>Casing</th><th>Water</th><th>From</th><th>To</th><th>Hours</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Date	Casing	Water	From	To	Hours																								
Date	Casing	Water	From	To	Hours																														

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	REMARKS No Groundwater Encountered Hand pit terminated at 0.95m due to drain Scale: 1:40	Water Strikes					
		Date	Strike	Level	Minutes	Casing	Sealed
		Daily Log Of Depths			Chiselling		
		Date	Casing	Water	From	To	Hours

			Project Title: Radcliffe Hub			WS03A					
			Project Number: 5238		Client: Bury Council				Sheet 1 Of 1		
			GL (mAOD): 64.36		N Coord: 406950.021		E Coord: 378524.624				
Date: 19/01/2022			Method: Window Sampler		Driller: Earth Engineering		Logged By: MJ				
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe			
0.50 0.50	J T		64.17		0.19	CONCRETE hardstanding					
1.20 - 1.65	SPT	N=2	63.56		0.80	MADE GROUND: Red brown gravelly sand with brick cobbles.					
2.00 - 2.45	SPT	N=7	62.96		1.40	MADE GROUND: Grey brown sandy gravelly clay with brick cobble. Gravel is of clinker, slate and mudstone. Piece of timber encountered.					
2.20	T					Light brown mottled grey sandy CLAY with occasional gravel.					
3.00 - 3.45	SPT	N=6	61.66		2.70	Yellow brown medium to coarse grained SAND with occasional gravel from 3.0m.					
4.00 - 4.45	SPT	N=4									
5.00 - 5.45	SPT	N=50	59.46		4.90						
			59.26		5.10	Grey MUDSTONE recovered as clayey gravel					
						End Of Borehole At 5.10 m					
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS Hand pit excavated to 1.2m bgl before commencement of drilling Scale: 1:40			Water Strikes					
						Date	Strike	Level	Minutes	Casing	Sealed
						19/01/2022	4.1				
						Daily Log Of Depths			Chiselling		
						Date	Casing	Water	From	To	Hours

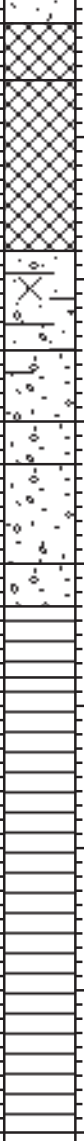
			Project Title: Radcliffe Hub			WS04																																																								
			Project Number: 5238		Client: Bury Council				Sheet 1 Of 1																																																					
			GL (mAOD): 63.63		N Coord: 406942.415		E Coord: 378551.236																																																							
Date: 15/05/2022			Method: Comacchio Geo 205		Driller: Dynamic Sampling UK		Logged By: BRB																																																							
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																																																						
0.90 - 1.00	ES	N=6	63.53 63.43		0.10 0.20	MADE GROUND: Concrete paving slab overlying grey coarse sand bedding.																																																								
									MADE GROUND: Concrete Slab (100mm).																																																					
			62.83		0.80	MADE GROUND: Grey limestone sandy gravel (similar to MOT type 1 aggregate).																																																								
						MADE GROUND: Red grey mottled angular to sub-rounded gravel and cobbles of limestone aggregate, brick and sandstone.																																																								
1.60 - 2.00 1.60 - 2.00	D ES	N=15	62.03		1.60	Loose becoming medium dense brown sandy GRAVEL. Gravel is of rounded to sub-rounded medium to coarse sandstone and quartzite with occasional fine angular gravel of coal. 2.00 - 2.45 CPT no recovery																																																								
		pp 50/90mm				2.90 - 3.50 Cobbles of orange brown sandstone 3.00 - 3.45 CPT no recovery																																																								
			60.13 60.03		3.50 3.60	BEDROCK 3.50 CPT no recovery End Of Borehole At 3.60 m																																																								
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS No Groundwater Encountered Location CAT scanned before drilling. Vacuum excavation used to 1.5m to ensure services absent. Scale: 1:40			Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="3">Daily Log Of Depths</th> <th colspan="3">Chiselling</th> </tr> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			Date	Strike	Level	Minutes	Casing	Sealed																									Daily Log Of Depths			Chiselling			Date	Casing	Water	From	To	Hours												
Date	Strike	Level	Minutes	Casing	Sealed																																																									
Daily Log Of Depths			Chiselling																																																											
Date	Casing	Water	From	To	Hours																																																									

		Project Title: Radcliffe Hub					BH05																																																							
		Project Number: 5238		Client: Bury Council		Sheet 1 Of 2																																																								
		GL (mAOD): 64.10		N Coord: 406968.911		E Coord: 378558.913																																																								
Date: 15/05/2022-18/05/2022		Method: Comacchio Geo 205		Driller: Dynamic Sampling UK		Logged By: MJ																																																								
Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe																																																			
0.70 D 0.70 ES						63.50		0.60	MADE GROUND: Paver over compact grey limestone sandy gravel (similar to MOT Type 1 aggregate). Firm brown sandy gravelly CLAY.																																																					
						63.10		1.00																																																						
2.00 D					N=4	62.10		2.00	Grey brown medium to coarse slightly gravelly SAND.																																																					
						61.90		2.20																																																						
3.00 D					N=50	61.10		3.00	Thinly laminated with close spacing (<5mm) light grey sandy MUDSTONE. Laminations have a shallow dip angle (approx 3-5 degrees). Natural fractures are typically rough with an undulating surface, some have iron staining.																																																					
3.00-4.50	52%	30%	30%			60.10		4.00																																																						
4.50-5.20	99%	66%	47%	2.9		59.40		4.70	Thinly laminated with close spacing (<5mm) grey MUDSTONE. Laminations have a shallow dip angle (approx 3-5 degrees). Natural fractures are typically rough with an undulating surface. Weathering around fractures noted to up to 5mm. Fractures are occasionally infilled with clay. 5.20 - 7.00 Mudstone is highly weathered with bands of clay present.																																																					
						59.10		5.00																																																						
5.20-6.00	50%	14%	14%			58.10		6.00	Borehole Continues																																																					
6.00-7.00	48%	7%	0%			57.10		7.00																																																						
7.00-8.50	60%	44%	33%			56.10		8.00																																																						
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 					REMARKS No Groundwater Encountered Location CAT scanned before drilling. Vacuum excavation used to 1.5m Scale: 1:50					Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Remarks</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="3">Daily Log Of Depths</th> <th colspan="3">Flushing Medium</th> </tr> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td>3</td> <td>13.5</td> <td>Water</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>					Date	Strike	Level	Minutes	Casing	Remarks																			Daily Log Of Depths			Flushing Medium			Date	Casing	Water	From	To	Type				3	13.5	Water						
Date	Strike	Level	Minutes	Casing	Remarks																																																									
Daily Log Of Depths			Flushing Medium																																																											
Date	Casing	Water	From	To	Type																																																									
			3	13.5	Water																																																									

				Project Title: Radcliffe Hub					BH05				
				Project Number: 5238		Client: Bury Council							
				GL (mAOD): 64.10		N Coord: 406968.911			E Coord: 378558.913				
Date: 15/05/2022-18/05/2022				Method: Comacchio Geo 205		Driller: Dynamic Sampling UK			Logged By: MJ				
Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe		
8.50-10.00	87%	56%	43%			55.10		9.00	Thinly laminated with close spacing (<5mm) grey MUDSTONE. Laminations have a shallow dip angle (approx 3-5 degrees). Natural fractures are typically rough with an undulating surface. Weathering around fractures noted to up to 5mm. Fractures are occasionally infilled with clay.				
						54.10		10.00					
10.00-11.50	100%	73%	49%	4.7		53.60		10.50	Thinly laminated with close spacing (<5mm) dark grey MUDSTONE. Laminations have a shallow dip angle (approx 3-5 degrees). Natural fractures are typically rough with an undulating surface. Weathering around fractures noted to up to 5mm.				
						53.10		11.00					
11.50-13.00	42%	38%	10%			52.10		12.00	12.50 - 12.70 Band of highly weathered Mudstone (clay), depth approximated due to poor recovery				
						51.10		13.00					
13.00-13.50	92%	90%	54%	10		50.60		13.50	End Of Borehole At 13.50 m				
						50.10		14.00					
						49.10		15.00					
						48.10		16.00					
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 				REMARKS No Groundwater Encountered Location CAT scanned before drilling. Vacuum excavation used to 1.5m Scale: 1:50				Water Strikes					
								Date	Strike	Level	Minutes	Casing	Remarks
Daily Log Of Depths						Flushing Medium							
Date	Casing	Water	From	To	Type								
			3	13.5	Water								

		Project Title: Radcliffe Hub						BH06																																	
		Project Number: 5238			Client: Bury Council																																				
		GL (mAOD): 65.62			N Coord: 406992.541			E Coord: 378539.941																																	
Date: 18/05/2022-20/05/2022		Method: Comacchio Geo 205			Driller: Dynamic Sampling UK			Logged By: MJ																																	
Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe																														
0.70 D 0.70 ES						65.02		0.60	MADE GROUND: Paver over compact grey limestone sandy gravel (similar to MOT Type 1 aggregate). Firm brown sandy gravelly CLAY.																																
						64.62		1.00																																	
2.00 D					N=31	63.62		2.00	Grey brown medium to coarse slightly gravelly SAND.																																
					N=45	63.42		2.20																																	
3.00 D						62.62		3.00	Thinly laminated with close spacing (<5mm) grey MUDSTONE. Laminations have a shallow dip angle (approx 3-5 degrees). Natural fractures are typically rough with an undulating surface.																																
					N=50	62.42		3.20																																	
3.50-5.00	47%	25%	10%			62.12		3.50	Thinly laminated with close spacing (<5mm) grey and dark grey MUDSTONE. Natural fractures are typically rough with an undulating surface. Weathering around fractures noted to up to 5mm. 5.50 - 6.00 Possible fossiliferous band of dark grey Mudstone																																
						61.62		4.00																																	
5.00-6.50	80%	21%	9%			60.62		5.00																																	
						59.62		6.00																																	
6.50-7.50	75%	56%	10%			58.62		7.00																																	
						57.62		8.00																																	
						Borehole Continues																																			
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				Project Title: Radcliffe Hub					BH06					
				Project Number: 5238		Client: Bury Council								
				GL (mAOD): 65.62		N Coord: 406992.541			E Coord: 378539.941					
Date: 18/05/2022-20/05/2022				Method: Comacchio Geo 205		Driller: Dynamic Sampling UK			Logged By: MJ					
Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe			
7.50-9.00	69%	34%	0%			56.62		9.00	Thinly laminated with close spacing (<5mm) grey and dark grey MUDSTONE. Natural fractures are typically rough with an undulating surface. Weathering around fractures noted to up to 5mm.					
9.00-10.50	63%	51%	36%			55.62		10.00	9.50 - 10.50 Mudstone is highly weathered and clayey					
10.50-12.00	83%	68%	46%			54.62		11.00						
						53.62		12.00						
12.00-13.50	30%	18%	15%			52.62		13.00	Thinly laminated with close spacing (<5mm) dark grey MUDSTONE. Natural fractures are typically rough with an undulating surface.					
						52.42		13.20						
						52.32		13.30						
						52.12		13.50	Black COAL					
									Thinly laminated with close spacing (<5mm) grey MUDSTONE.					
						51.62		14.00	End Of Borehole At 13.50 m					
						50.62		15.00						
						49.62		16.00						
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 				REMARKS No Groundwater Encountered Location CAT scanned before drilling. Vacuum excavation used to 1.5m Scale: 1:50					Water Strikes					
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Daily Log Of Depths						Flushing Medium								
Date	Casing	Water	From	To	Type									
25/05/2022			3.5	13.5	Water									
25/05/2022														

		Project Title: Radcliffe Hub					BH07																																																									
		Project Number: 5238		Client: Bury Council		Sheet 1 Of 3																																																										
		GL (mAOD): 64.13		N Coord: 406939.302		E Coord: 378517.82																																																										
Date: 04/07/2022-06/07/2022		Method: Comacchio Geo 205		Driller: Dynamic Sampling UK		Logged By: MJ																																																										
Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe																																																					
0.70 D 0.70 ES 2.00 D 3.00 D						63.93		0.20	MADE GROUND: Concrete Hardstanding																																																							
						63.53		0.60	MADE GROUND: Brown gravelly sand with brick cobble.																																																							
						63.13		1.00	MADE GROUND: Brown gravelly sand with cobbles becoming clayey from 1.4m.																																																							
						62.33		1.80																																																								
						62.13		2.00	Grey brown with black patches becoming orange brown very sandy slightly gravelly CLAY.																																																							
						61.63		2.50	Orange brown clayey SAND.																																																							
						61.13		3.00																																																								
						60.83		3.30	Grey medium to coarse grained SAND.																																																							
						60.13		4.00	Orange brown very gravelly coarse grained SAND with occasional cobble.																																																							
						59.83		4.30	Brown clayey SAND & GRAVEL.																																																							
4.00-6.00	0	0	0			59.33		4.80	Dark grey organic MUDSTONE. Rotary coring commenced at 4.5m, dark grey flush observed to 4.8m, no core recovered in drill run (4.5m-6.0m) depth at which strata finishes inferred from colour of water flush returned to surface.																																																							
						59.13		5.00																																																								
						58.13		6.00				Thinly laminated with close spacing (<5mm) light grey MUDSTONE.																																																				
						57.13		7.00				6.15 - 6.40 Mudstone weathered to a clay																																																				
6.00-7.50	87%	70%	67%	2		56.13		8.00	7.50 - 9.00 Mudstone highly fractured - poor core recovery																																																							
												Borehole Continues																																																				
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		Project Title: Radcliffe Hub						BH07																																																						
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Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe																																																			
7.50-9.00	73%	37%	17%			55.13		9.00	Thinly laminated with close spacing (<5mm) light grey MUDSTONE.																																																					
9.00-10.50	91%	71%	57%	3.3		54.13		10.00	Thinly laminated with close spacing (<5mm) grey MUDSTONE. 10.30 - 10.50 Mudstone weathered to a clay																																																					
10.50-12.00	83%	63%	38%	3.3		53.13		11.00																																																						
						52.13		12.00	12.00 - 13.50 Mudstone highly fractured - poor core recovery																																																					
12.00-13.50	40%	26%	23%			51.13		13.00																																																						
						50.13		14.00	Thinly laminated with close spacing (<5mm) dark grey MUDSTONE.																																																					
13.50-15.00	90%	65%	41%	4.7		49.13		15.00																																																						
						48.13		16.00	Borehole Continues																																																					
15.00-16.50	83%	77%	53%	3.3																																																										
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		Project Number: 5238		Client: Bury Council		Sheet 3 Of 3																																	
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Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe																												
16.50-18.00	100%	90%	58%	3.3		47.13		17.00	Thinly laminated with close spacing (<5mm) dark grey MUDSTONE.																														
						46.13		18.00																															
						45.13		19.00	End Of Borehole At 18.00 m																														
						44.13		20.00																															
						43.13		21.00																															
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Appendix E

Hole ID		Depth (m)	Material	Table 1: Inorganics - Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below												
				pH	As	Cd	Cr (III)	Cu	Pb	Hg	Ni	Se	Zn	SO ₄ (g/l)	Asbestos	Calorific Value (MJ/kg)
				640	190	8600	68000	2330	1100	980	12000	730000				
S4UL Commerical Land	WS01B	0.40	MADE GROUND	8.6	5.0	0.9	13	53	35	<0.17	18	<1	46	0.03	NAD	-
	WS01B	3.00	GLACIOFLUVIAL DEPOSITS	7.8	-	-	-	-	-	-	-	-	-	<0.01	-	-
	WS01B	4.50	MUDSTONE	7.6	-	-	-	-	-	-	-	-	-	0.01	-	-
	WS02	0.40	MADE GROUND	8.3	13	1.0	16	89	84	<0.17	20	<1	109	0.04	NAD	-
	WS02	1.00	MADE GROUND	8.1	12	1.8	17	51	75	<0.17	25	<1	112	0.03	NAD	-
	WS02	1.70	GLACIOFLUVIAL DEPOSITS	7.7	-	-	-	-	-	-	-	-	-	0.02	-	-
	WS02	3.80	GLACIOFLUVIAL DEPOSITS	7.9	-	-	-	-	-	-	-	-	-	<0.01	-	-
	WS03A	0.50	MADE GROUND	8.4	22	2.0	32	212	227	<0.17	39	<1	103	0.03	NAD	-
	WS03A	2.20	GLACIOFLUVIAL DEPOSITS	7.9	-	-	-	-	-	-	-	-	-	0.01	-	-
	WS04	0.80	MADE GROUND	9.8	12	0.6	43	40	59	1.5	41	<1	99	0.04	NAD	-
	BH05	0.70	MADE GROUND	8.0	2.0	<0.5	12	7.0	16	<0.17	8.0	<1	34	<0.01	NAD	-
	BH05	4.40	MUDSTONE	8.4	-	-	-	-	-	-	-	-	-	0.07	-	-
	BH05	8.40	MUDSTONE	9.0	-	-	-	-	-	-	-	-	-	<0.01	-	-
	BH05	13.40	MUDSTONE	8.8	-	-	-	-	-	-	-	-	-	0.02	-	-
	BH06	1.40	MADE GROUND	8.7	5.0	<0.5	21	17	15	0.3	21	<1	45	<0.01	NAD	-
	BH06	2.20	GLACIOFLUVIAL DEPOSITS	8.3	2.0	0.6	23	15	15	<0.17	35	<1	88	-	-	-
BH06	3.50	MUDSTONE	8.5	<1	<0.5	21	35	15	<0.17	39	<1	85	-	-	-	
BH06	4.50	MUDSTONE	8.7	-	-	-	-	-	-	-	-	-	0.08	-	-	
BH06	8.80	MUDSTONE	9.0	-	-	-	-	-	-	-	-	-	0.02	-	8.6	
BH06	11.50	MUDSTONE	-	-	-	-	-	-	-	-	-	-	11	-	-	
BH06	13.30	COAL	8.1	-	-	-	-	-	-	-	-	-	0.17	-	9.2	
BH07	2.80	GLACIOFLUVIAL DEPOSITS	8.0	-	-	-	-	-	-	-	-	-	0.05	-	-	
BH07	6.50	MUDSTONE	8.8	-	-	-	-	-	-	-	-	-	0.01	-	2.1	
BH07	9.50	MUDSTONE	9.0	-	-	-	-	-	-	-	-	-	<0.01	-	2.9	
BH07	12.5	MUDSTONE	9.1	-	-	-	-	-	-	-	-	-	<0.01	-	2.0	
BH07	15.5	MUDSTONE	9.1	-	-	-	-	-	-	-	-	-	0.01	-	1.8	

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	For source of Generic Assessment Criteria refer to Generic Notes 4 "Contamination Assessment"	
-	Determinand not tested for		
<	Determinand concentration is below indicated "method" level of detection		
NAD	Abestos not detected		

Table 2: Speciated Polycyclic Aromatic Hydrocarbons - Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below																				
Hole ID	Depth (m)	Material	TOC	SOM	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(ah)anthracene	Fluoranthene	Fluorene	Indeno(123-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
S4UL Commercial Land (1% SOM)			%	%	84000	83000	520000	170	35	44	3900	1200	350	3.5	23000	63000	500	190	22000	54000
WS01B	0.40	MADE GROUND	5.4	9.3	0.0	0.0	0.1	0.3	0.4	0.4	0.2	0.1	0.4	0.0	0.6	0.0	0.2	<0.03	0.3	0.6
WS02	0.40	MADE GROUND	2.6	4.4	0.1	<0.01	0.1	0.3	0.3	0.4	0.2	0.1	0.3	<0.04	0.7	0.0	0.2	<0.03	0.5	0.6
WS02	1.00	MADE GROUND	3.6	6.2	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
WS03A	0.50	MADE GROUND	2.1	3.6	0.1	<0.01	0.2	0.5	0.5	0.5	0.2	0.2	0.5	0.1	1.1	0.0	0.3	<0.03	0.5	1.0
WS04	0.80	MADE GROUND	2.9	4.9	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
BH05	0.70	MADE GROUND	0.9	1.6	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
BH06	1.40	MADE GROUND	0.3	0.5	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
BH06	2.20	GLACIOFLUVIAL DEPOSITS	0.3	0.5	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
BH06	3.50	MUDSTONE	0.6	1.0	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07

Key		Source of Critical Concentration
BOLD	Determinand in excess of critical concentration	For source of Generic Assessment Criteria refer to Generic Notes 4 "Contamination Assessment"
-	Determinand not tested for	
<	Determinand concentration is below indicated "method" level of detection	

Table 3: Speciated Total Petroleum Hydrocarbons - Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below														
Hole ID	Depth (m)	Material	BTX				Aliphatic TPH Bandings				Aromatic TPH Bandings			
			Benzene	Toluene	Ethyl Benzene	Xylenes	C ₅ -C ₆	C ₆ -C ₈	C ₈ -C ₁₀	C ₁₀ -C ₁₂	C ₁₂ -C ₁₆	C ₁₆ -C ₂₁	C ₂₁ -C ₃₅	
SAUL Commercial (1% SOM)			%	%	%	%	%	%	%	%	%	%	%	
BH06	1.40	MADE GROUND	0.28	0.5	0.5	1.0	0.57	0.3	0.3	0.3	0.3	0.3	0.3	
BH06	2.20	GLACIOFLUVIAL DEPOSITS	0.3	0.5	0.5	1.0	0.57	0.3	0.3	0.3	0.3	0.3	0.3	
BH06	3.50	MUDSTONE	0.57	1.0	1.0	1.0	0.57	0.3	0.3	0.3	0.3	0.3	0.3	

Source of Critical Concentration		
Key	For source of Generic Assessment Criteria refer to Generic Notes 4 "Contamination Assessment"	
BOLD	Parameter tested and found to be in excess of critical concentration	
-	Determinand not tested for	
<	Determinand concentration is below indicated "method" level of detection	

Hole ID	Water Body	Table 4 Groundwater Inorganic Assessment Concentrations in µg/l unless otherwise stated. Critical Concentrations are shown below										
		pH	As	Cd	Cr (III)	Cu	Pb	Hg	Ni	Se	Zn	SO ₄
			7.5 [^]	-	-	1500 [^]	7.5 [^]	-	15 [^]	-	-	mg/l
W503A	GLACIOFLUVIAL DEPOSITS	6.81	1	<0.2	3	9	<1	<0.1	2	<1	15	16
BH07	PENNINE MIDDLE COAL MEASURES	7.38	<1	<0.2	6	<4	<1	<0.1	5	<1	54	67

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	∞	Annual Average EQS for Priority Substances & other Pollutants - Inland Surface Waters, Table 1, Schedule 3, Part 3 – Water Framework Directive (England and Wales) Directions 2015
-	Determinand not tested for	#	Threshold Values for Groundwater - Table 1, Schedule 5, Groundwater Impacts on: Surface Waters, Water Framework Directive (England and Wales) Directions 2015
<	Determinand concentration is below indicated “method” level of detection	\$	Threshold Values for Groundwater - Table 1, Schedule 5, GW Drinking Water Protected Areas, Water Framework Directive (England and Wales) Directions 2015
*	EQS for Specific Pollutants - Table 1, Schedule 3, Part 2, Water Framework Directive (England and Wales) Directions 2015	^	Threshold Values for Groundwater - Table 1, Schedule 5, General Quality of GW Body, Water Framework Directive (England and Wales) Directions 2015

Hole ID	Water Body	Table 5: Groundwater Organic Assessment Concentrations in µg/l unless otherwise stated. Critical Concentrations are shown below												
		Benzene	Toluene	Ethylbenzene	Xylene	Phenols	Dissolved TPH	PAH	Benzo(a)pyrene	Anthracene	Flouranthene	Benzo(b,k)flouranthene	Benzo(g,h,i)perylene & Indeno(1,2,3-cd)pyrene	Naphthalene
WS03A	GLACIOFLUVIAL DEPOSITS	0.75^v	-	-	-	-	-	-	-	-	0.075^v	-	-	0.075^v
		-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	∞	Annual Average EQS for Priority Substances & other Pollutants - Inland Surface Waters, Table 1, Schedule 3, Part 3 – Water Framework Directive (England and Wales) Directions 2015
-	Determinand not tested for	#	Threshold Values for Groundwater - Table 1, Schedule 5, Groundwater Impacts on: Surface Waters, Water Framework Directive (England and Wales) Directions 2015
<	Determinand concentration is below indicated "method" level of detection	#	Threshold Values for Groundwater - Table 1, Schedule 5, GW Drinking Water Protected Areas, Water Framework Directive (England and Wales) Directions 2015
*	EQS for Specific Pollutants - Table 1, Schedule 3, Part 2, Water Framework Directive (England and Wales) Directions 2016	Λ	Threshold Values for Groundwater - Table 1, Schedule 5, General Quality of GW Body, Water Framework Directive (England and Wales) Directions 2015

FINAL ANALYTICAL TEST REPORT

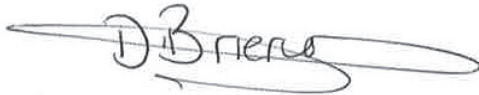
Envirolab Job Number: 22/00678
Issue Number: 1

Date: 01 February, 2022

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe Hub
Project Ref: 5238
Order No: N/A
Date Samples Received: 25/01/22
Date Instructions Received: 26/01/22
Date Analysis Completed: 01/02/22

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/1	22/00678/2	22/00678/3	22/00678/4	22/00678/5	22/00678/6	22/00678/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01B	WS01B	WS01B	WS02	WS02	WS02	WS02			
Depth to Top	0.40	3.00	4.50	0.40	1.00	1.70	3.80			
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22			
Sample Type	Soil	Soil	Solid	Soil	Soil	Soil	Soil			
Sample Matrix Code	4AB	4AB	7	4AB	6A	5A	4A			
% Stones >10mm _A	12.6	42.7	<0.1	40.1	7.3	<0.1	6.0	% w/w	0.1	A-T-044
pH _D ^{M#}	8.61	7.76	7.56	8.25	8.11	7.73	7.88	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.03	<0.01	0.01	0.04	0.03	0.02	<0.01	g/l	0.01	A-T-026s
Total Organic Carbon _D ^{M#}	5.42	-	-	2.55	3.58	-	-	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	5	-	-	13	12	-	-	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	0.9	-	-	1.0	1.8	-	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	53	-	-	89	51	-	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	13	-	-	16	17	-	-	mg/kg	1	A-T-024s
Lead _D ^{M#}	35	-	-	84	75	-	-	mg/kg	1	A-T-024s
Mercury _D	<0.17	-	-	<0.17	<0.17	-	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	18	-	-	20	25	-	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	-	-	<1	<1	-	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	46	-	-	109	112	-	-	mg/kg	5	A-T-024s

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/1	22/00678/2	22/00678/3	22/00678/4	22/00678/5	22/00678/6	22/00678/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01B	WS01B	WS01B	WS02	WS02	WS02	WS02			
Depth to Top	0.40	3.00	4.50	0.40	1.00	1.70	3.80			
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22			
Sample Type	Soil	Soil	Solid	Soil	Soil	Soil	Soil			
Sample Matrix Code	4AB	4AB	7	4AB	6A	5A	4A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	-	-	NAD	NAD	-	-			A-T-045
Asbestos Matrix (visual) ₀	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) ₀	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? ₀	N/A	-	-	N/A	N/A	-	-			A-T-045

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/1	22/00678/2	22/00678/3	22/00678/4	22/00678/5	22/00678/6	22/00678/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01B	WS01B	WS01B	WS02	WS02	WS02	WS02			
Depth to Top	0.40	3.00	4.50	0.40	1.00	1.70	3.80			
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22			
Sample Type	Soil	Soil	Solid	Soil	Soil	Soil	Soil			
Sample Matrix Code	4AB	4AB	7	4AB	6A	5A	4A			
PAH-16MS										
Acenaphthene _A ^{M#}	0.03	-	-	0.08	<0.01	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.01	-	-	<0.01	<0.01	-	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.06	-	-	0.09	<0.02	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.34	-	-	0.29	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.37	-	-	0.29	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.43	-	-	0.35	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.18	-	-	0.15	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.13	-	-	0.13	<0.07	-	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.36	-	-	0.31	<0.06	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.04	-	-	<0.04	<0.04	-	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.61	-	-	0.70	<0.08	-	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.02	-	-	0.04	<0.01	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.24	-	-	0.20	<0.03	-	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	-	-	<0.03	<0.03	-	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.27	-	-	0.45	<0.03	-	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.61	-	-	0.62	<0.07	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	3.70	-	-	3.70	<0.08	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/1	22/00678/2	22/00678/3	22/00678/4	22/00678/5	22/00678/6	22/00678/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01B	WS01B	WS01B	WS02	WS02	WS02	WS02			
Depth to Top	0.40	3.00	4.50	0.40	1.00	1.70	3.80			
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22	19-Jan-22			
Sample Type	Soil	Soil	Solid	Soil	Soil	Soil	Soil			
Sample Matrix Code	4AB	4AB	7	4AB	6A	5A	4A			
Speciated PCB-WHO12										
PCB BZ 81 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 105 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 114 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 118 _A ^{MM}	<0.007	-	-	-	-	-	-	mg/kg	0.007	A-T-004s
PCB BZ 123 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 126 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 156 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 157 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 167 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 169 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 189 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
PCB BZ 77 _A	<0.005	-	-	-	-	-	-	mg/kg	0.005	A-T-004s
Total Speciated PCB-WHO12 _A	<0.007	-	-	-	-	-	-	mg/kg	0.005	A-T-004s

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/8	22/00678/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03A	WS03A								
Depth to Top	0.50	2.20								
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22								
Sample Type	Soil	Soil								
Sample Matrix Code	4AB	3A								
% Stones >10mm _A	16.7	<0.1						% w/w	0.1	A-T-044
pH _D ^{M#}	8.43	7.86						pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.03	0.01						g/l	0.01	A-T-026s
Total Organic Carbon _D ^{M#}	2.07	-						% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	22	-						mg/kg	1	A-T-024s
Cadmium _D ^{M#}	2.0	-						mg/kg	0.5	A-T-024s
Copper _D ^{M#}	212	-						mg/kg	1	A-T-024s
Chromium _D ^{M#}	32	-						mg/kg	1	A-T-024s
Lead _D ^{M#}	227	-						mg/kg	1	A-T-024s
Mercury _D	<0.17	-						mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	39	-						mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	-						mg/kg	1	A-T-024s
Zinc _D ^{M#}	103	-						mg/kg	5	A-T-024s

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/8	22/00678/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03A	WS03A								
Depth to Top	0.50	2.20								
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22								
Sample Type	Soil	Soil								
Sample Matrix Code	4AB	3A								
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	-								A-T-045
Asbestos Matrix (visual) ₀	-	-								A-T-045
Asbestos Matrix (microscope) ₀	-	-								A-T-045
Asbestos ACM - Suitable for Water Absorption Test? ₀	N/A	-								A-T-045

Envirolab Job Number: 22/00678

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/00678/8	22/00678/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03A	WS03A								
Depth to Top	0.50	2.20								
Depth To Bottom										
Date Sampled	19-Jan-22	19-Jan-22								
Sample Type	Soil	Soil								
Sample Matrix Code	4AB	3A								
PAH-16MS										
Acenaphthene _A ^{MS}	0.07	-						mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{MS}	<0.01	-						mg/kg	0.01	A-T-019s
Anthracene _A ^{MS}	0.15	-						mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{MS}	0.45	-						mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{MS}	0.46	-						mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{MS}	0.54	-						mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{MS}	0.22	-						mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{MS}	0.19	-						mg/kg	0.07	A-T-019s
Chrysene _A ^{MS}	0.48	-						mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{MS}	0.05	-						mg/kg	0.04	A-T-019s
Fluoranthene _A ^{MS}	1.10	-						mg/kg	0.08	A-T-019s
Fluorene _A ^{MS}	0.04	-						mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{MS}	0.28	-						mg/kg	0.03	A-T-019s
Naphthalene _A ^{MS}	<0.03	-						mg/kg	0.03	A-T-019s
Phenanthrene _A ^{MS}	0.51	-						mg/kg	0.03	A-T-019s
Pyrene _A ^{MS}	1.01	-						mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{MS}	5.55	-						mg/kg	0.01	A-T-019s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

TPH CWG *C1 indicates results with humics mathematically subtracted through instrument calculation

TPH CWG *C2 indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG with Clean Up _{C1}

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client:	iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street, Knutsford, WA16 6AG	Project No:	22/00678
Project:	Radcliffe Hub	Date Received:	26/01/2022 (am)
Clients Project No:	5238	Cool Box Temperatures (°C):	7.0

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/00678/1	22/00678/2	22/00678/3	22/00678/4	22/00678/5	22/00678/6	22/00678/7	22/00678/8	22/00678/9
Client Sample No									
Client Sample ID/Depth	WS01B 0.40m	WS01B 3.00m	WS01B 4.50m	WS02 0.40m	WS02 1.00m	WS02 1.70m	WS02 3.80m	WS03A 0.50m	WS03A 2.20m
Date Sampled	19/01/22	19/01/22	19/01/22	19/01/22	19/01/22	19/01/22	19/01/22	19/01/22	19/01/22
A-T-004s	01/02/2022								
A-T-019s	01/02/2022			01/02/2022	01/02/2022			01/02/2022	
A-T-024s	01/02/2022			01/02/2022	01/02/2022			01/02/2022	
A-T-026s	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022
A-T-031s	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022	31/01/2022
A-T-032s	31/01/2022			31/01/2022	31/01/2022			31/01/2022	
A-T-044	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022
A-T-045	27/01/2022			27/01/2022	27/01/2022			27/01/2022	

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Final Test Report

Envirolab Job Number: 22/05381
Issue Number: 1
Date: 13-Jun-22

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe
Project Ref: 5238
Order No: N/A

Date Samples Received: 23-May-22
Date Instructions Received: 31-May-22
Date Analysis Completed: 13-Jun-22

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts.

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

HWOL TPH Code: EH_CU_1D_AL: Extractable hydrocarbons - i.e. everything extracted by the solvent(s), Clean-up - e.g. by florisil, silica gel, GC - Single coil gas chromatography, Aliphatics only

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Sample Details							Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	22/05381/7						
Client Sample Number							Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				BH06						
Depth to Top				1.4						
Depth to Bottom				1.70						
Date Sampled				18/05/2022						
Sample Type				Soil						
Sample Matrix Code				4A						
Solid Waste Analysis										
pH (pH Units) _D	A-T-031	N	N	8.69			-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.07			-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.06			-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	2.1			-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	0.28			3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08			100	-	-	
Mineral Oil (mg/kg) _{A EH CU 1D AL}	A-T-007	N	N	15			500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007			1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01			6	-	-	
Eluate Analysis				2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
				mg/l		mg/kg				
Arsenic	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.037	0.013	0.075	0.160	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.001	0.001	0.002	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.005	0.006	0.010	0.060	4	50	200
Chloride	A-T-026	N	N	<1.00	2	<2	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.5	0.2	1.0	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	9	2	19	32	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	111	22	226	323	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	36.8	77.00	75	727	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	7.8	7.3					
Conductivity (µS/cm)	A-T-037	N	N	222	44					
Mass Sample (kg)				0.181						
Dry Matter (%)	A-T-044	N	N	96.5						
Stage 1										
Volume Leachant, L ₂ (l)	A-T-046			0.350						
Filtered Eluate Volume, VE ₁ (l)	A-T-046			0.200						
Stage 2										
Volume Leachant, L ₈ (l)	A-T-046			1.400						
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation										

Sample Details							Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	22/05381/8						
Client Sample Number							Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				BH06						
Depth to Top				2.2						
Depth to Bottom				2.50						
Date Sampled				18/05/2022						
Sample Type				Soil						
Sample Matrix Code				4A						
Solid Waste Analysis										
pH (pH Units) _D	A-T-031	N	N	8.29			-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.05			-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.05			-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	2.3			-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	0.3			3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08			100	-	-	
Mineral Oil (mg/kg) _{A EH_CU_1D_AL}	A-T-007	N	N	161			500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007			1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01			6	-	-	
Eluate Analysis				2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using		
				mg/l		mg/kg		BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.014	0.009	0.029	0.100	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.003	0.001	0.006	0.010	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.006	0.001	0.012	0.020	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	0.002	<0.002	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.001	0.001	0.002	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.003	0.004	0.006	0.040	4	50	200
Chloride	A-T-026	N	N	<1.00	2	<2	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.4	<0.10	0.7	<1	10	150	500
Sulphate as SO ₄	A-T-026	N	N	3	2	5	19	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	70	22	143	276	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	29.7	<20.0	61	<200	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	7.8	7.6					
Conductivity (µS/cm)	A-T-037	N	N	141	45					
Mass Sample (kg)				0.182						
Dry Matter (%)	A-T-044	N	N	96.3						
Stage 1										
Volume Leachant, L ₂ (l)	A-T-046			0.350						
Filtered Eluate Volume, VE ₁ (l)	A-T-046			0.200						
Stage 2										
Volume Leachant, L ₈ (l)	A-T-046			1.400						
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation										

Sample Details							Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	22/05381/9						
Client Sample Number							Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				BH06						
Depth to Top				3.5						
Depth to Bottom										
Date Sampled				18/05/2022						
Sample Type				Soil						
Sample Matrix Code				3						
Solid Waste Analysis										
pH (pH Units) _D	A-T-031	N	N	8.49				-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.04				-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.04				-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	N	N	5.1				-	-	10
Total Organic Carbon (%) _D	A-T-032	N	N	0.57				3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08				100	-	-
Mineral Oil (mg/kg) _{A EH CU 1D AL}	A-T-007	N	N	<10				500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007				1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01				6	-	-
Eluate Analysis				2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using		
				mg/l		mg/kg		BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.125	0.072	0.255	0.780	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.002	0.001	0.004	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.005	0.005	0.010	0.050	4	50	200
Chloride	A-T-026	N	N	1	<1.00	2	<10	800	15000	25000
Fluoride	A-T-026	N	N	<0.10	<0.10	<0.2	<1	10	150	500
Sulphate as SO ₄	A-T-026	N	N	17	3	36	45	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	230	96	470	1117	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	0.03	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<20.0	23.20	<40	<200	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	7.8	7.9					
Conductivity (µS/cm)	A-T-037	N	N	461	193					
Mass Sample (kg)				0.182						
Dry Matter (%)	A-T-044	N	N	96						
Stage 1										
Volume Leachant, L ₂ (l)	A-T-046			0.350						
Filtered Eluate Volume, VE ₁ (l)	A-T-046			0.200						
Stage 2										
Volume Leachant, L ₈ (l)	A-T-046			1.400						
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation										

FINAL ANALYTICAL TEST REPORT

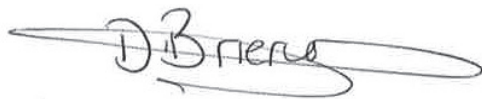
Envirolab Job Number: 22/05381
Issue Number: 1

Date: 14 June, 2022

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe
Project Ref: 5238
Order No: N/A
Date Samples Received: 23/05/22
Date Instructions Received: 31/05/22
Date Analysis Completed: 14/06/22

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	BH05	BH05	BH05	BH05	BH06	BH06			
Depth to Top	0.80	0.70	4.40	8.40	13.40	1.40	2.20			
Depth To Bottom						1.70	2.50			
Date Sampled	16-May-22	16-May-22	20-May-22	20-May-22	20-May-22	18-May-22	18-May-22			
Sample Type	Soil	Soil	Soil	Solid	Solid	Soil	Soil			
Sample Matrix Code	6A	5A	6A	7	7	4A	4A			
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	9.80	7.98	8.36	9.02	8.81	8.69	8.29	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.04	<0.01	0.07	<0.01	0.02	<0.01	-	g/l	0.01	A-T-026s
Sulphate (acid soluble) _D ^{M#}	-	-	210	<200	<200	-	-	mg/kg	200	A-T-028s
Sulphur (total) _D	-	-	1150	570	730	-	-	mg/kg	50	A-T-024s
Sulphide _A	-	-	360	390	360	-	-	mg/kg	5	A-T-043-s
Total Organic Carbon _D ^{M#}	2.85	0.90	-	-	-	0.28	0.30	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	12	2	-	-	-	5	2	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	0.6	<0.5	-	-	-	<0.5	0.6	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	40	7	-	-	-	17	15	mg/kg	1	A-T-024s
Chromium _D ^{M#}	43	12	-	-	-	21	23	mg/kg	1	A-T-024s
Lead _D ^{M#}	59	16	-	-	-	15	15	mg/kg	1	A-T-024s
Mercury _D	1.45	<0.17	-	-	-	0.28	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	41	8	-	-	-	21	35	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	-	-	-	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	99	34	-	-	-	45	88	mg/kg	5	A-T-024s

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	BH05	BH05	BH05	BH05	BH06	BH06			
Depth to Top	0.80	0.70	4.40	8.40	13.40	1.40	2.20			
Depth To Bottom						1.70	2.50			
Date Sampled	16-May-22	16-May-22	20-May-22	20-May-22	20-May-22	18-May-22	18-May-22			
Sample Type	Soil	Soil	Soil	Solid	Solid	Soil	Soil			
Sample Matrix Code	6A	5A	6A	7	7	4A	4A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	-	-	-	NAD	-			A-T-045
Asbestos Matrix (visual) ₀	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) ₀	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? ₀	N/A	N/A	-	-	-	N/A	-			A-T-045

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	BH05	BH05	BH05	BH05	BH06	BH06			
Depth to Top	0.80	0.70	4.40	8.40	13.40	1.40	2.20			
Depth To Bottom						1.70	2.50			
Date Sampled	16-May-22	16-May-22	20-May-22	20-May-22	20-May-22	18-May-22	18-May-22			
Sample Type	Soil	Soil	Soil	Solid	Solid	Soil	Soil			
Sample Matrix Code	6A	5A	6A	7	7	4A	4A			
PAH-16MS										
Acenaphthene _A ^{MS}	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{MS}	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{MS}	<0.02	<0.02	-	-	-	<0.02	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{MS}	<0.04	<0.04	-	-	-	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{MS}	<0.04	<0.04	-	-	-	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{MS}	<0.05	<0.05	-	-	-	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{MS}	<0.05	<0.05	-	-	-	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{MS}	<0.07	<0.07	-	-	-	<0.07	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{MS}	<0.06	<0.06	-	-	-	<0.06	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{MS}	<0.04	<0.04	-	-	-	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{MS}	<0.08	<0.08	-	-	-	<0.08	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{MS}	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{MS}	<0.03	<0.03	-	-	-	<0.03	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{MS}	<0.03	<0.03	-	-	-	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{MS}	<0.03	<0.03	-	-	-	<0.03	<0.03	mg/kg	0.03	A-T-019s
Pyrene _A ^{MS}	<0.07	<0.07	-	-	-	<0.07	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{MS}	<0.08	<0.08	-	-	-	<0.08	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	BH05	BH05	BH05	BH05	BH06	BH06			
Depth to Top	0.80	0.70	4.40	8.40	13.40	1.40	2.20			
Depth To Bottom						1.70	2.50			
Date Sampled	16-May-22	16-May-22	20-May-22	20-May-22	20-May-22	18-May-22	18-May-22			
Sample Type	Soil	Soil	Soil	Solid	Solid	Soil	Soil			
Sample Matrix Code	6A	5A	6A	7	7	4A	4A			
TPH CWG with Clean Up *C1										
Alii >C5-C6 _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Alii >C6-C8 _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Alii >C8-C10 _A	-	-	-	-	-	<1	<1	mg/kg	1	A-T-055s
Alii >C10-C12 _A ^{M#}	-	-	-	-	-	<1	<1	mg/kg	1	A-T-055s
Alii >C12-C16 _A ^{M#}	-	-	-	-	-	1	3	mg/kg	1	A-T-055s
Alii >C16-C21 _A ^{M#}	-	-	-	-	-	2	6	mg/kg	1	A-T-055s
Alii >C21-C35 _A ^{M#}	-	-	-	-	-	9	66	mg/kg	1	A-T-055s
Total Aliphatics _A	-	-	-	-	-	12	76	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	-	-	-	-	-	1	<1	mg/kg	1	A-T-055s
Aro >C10-C12 _A	-	-	-	-	-	<1	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	-	-	-	-	-	1	2	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	-	-	-	-	-	1	3	mg/kg	1	A-T-055s
Aro >C21-C35 _A	-	-	-	-	-	3	6	mg/kg	1	A-T-055s
Total Aromatics _A	-	-	-	-	-	6	12	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	-	-	-	-	-	19	87	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	-	-	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/9	22/05381/10	22/05381/11	22/05381/12	22/05381/13			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH06	BH06	BH06	BH06	BH06					
Depth to Top	3.50	4.50	8.80	11.50	13.30					
Depth To Bottom										
Date Sampled	18-May-22	20-May-22	20-May-22	20-May-22	20-May-22					
Sample Type	Soil	Soil	Solid	Soil	Solid					
Sample Matrix Code	3	3	7		7					
% Stones >10mm _A	<0.1	<0.1	<0.1	-	<0.1			% w/w	0.1	A-T-044
pH _D ^{M#}	8.49	8.70	9.02	-	8.08			pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	-	0.08	0.02	-	0.17			g/l	0.01	A-T-026s
Sulphate (acid soluble) _D ^{M#}	-	<200	<200	-	420			mg/kg	200	A-T-028s
Sulphur (total) _D	-	268	753	-	40900			mg/kg	50	A-T-024s
Sulphide _A	-	350	350	-	400			mg/kg	5	A-T-043-s
Total Organic Carbon _D ^{M#}	0.57	-	-	-	-			% w/w	0.03	A-T-032s
Calorific Value _A	-	-	8.6	11.0	9.2			MJ/kg	0.1	Subcon Chemtest
Arsenic _D ^{M#}	<1	-	-	-	-			mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	-	-	-	-			mg/kg	0.5	A-T-024s
Copper _D ^{M#}	35	-	-	-	-			mg/kg	1	A-T-024s
Chromium _D ^{M#}	21	-	-	-	-			mg/kg	1	A-T-024s
Lead _D ^{M#}	15	-	-	-	-			mg/kg	1	A-T-024s
Mercury _D	<0.17	-	-	-	-			mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	39	-	-	-	-			mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	-	-	-	-			mg/kg	1	A-T-024s
Zinc _D ^{M#}	85	-	-	-	-			mg/kg	5	A-T-024s

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/9	22/05381/10	22/05381/11	22/05381/12	22/05381/13			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH06	BH06	BH06	BH06	BH06					
Depth to Top	3.50	4.50	8.80	11.50	13.30					
Depth To Bottom										
Date Sampled	18-May-22	20-May-22	20-May-22	20-May-22	20-May-22					
Sample Type	Soil	Soil	Solid	Soil	Solid					
Sample Matrix Code	3	3	7		7					
PAH-16MS										
Acenaphthene _A ^{MS}	<0.01	-	-	-	-			mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{MS}	<0.01	-	-	-	-			mg/kg	0.01	A-T-019s
Anthracene _A ^{MS}	<0.02	-	-	-	-			mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{MS}	<0.04	-	-	-	-			mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{MS}	<0.04	-	-	-	-			mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{MS}	<0.05	-	-	-	-			mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{MS}	<0.05	-	-	-	-			mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{MS}	<0.07	-	-	-	-			mg/kg	0.07	A-T-019s
Chrysene _A ^{MS}	<0.06	-	-	-	-			mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{MS}	<0.04	-	-	-	-			mg/kg	0.04	A-T-019s
Fluoranthene _A ^{MS}	<0.08	-	-	-	-			mg/kg	0.08	A-T-019s
Fluorene _A ^{MS}	<0.01	-	-	-	-			mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{MS}	<0.03	-	-	-	-			mg/kg	0.03	A-T-019s
Naphthalene _A ^{MS}	<0.03	-	-	-	-			mg/kg	0.03	A-T-019s
Phenanthrene _A ^{MS}	<0.03	-	-	-	-			mg/kg	0.03	A-T-019s
Pyrene _A ^{MS}	<0.07	-	-	-	-			mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{MS}	<0.08	-	-	-	-			mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/05381

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/05381/9	22/05381/10	22/05381/11	22/05381/12	22/05381/13			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH06	BH06	BH06	BH06	BH06					
Depth to Top	3.50	4.50	8.80	11.50	13.30					
Depth To Bottom										
Date Sampled	18-May-22	20-May-22	20-May-22	20-May-22	20-May-22					
Sample Type	Soil	Soil	Solid	Soil	Solid					
Sample Matrix Code	3	3	7		7					
TPH CWG with Clean Up *C1										
Ali >C5-C6 _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	-	-	-	-			mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	-	-	-	-			mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	-	-	-	-			mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	-	-	-	-			mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	2	-	-	-	-			mg/kg	1	A-T-055s
Total Aliphatics _A	2	-	-	-	-			mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	-	-	-	-			mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	-	-	-	-			mg/kg	1	A-T-055s
Aro >C12-C16 _A	2	-	-	-	-			mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	2	-	-	-	-			mg/kg	1	A-T-055s
Aro >C21-C35 _A	3	-	-	-	-			mg/kg	1	A-T-055s
Total Aromatics _A	8	-	-	-	-			mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	10	-	-	-	-			mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	-	-	-	-			mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed.

Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client: iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street, Knutsford, WA16 6AG **Project No:** 22/05381
Project: Radcliffe **Date Received:** 31/05/2022 (am)
Clients Project No: 5238 **Cool Box Temperatures (°C):** 14.8 & 15.1

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	22/05381/9	22/05381/10	22/05381/11	22/05381/13
Client Sample No											
Client Sample ID/Depth	WS04 0.80m	BH05 0.70m	BH05 4.40m	BH05 8.40m	BH05 13.40m	BH06 1.40-1.70m	BH06 2.20-2.50m	BH06 3.50m	BH06 4.50m	BH06 8.80m	BH06 13.30m
Date Sampled	16/05/22	16/05/22	20/05/22	20/05/22	20/05/22	18/05/22	18/05/22	18/05/22	20/05/22	20/05/22	20/05/22
Deviation Code											
F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Key
F

Maximum holding time exceeded between sampling date and analysis for analytes listed below

HOLDING TIME EXCEEDANCES

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	22/05381/9	22/05381/10	22/05381/11	22/05381/13
Client Sample No											
Client Sample ID/Depth	WS04 0.80m	BH05 0.70m	BH05 4.40m	BH05 8.40m	BH05 13.40m	BH06 1.40-1.70m	BH06 2.20-2.50m	BH06 3.50m	BH06 4.50m	BH06 8.80m	BH06 13.30m
Date Sampled	16/05/22	16/05/22	20/05/22	20/05/22	20/05/22	18/05/22	18/05/22	18/05/22	20/05/22	20/05/22	20/05/22
PAH-16MS	✓	✓				✓	✓	✓			
Sulphide			✓	✓	✓	✓	✓	✓	✓	✓	✓
VPHCWG						✓	✓	✓			
PAH (total 17)						✓	✓	✓			
BTEX (total)						✓	✓	✓			

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/05381/1	22/05381/3	22/05381/4	22/05381/5	22/05381/6	22/05381/7	22/05381/8	22/05381/9	22/05381/10	22/05381/11	22/05381/12	22/05381/13
Client Sample No												
Client Sample ID/Depth	WS04 0.80m	BH05 0.70m	BH05 4.40m	BH05 8.40m	BH05 13.40m	BH06 1.40-1.70m	BH06 2.20-2.50m	BH06 3.50m	BH06 4.50m	BH06 8.80m	BH06 11.50m	BH06 13.30m
Date Sampled	16/05/22	16/05/22	20/05/22	20/05/22	20/05/22	18/05/22	18/05/22	18/05/22	20/05/22	20/05/22	20/05/22	20/05/22
A-T-004s						08/06/2022	08/06/2022	08/06/2022				
A-T-007s						08/06/2022	08/06/2022	08/06/2022				
A-T-019s	07/06/2022	07/06/2022				07/06/2022	07/06/2022	07/06/2022				
A-T-022s						07/06/2022	07/06/2022	07/06/2022				
A-T-024s	08/06/2022	08/06/2022	14/06/2022	14/06/2022	14/06/2022	08/06/2022	08/06/2022	08/06/2022	14/06/2022	14/06/2022		14/06/2022
A-T-025w						13/06/2022	13/06/2022	13/06/2022				
A-T-026s	10/06/2022	10/06/2022	10/06/2022	10/06/2022	10/06/2022	10/06/2022			10/06/2022	10/06/2022		10/06/2022
A-T-026w						13/06/2022	13/06/2022	13/06/2022				
A-T-028s			08/06/2022	08/06/2022	08/06/2022				08/06/2022	08/06/2022		08/06/2022
A-T-030s						08/06/2022	08/06/2022	08/06/2022				
A-T-031s	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022		08/06/2022
A-T-031w						13/06/2022	13/06/2022	13/06/2022				
A-T-032s	08/06/2022	08/06/2022				08/06/2022	08/06/2022	08/06/2022				
A-T-032w						13/06/2022	13/06/2022	13/06/2022				
A-T-037w						13/06/2022	13/06/2022	13/06/2022				
A-T-043-s			08/06/2022	08/06/2022	08/06/2022				08/06/2022	08/06/2022		08/06/2022
A-T-044	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022	08/06/2022		08/06/2022
A-T-045	01/06/2022	01/06/2022				01/06/2022						
A-T-050w						13/06/2022	13/06/2022	13/06/2022				
A-T-055s						07/06/2022	07/06/2022	07/06/2022				
A-T-ANCs						08/06/2022	08/06/2022	08/06/2022				
Calc						01/06/2022	01/06/2022	01/06/2022				
Calc-no stones						13/06/2022	13/06/2022	13/06/2022				
Probe (w)						13/06/2022	13/06/2022	13/06/2022				

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

FINAL ANALYTICAL TEST REPORT

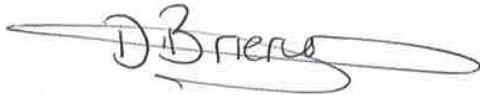
Envirolab Job Number: 22/06702
Issue Number: 1

Date: 14 July, 2022

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe Hub
Project Ref: 5238
Order No: N/A
Date Samples Received: 08/07/22
Date Instructions Received: 08/07/22
Date Analysis Completed: 14/07/22

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Envirolab Job Number: 22/06702

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/06702/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03A									
Depth to Top										
Depth To Bottom										
Date Sampled	07-Jul-22									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
pH (w) _A [#]	6.81							pH	0.01	A-T-031w
Sulphate (w) _A [#]	16							mg/l	1	A-T-026w
Arsenic (dissolved) _A [#]	1							µg/l	1	A-T-025w
Cadmium (dissolved) _A [#]	<0.2							µg/l	0.2	A-T-025w
Copper (dissolved) _A	9							µg/l	1	A-T-025w
Chromium (dissolved) _A [#]	3							µg/l	1	A-T-025w
Lead (dissolved) _A [#]	<1							µg/l	1	A-T-025w
Mercury (dissolved) _A [#]	<0.1							µg/l	0.1	A-T-025w
Nickel (dissolved) _A [#]	2							µg/l	1	A-T-025w
Selenium (dissolved) _A [#]	<1							µg/l	1	A-T-025w
Zinc (dissolved) _A [#]	15							µg/l	1	A-T-025w

Envirolab Job Number: 22/06702

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/06702/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03A									
Depth to Top										
Depth To Bottom										
Date Sampled	07-Jul-22									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
PAH 16MS (w)										
Acenaphthene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Acenaphthylene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Anthracene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Benzo(a)anthracene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Benzo(a)pyrene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Chrysene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Fluoranthene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Fluorene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Naphthalene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Phenanthrene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Pyrene (w) _A [#]	<0.01							µg/l	0.01	A-T-019w
Total PAH 16MS (w) _A [#]	<0.01							µg/l	0.01	A-T-019w

REPORT NOTES

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Analytical results reflect the quality of the sample at the time of analysis only.

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The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client: iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street, Knutsford, WA16 6AG **Project No:** 22/06702
Project: Radcliffe Hub **Date Received:** 08/07/2022 (am)
Clients Project No: 5238 **Cool Box Temperatures (°C):** 18.6

Lab Sample ID	22/06702/1
Client Sample No	
Client Sample ID/Depth	WS03A
Date Sampled	07/07/22
Deviation Code	
A7 (no HNO3)	✓

Key

A7 (no HNO3) No HNO3 preserved bottle provided (dissolved metals will be deviating)

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/06702/1
Client Sample No	
Client Sample ID/Depth	WS03A
Date Sampled	07/07/22
A-T-019w	14/07/2022
A-T-025w	14/07/2022
A-T-026w	12/07/2022
A-T-031w	13/07/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

FINAL ANALYTICAL TEST REPORT

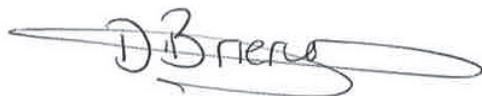
Envirolab Job Number: 22/06703
Issue Number: 1

Date: 19 July, 2022

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe Hub
Project Ref: 5238
Order No: TBC
Date Samples Received: 08/07/22
Date Instructions Received: 08/07/22
Date Analysis Completed: 19/07/22

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Envirolab Job Number: 22/06703

Client Project Name: Radcliffe Hub

Client Project Ref: 5238

Lab Sample ID	22/06703/1	22/06703/2	22/06703/3	22/06703/4	22/06703/5			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH07	BH07	BH7	BH07	BH07					
Depth to Top	2.80	6.50	9.50	12.50	15.50					
Depth To Bottom										
Date Sampled	04-Jul-22	04-Jul-22	05-Jul-22	05-Jul-22	04-Jul-22					
Sample Type	Soil	Solid	Solid	Solid	Solid					
Sample Matrix Code	5A	7	7	7	7					
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	<0.1			% w/w	0.1	A-T-044
pH _D ^{M#}	7.98	8.76	8.95	9.09	9.07			pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.05	0.01	<0.01	<0.01	0.01			g/l	0.01	A-T-026s
Sulphate (acid soluble) _D ^{M#}	-	<200	<200	<200	<200			mg/kg	200	A-T-028s
Sulphur (total) _D	-	203	362	167	505			mg/kg	50	A-T-024s
Calorific Value _A	-	2.1	2.9	2.0	1.8			MJ/kg	0.1	Subcon Chemtest

REPORT NOTES

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The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

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E = contains roots/twigs.

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NAD indicates No Asbestos Detected.

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Superscript # indicates method accredited to ISO 17025.

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EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client:	iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street, Knutsford, WA16 6AG	Project No:	22/06703
Project:	Radcliffe Hub	Date Received:	08/07/2022 (am)
Clients Project No:	5238	Cool Box Temperatures (°C):	18.6

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/06/203/1	22/06/203/2	22/06/203/3	22/06/203/4	22/06/203/5
Client Sample No					
Client Sample ID/Depth	BH07 2.80m	BH07 6.50m	BH7 9.50m	BH07 12.50m	BH07 15.50m
Date Sampled	04/07/22	04/07/22	05/07/22	05/07/22	04/07/22
A-T-024s		14/07/2022	14/07/2022	14/07/2022	14/07/2022
A-T-026s	15/07/2022	15/07/2022	15/07/2022	15/07/2022	15/07/2022
A-T-028s		13/07/2022	13/07/2022	13/07/2022	13/07/2022
A-T-031s	14/07/2022	14/07/2022	14/07/2022	14/07/2022	14/07/2022
A-T-044	13/07/2022	13/07/2022	13/07/2022	13/07/2022	13/07/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

FINAL ANALYTICAL TEST REPORT

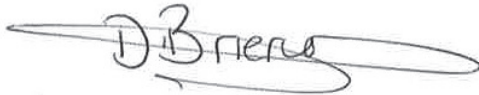
Envirolab Job Number: 22/06986
Issue Number: 1

Date: 22 July, 2022

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

Project Manager: Michael Jones
Project Name: Radcliffe
Project Ref: 5238
Order No: N/A
Date Samples Received: 15/07/22
Date Instructions Received: 18/07/22
Date Analysis Completed: 22/07/22

Approved by:



Danielle Brierley
Deputy Client Services Supervisor

Envirolab Job Number: 22/06986

Client Project Name: Radcliffe

Client Project Ref: 5238

Lab Sample ID	22/06986/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH07									
Depth to Top										
Depth To Bottom										
Date Sampled	14-Jul-22									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
pH (w) _A [#]	7.38							pH	0.01	A-T-031w
Sulphate (w) _A [#]	67							mg/l	1	A-T-026w
Arsenic (dissolved) _A [#]	<1							µg/l	1	A-T-025w
Cadmium (dissolved) _A [#]	<0.2							µg/l	0.2	A-T-025w
Copper (dissolved) _A	<4							µg/l	4	A-T-025w
Chromium (dissolved) _A [#]	6							µg/l	1	A-T-025w
Lead (dissolved) _A [#]	<1							µg/l	1	A-T-025w
Mercury (dissolved) _A [#]	<0.1							µg/l	0.1	A-T-025w
Nickel (dissolved) _A [#]	5							µg/l	2	A-T-025w
Selenium (dissolved) _A [#]	<1							µg/l	1	A-T-025w
Zinc (dissolved) _A [#]	54							µg/l	2	A-T-025w

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TPH analysis of water by method A-T-007:

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TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

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v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client: iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street, Knutsford, WA16 6AG **Project No:** 22/06986
Project: Radcliffe **Date Received:** 18/07/2022 (am)
Clients Project No: 5238 **Cool Box Temperatures (°C):** 21.2

Lab Sample ID	22/06986/1
Client Sample No	
Client Sample ID/Depth	BH07
Date Sampled	14/07/22
Deviation Code	
A7 (no HNO3)	✓

Key

A7 (no HNO3) No HNO3 preserved bottle provided (dissolved metals will be deviating)

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/06986/1
Client Sample No	
Client Sample ID/Depth	BH07
Date Sampled	14/07/22
A-T-025w	22/07/2022
A-T-026w	22/07/2022
A-T-031w	22/07/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix F

TEST REPORT

Client iD GeoEnvironmental Ltd

Address Caledonian House
Tatton Street
Knutsford
WA16 6AG

Contract 5238 -
Radcliffe Hub

Job Number MRN 4296/2
Date of Issue 22 February 2022
Pages 1 of 4

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.
- 5 The results included within the report are representative of the samples submitted for analysis.
- 6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

Murray Rix is the trading name of Murray Rix (Northern) Limited. Registered in England 2878361

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.5: 1990

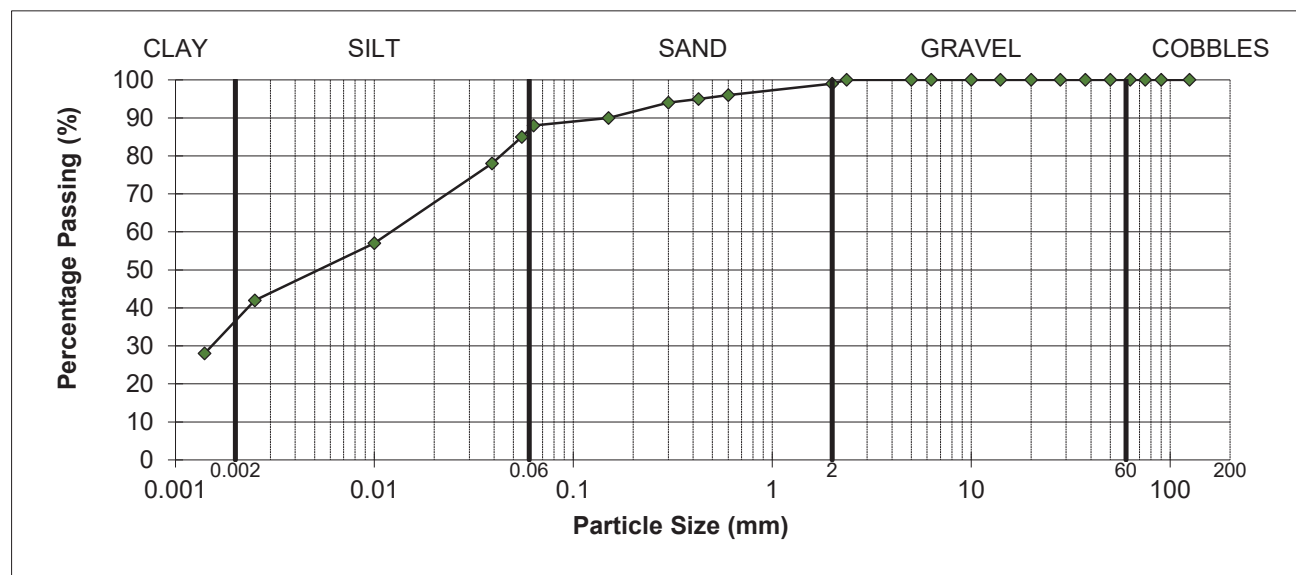
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	iD GeoEnvironmental Ltd
SITE	5238 - Radcliffe Hub
JOB NUMBER	MRN 4296/2

SAMPLE LABEL	WS02 1.5-2.0	DATE SAMPLED	19-Jan-22
LAB SAMPLE No	108802	DATE RECEIVED	27-Jan-22
DATE TESTED	02-Feb-22	SAMPLED BY	Client

MATERIAL	Firm brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		2.36	100	
90	100		2	99	
75	100		0.6	96	
63	100		0.425	95	
50	100		0.3	94	
37.5	100		0.15	90	
28	100		0.063	88	
20	100		0.055	85	
14	100		0.039	78	
10	100		0.01	57	
6.3	100		0.0025	42	
5	100		0.0014	28	



REMARKS

As received moisture content = 33%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

22-Feb-22

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

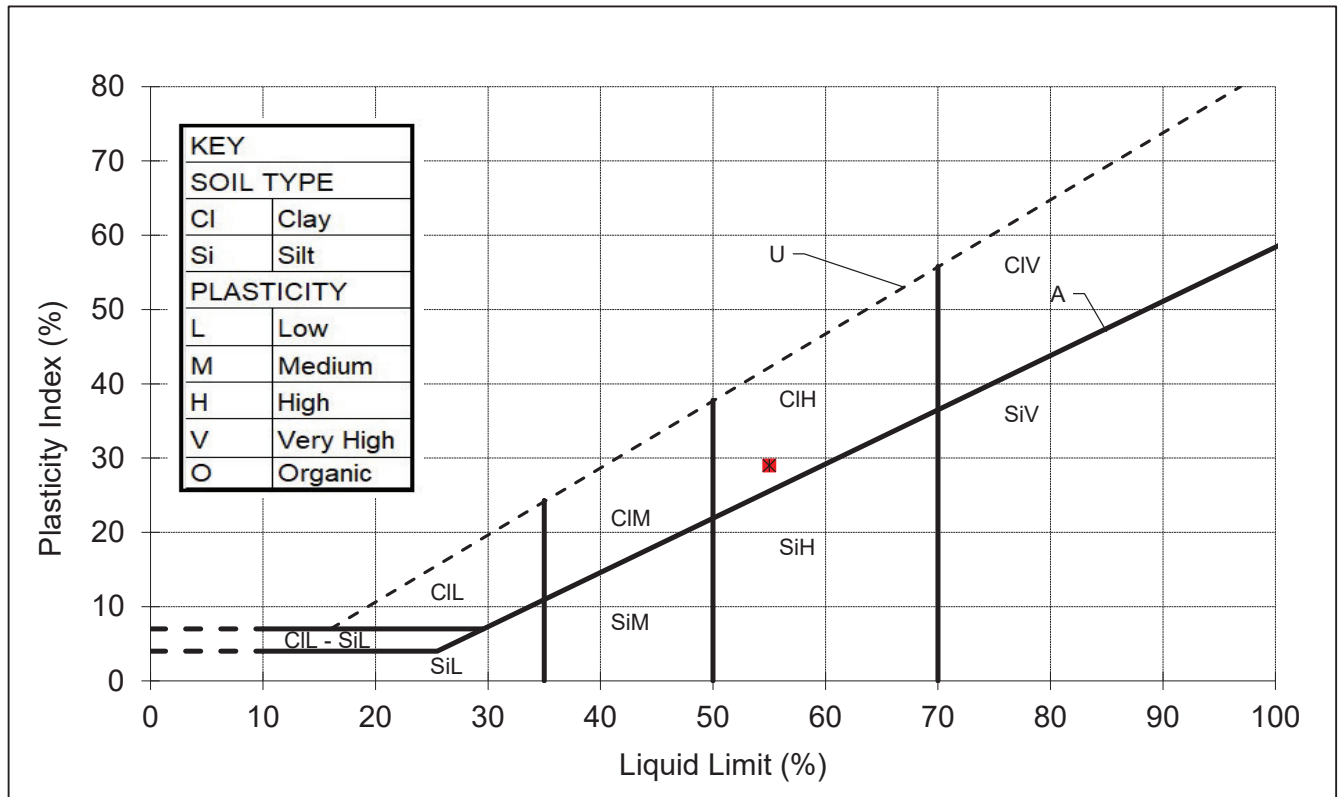
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	iD GeoEnvironmental Ltd
SITE	5238 - Radcliffe Hub
JOB NUMBER	MRN 4296/2

SAMPLE LABEL	WS02 1.5-2.0	DATE SAMPLED	19-Jan-22
SAMPLE No.	108802	DATE RECEIVED	27-Jan-22
DATE TESTED	11-Feb-22	SAMPLED BY	Client

MATERIAL	Firm brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
33	55	26	29	95



REMARKS

Sample tested in natural condition

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

22-Feb-22

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.5: 1990

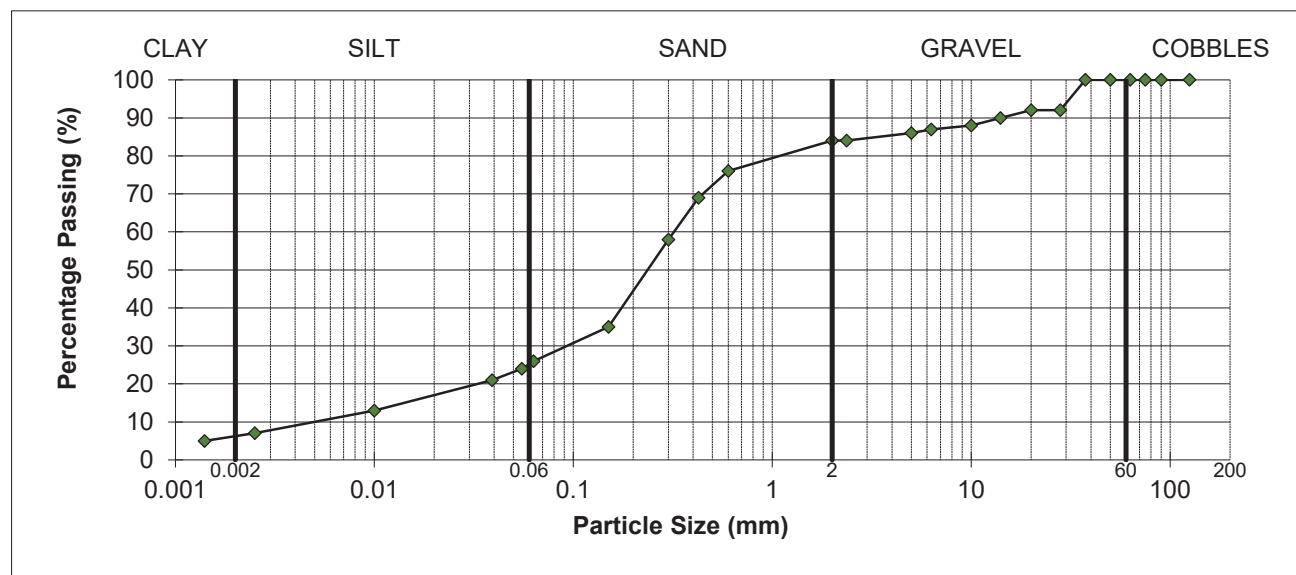
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	iD GeoEnvironmental Ltd
SITE	5238 - Radcliffe Hub
JOB NUMBER	MRN 4296/2

SAMPLE LABEL	WS002 2.5-3.5	DATE SAMPLED	19-Jan-22
LAB SAMPLE No	108803	DATE RECEIVED	27-Jan-22
DATE TESTED	02-Feb-22	SAMPLED BY	Client

MATERIAL	Brown clay bound silty SAND with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		2.36	84	
90	100		2	84	
75	100		0.6	76	
63	100		0.425	69	
50	100		0.3	58	
37.5	100		0.15	35	
28	92		0.063	26	
20	92		0.055	24	
14	90		0.039	21	
10	88		0.01	13	
6.3	87		0.0025	7	
5	86		0.0014	5	



REMARKS

As received moisture content = 16%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

22-Feb-22

TEST REPORT

Client iD GeoEnvironmental Ltd

Address Caledonian House
Tatton Street
Knutsford
WA16 6AG

Contract Blackburn Street

Job Number MRN 4296/7

Date of Issue 20 June 2022

Page 1 of 3

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.
- 5 The results included within the report are representative of the samples submitted for analysis.
- 6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

Murray Rix is the trading name of Murray Rix (Northern) Limited. Registered in England 2878361

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

		Test Type *	*W	Entry required if test type is not
A	Axial Test	D	Diametral Test	Diametral
B	Block Test	I	Irregular Lump Test	

Page 2 of 3

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	iD GeoEnvironmental Ltd
SITE	Blackburn Street
JOB NUMBER	MRN 4296/7

SAMPLE LABEL	BH06	DATE SAMPLED	Not advised
LAB SAMPLE No	112808-112811	DATE RECEIVED	25-May-22
DATE TESTED	17-Jun-22	SAMPLED BY	Client

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

[illegible]

		Test Type *	*W	Entry required if test type is not
A	Axial Test	D		Diametral
B	Block Test	I		Irregular Lump Test

REMARKS

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 20-Jun-22

TEST REPORT

Client iD GeoEnvironmental Ltd

Address Caledonian House
Tatton Street
Knutsford
WA16 6AG

Contract Blackburn Street

Job Number MRN 4296/9

Date of Issue 19 July 2022

Page 1 of 4

Approved Signatories

S J Hutchings, O P Davies

Notes

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- 5 The results included within the report are representative of the samples submitted for analysis.
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DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

		Test Type *	*W	Entry required if test type is not
A	Axial Test	D	Diametral Test	Diametral
B	Block Test	I	Irregular Lump Test	

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D7012 - 14 Method C

CLIENT	iD GeoEnvironmental Ltd
SITE	Blackburn Street
JOB NUMBER	MRN 4296/9

SAMPLE REFERENCE	9.75	DATE RECEIVED	07-Jul-22
SAMPLE NUMBER	114152	DATE SAMPLED	Not advised
DATE TESTED	18-Jul-22	SAMPLED BY	Client

DIMENSIONS

TESTED BY	MW	DIAMETER (mm)	83
LENGTH AFTER PREPARATION (mm)	166	LENGTH/DIAMETER RATIO	2.00

METHOD OF END PREPARATION	Saw / Grinding	TIME IN WATER PRIOR TO TEST	0 Hours
DATE OF DRILLING	Not advised	DRILLED BY	Others
MATERIAL	Rock Core	SAMPLE LOCATION	Not advised

DESCRIPTION OF CORE AFTER TEST	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

COMPRESSIVE STRENGTH

LOAD AT FAILURE (kN)	48.4	MEASURED COMPRESSIVE STRENGTH (N/mm ²)	8.9
----------------------	------	--	-----

COMPRESSIVE STRENGTH (MPa)	8.9
----------------------------	-----

Comments / Deviation from standard method / Abnormalities noted during visual inspection.
None

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

SIGNED



DATE 19-Jul-22

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D7012 - 14 Method C

CLIENT	iD GeoEnvironmental Ltd
SITE	Blackburn Street
JOB NUMBER	MRN 4296/9

SAMPLE REFERENCE	16.60	DATE RECEIVED	07-Jul-22
SAMPLE NUMBER	114154	DATE SAMPLED	Not advised
DATE TESTED	18-Jul-22	SAMPLED BY	Client

DIMENSIONS

TESTED BY	MW	DIAMETER (mm)	83
LENGTH AFTER PREPARATION (mm)	166	LENGTH/DIAMETER RATIO	2.00

METHOD OF END PREPARATION	Saw / Grinding	TIME IN WATER PRIOR TO TEST	0 Hours
DATE OF DRILLING	Not advised	DRILLED BY	Others
MATERIAL	Rock Core	SAMPLE LOCATION	Not advised

DESCRIPTION OF CORE AFTER TEST	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

COMPRESSIVE STRENGTH

LOAD AT FAILURE (kN)	28.4	MEASURED COMPRESSIVE STRENGTH (N/mm ²)	5.2
----------------------	------	--	-----

COMPRESSIVE STRENGTH (MPa)	5.2
----------------------------	-----

Comments / Deviation from standard method / Abnormalities noted during visual inspection.
None

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

SIGNED



DATE 19-Jul-22

Appendix G

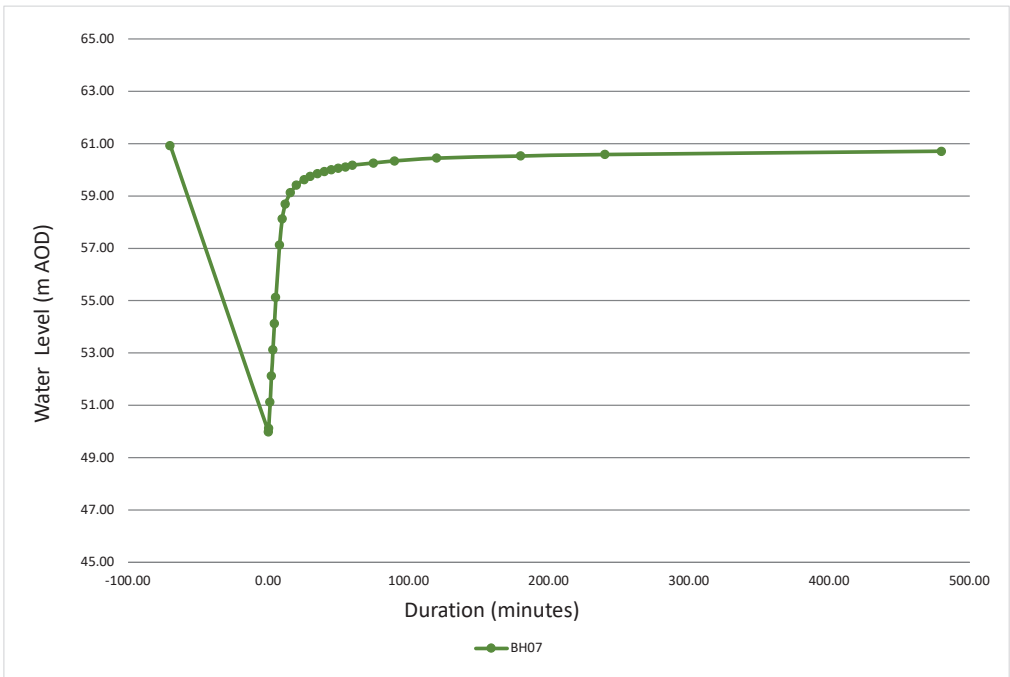
Date	WS01B		WS02		WS03A	
	Response Zone	AOD	Response Zone	AOD	Response Zone	AOD
	2.0 - 4.0m	63.97	1.5 - 4.5m	64.45	1.9 - 4.9m	64.36
	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)
26/01/2022	3.76	60.21	4.07	60.38	3.87	60.49
08/03/2022	3.80	60.17	4.06	60.39	3.75	60.61
18/05/2022	-	-	-	-	-	-
27/05/2022	3.77	60.2	4.10	60.35	2.41	61.95
24/06/2022	3.81	60.16	4.15	60.3	2.18	62.18
05/07/2022	3.74	60.23	4.12	60.33	2.37	61.99
14/07/2022	3.83	60.14	4.14	60.31	2.09	62.27
28/07/2022	3.82	60.15	4.14	60.31	2.10	62.26

Date	WS04		BH05		BH06	
	Response Zone	AOD	Response Zone	AOD	Response Zone	AOD
	1.2 - 3.2m	63.63	2.0 - 3.0m	64.10	2.0 - 3.0m	65.62
	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)
26/01/2022	-	-	-	-	-	-
08/03/2022	-	-	-	-	-	-
18/05/2022	Dry	-	2.36	61.74	-	-
27/05/2022	Dry	-	2.67	61.43	1.33	64.29
24/06/2022	Dry	-	2.51	61.59	1.62	64.00
05/07/2022	Dry	-	2.74	61.36	1.97	63.65
14/07/2022	Dry	-	2.90	61.20	2.27	63.35
28/07/2022	Dry	-	2.94	61.16	2.52	63.10

Date	BH07					
	Response Zone	AOD	Response Zone	AOD	Response Zone	AOD
	7.6 - 17.1m	64.13				
	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Groundwater Level (m bgl)	Groundwater Level (m AOD)
26/01/2022	-	-				
08/03/2022	-	-				
18/05/2022	-	-				
27/05/2022	-	-				
24/06/2022	-	-				
12/07/2022	3.19	60.94				
14/07/2022	3.20	60.93				
24/07/2022	3.20	60.93				
28/07/2022	3.16	60.97				

GROUNDWATER RECOVERY MONITORING				
Job Ref:	5238	Date:	14/07/2022	
Site Name:	Radcliffe Hub	Engineer:	MJ	
BH Ref:	BH07			
Borehole	BH07	WS01B	WS02	WS03A
Borehole Elevation (m AOD)	64.13	63.97	64.45	64.36

Time	Duration (m)	BH07		WS01B		WS02		WS03A	
		Depth (m bgl)	Elevation (m AOD)	Depth (m bgl)	Elevation (m AOD)	Depth (m bgl)	Elevation (m AOD)	Depth (m bgl)	Elevation (m AOD)
07:05:00	-70.00	3.20	60.93	3.83	60.14	4.14	60.31	2.1	62.26
08:15:00	0.00	14.14	49.99	3.83	60.14	4.14	60.31	2.1	62.26
08:15:17	0.28	14.00	50.13						
08:16:12	1.20	13.00	51.13						
08:17:14	2.23	12.00	52.13						
08:18:16	3.27	11.00	53.13						
08:19:18	4.30	10.00	54.13						
08:20:20	5.33	9.00	55.13						
08:23:00	8.00	7.00	57.13						
08:24:55	9.92	6.00	58.13						
08:27:04	12.07	5.44	58.69						
08:30:45	15.75	5.00	59.13	3.83	60.14	4.14	60.31	2.1	62.26
08:35:10	20.17	4.71	59.42						
08:40:33	25.55	4.50	59.63						
08:45:00	30.00	4.38	59.75						
08:50:00	35.00	4.28	59.85						
08:55:00	40.00	4.19	59.94						
09:00:00	45.00	4.13	60.00	3.83	60.14	4.14	60.31	2.1	62.26
09:05:00	50.00	4.07	60.06						
09:10:00	55.00	4.02	60.11						
09:15:00	60.00	3.95	60.18						
09:30:00	75.00	3.87	60.26						
09:45:00	90.00	3.79	60.34						
10:15:00	120.00	3.68	60.45						
11:15:00	180.00	3.60	60.53						
12:15:00	240.00	3.54	60.59	3.83	60.14	4.14	60.31	2.1	62.26
16:15:00	480.00	3.42	60.71	3.83	60.14	4.14	60.31	2.1	62.26



Appendix H

Generic Notes – ID Geoenvironmental Investigations

Environmental Setting

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority and the Local Authority etc is presented in the Correspondence Appendix of this Geoenvironmental Report.

Geology, Mining & Quarrying

In order to establish the geological setting of a site, ID Geoenvironmental refer to BGS maps for the area, and the relevant geological memoir.

A coal mining report is obtained from the Coal Authority. Further information is sourced from the Local Authority and by reference to current and historical OS plans.

Landfills and other Historical Land Uses

ID Geoenvironmental obtain data from the either Landmark Information Group or Groundsure, and if required from the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Historical maps dating from the middle of the nineteenth century are also studied for evidence of historical land uses (i.e. gas works, foundries, chemical works) which may represent potential sources of contamination or ground instability.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

Radon Affected Areas are designated by the UK Health Security Agency (UKHSA). UKHSA advise that radon concentrations should be measured in all properties located within Radon Affected Areas.

The risk of proposed properties being affected by radon has been assessed by reference to the information presented in the Groundsure Geosight Report or Landmark Report. The search data is based on a BGS radon dataset with a 75m resolution.

Radon potential maps published online by UKHSA (www.ukradon.org) are of a significantly lower resolution and show the worst-case radon potential within a 1km grid square.

Further details of the protective measures required, if appropriate, are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

iD Geoenvironmental obtain information from the Environment Agency (EA) and the Landmark Information Group with respect to:

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

From 1 April 2010 the Environment Agency's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey.

These maps are split into two differing aquifer designations:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits such as sands and gravels.
- **Bedrock** – solid permeable formations such as sandstone, chalk or limestone.

The maps display the following aquifer designations:

- **Principal aquifers:** *"These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer".*
- **Secondary A** – *"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers";*
- **Secondary B** – *predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers*
- **Unproductive Strata:** *These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. However groundwater flow through such rocks, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants. Some non-aquifers can yield water in sufficient quantities for domestic use".*

Groundwater vulnerability is determined by 4 variables:

1. The presence and nature of overlying soil (the weathered zone affected by living organisms; soil in the UK can extend up to 2m in depth). Physical properties of the soil affect the

downward passage of water and its ability to attenuate pollutants. The EA make reference to a three-fold classification of soil types:-

- Soils of **low** leaching potential are defined as *"soils in which the pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants"*.
- Soils of **intermediate** leaching potential are defined as *"soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer"*.
- Soils of **high** leaching potential are defined as *"soils with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater"*.

In urban areas and restored mineral workings the soil information is based on fewer observations than elsewhere. A worst-case vulnerability (H) is therefore assumed for these areas and for current mineral workings by the EA. All are given a designation of **HU** unless proved otherwise.

2. The presence and nature of Drift, which often overlies bedrock. Where Drift is of substantial thickness and low permeability, it can provide an effective barrier to surface pollutant migration. Permeable Drift is classified as a Minor Aquifer except where it is in probable hydraulic continuity with a Major Aquifer, where it is regarded as part of the Major Aquifer unless proven otherwise by site investigation.
3. The nature of the geological strata (bedrock). Rocks that contain groundwater in exploitable quantities are called aquifers.
4. The depth of the unsaturated zone; i.e. that part of the aquifer which lies above the water table

The EA have also designated Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

ID GeoEnvironmental obtain information from the Environment Agency and the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQO's). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which

reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are six GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps provide show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map:

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year (or 1 in 200 year as appropriate), areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

Furthermore, as discussed in Planning Policy Statement 25 (PPS25) a consequence of amendment 8 to Article 10 of The Town and Country Planning (General Development Procedure) Order 1995 ("the GDPO"), on 1st October 2006, LPAs are required to consult the Environment Agency on all applications for development in flood risk areas (except minor development), including those in areas with critical drainage problems and for any development on land exceeding 1 hectare outside flood risk areas.

COMAH & Explosive Sites

ID GeoEnvironmental obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. MMI's report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary Conceptual Ground Model

The site's environmental setting (and proposed end use) is used by ID GeoEnvironmental to assess the significance of any contamination encountered during the subsequent ground investigation

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this GeoEnvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

Generic Notes 2.

Ground Investigation Fieldwork

General

IDG Ground Investigations are undertaken in accordance with current UK guidance including:

- *BS EN 1997-1:2004 Eurocode 7: Geotechnical design — Part 1: General rules*
- *BS EN 1997-2:2007 Eurocode 7: Geotechnical design —Part 2: Ground investigation and testing*
- *NA to BS EN 1997-2:2007 UK National Annex to Eurocode 7. Geotechnical design. Ground investigation and testing*
- *BS 5930:1999 Code of practice for site investigations (partially replaced, under revision).*
- *BS 10175:2011 Investigation of potentially contaminated sites. Code of practice.*
- *BS EN ISO 14688-1:2002 Geotechnical investigation and testing. Identification and classification of soil. Identification and description.*
- *BS EN ISO 14688-2:2004 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.*
- *BS EN ISO 14689-1:2003 Geotechnical investigation and testing. Identification and classification of rock. Identification and description.*
- *“Guidance on the protection of housing on contaminated land” – NHBC & EA R&D Publication 66 (2000, 2008) updated 3rd June 2014*
- *“Technical Aspects of Site Investigation” – EA R&D Technical Report P5-065/TR (2000)*
- *“Development of appropriate soil sampling strategies for land contamination” – EA R&D Technical Report P5-066/TR (2001)*
- *AGS: 1996 “Guide to the selection of Geotechnical Soil Laboratory Testing”*

Exploratory hole logs are presented in Appendices to this Geoenvironmental Report. These logs include details of the:

- Investigation technique adopted
- Descriptions of the solid strata, and any groundwater encountered.
- Samples taken
- Results of any in-situ testing
- Any gas\groundwater monitoring well installed

Exploratory Hole Locations

Exploratory hole locations are selected by IDG, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation Techniques

Ground conditions can be investigated by a number of techniques. Techniques most commonly used by IDG include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket.
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing. Cable Percussive drilling is employed to advance boreholes in superficial (made ground and Drift strata).
- Window or Windowless Sampling boreholes. Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm) diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material) and cannot be used in solid strata.
- Rotary percussive open-hole probeholes are typically drilled using a tricone rock roller bit with water or air as the flushing medium. Rotary probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse. Rotary boreholes are used to enable progress in solid strata (rockhead) and are commonly drilled to identify the presence of shallow mineworkings or to install deep groundwater monitoring boreholes in the solid strata.

Hazardous ground gas and groundwater monitoring boreholes may be installed in cable percussive boreholes, window sample probeholes and rotary boreholes. Where installed, gas\groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10 mm diameter non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a circular or square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter raised steel helmet set in concrete, which stands approximately 300mm proud of ground level.

Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ Testing

Where relative densities of granular materials given on the trial pit and window sample logs are based on visual inspection only, they do not relate to any specific bearing capacities.

BS EN ISO 22476-3:2005 Geotechnical investigation and testing. Field testing. Standard penetration test

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS EN ISO 22476-3:2005. The sampler is penetrated over an initial seating drive of 150mm. The sampler is then driven for a test drive of 300mm in four increments of 75mm. The total number of blow required to drive the sampler 300mm is recorded as the penetration resistance or N-value. Where full penetration (450mm) is not possible the test is continued up to a maximum of 50 blows and the depth of penetration is recorded in millimetres.

The strength of cohesive deposits is determined using a hand shear vane in general accordance with BS1377-7-1990.

Shear strength test results reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Representative soil/fill samples are taken at regular intervals from the exploratory holes to assist in description of the ground and to allow selected laboratory testing to be performed. The type of sample taken is dependent on the nature of the stratum and the purpose of the analysis.

Where the soils encountered contain a significant proportion of coarse grained material, truly representative samples are not typically obtained and only the finer fraction is placed in sample containers. However, a visual estimate of the amount of coarse material is made on site. Note: Coarse constituents not sampled are defined as: coarse gravel, cobble and boulder. (i.e. any 'particles' with an average diameter greater than 20mm).

Occasionally, unrepresentative 'spot' samples are also taken from some exploratory locations for contaminant analysis, typically where unusual, localised pockets of materials are encountered.

Samples of soil for chemical testing are placed into appropriate containers (see below) prior to delivery to the selected laboratory. Samples of water are taken in one litre, brown glass bottles and stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory. Soil\fill samples for organic analysis are also stored in cool boxes.

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests are required.

Containers (for contaminant analysis). In order to comply with MCERTS requirements, labs have to provide a sample description and consequently require sufficient soil sample, and the use of wide-necked containers. For any sample requiring both inorganic & organic analysis, it is necessary to submit both a 1-litre glass jar and a 1 kg plastic tub.

Where scheduling for VOC (including GRO) testing is anticipated, a glass vial is also required. In summary (for contaminant analysis):

Anticipated testing	Container(s)	Remarks
pH & metals only	1 kg plastic tub	
organics (TPH, PAH) etc only	1 litre wide-necked glass jar	Vial required if TPH is to include GRO as well as DRO & LRO, or speciated PAH
VOCs (incl. naphthalene and\or GRO) only	glass vial & 1kg plastic tub	
pH & metals, and organics	1 litre wide-necked glass jar 1kg plastic tub	

pH & metals, and organics (incl. VOCs or GRO)	glass vial 1 litre wide-necked glass jar 1kg plastic tub	
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Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during the ground investigation.

Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

Description of Strata

Soils encountered during an IDG investigation are described (logged) in general accordance with EN ISO 14688-1. The descriptions and depth of deposits encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section of the report within the main body of text.

Rocks encountered during an IDG investigation are described (logged) in general accordance with EN ISO 14689-1. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section of the report within the main body of text.

The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to Exploratory Hole Logs

Keys to logs are presented in the Appendix(ces) containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

Generic Notes – ID Geoenvironmental Investigations

3. Geotechnical Laboratory Tests

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by IDG. All tests are carried out in accordance with BS 1377:1990.

The test results are presented as received in an Appendix to this Geoenvironmental Report.

The following laboratory testing are routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading.
- Compaction tests
- Particle density.

Atterberg Limits & Moisture Content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. IDG typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%.

PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'_p), defined as:

$$I'_p = I_p * (\% < 425\mu\text{m} / 100)$$

ie if PI is 30%, but the soil contains 80% < 425µm, then: $I'_p = 30 * 80/100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs.

IDG apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- the average values for each particular soil type (ie differentiate between residual soil and alluvium),
- the number of results in each class and
- the actual values.

Unless the judgment strongly indicates otherwise, IDG typically adopt a conservative approach and recommend assumption of the higher classification.

Soluble Sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

IDG refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- the nature of the site (greenfield, brownfield or pyritic)
- the groundwater regime (static, mobile or highly mobile)
- the Design Sulphate Class (DC Class) and
- the Aggressive Chemical Environment for Concrete (ACEC Class)

IDG reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Generic Notes – ID Geoenvironmental Investigations

4 Contamination Laboratory Analysis & Interpretation (including WAC)

Current UK Guidance

The UK approach to contaminated land is set out in **Land Contamination Risk Management (LCRM)** published on the Gov.uk website. The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source, (2) a receptor (eg controlled water or people exposed to the contaminants) and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

As recommended by LCRM, IDG adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. In general this comprises the following elements of work:

- A Preliminary Risk Assessment (PRA)
- A Generic Quantitative Risk Assessment (GQRA)
- A Detailed Quantitative Risk Assessment (DQRA)

Preliminary Risk Assessment

A preliminary risk assessment is generally undertaken as part of a “Desk Study” investigation. This investigation collates readily available information including historical land uses, the geological, hydrogeological and hydrological setting of the site, and the proposed end-use which is presented as a “Preliminary Conceptual Model”. Potential pollutant linkages are defined and a preliminary assessment of the risks posed to receptors is stated.

Further information regarding the development of a conceptual model for the site is presented in Generic Notes 1 – Environmental Setting and Preliminary Risk Assessment.

Generic Quantitative Risk Assessment

Where potential pollutant linkages are identified in the preliminary conceptual model a generic quantitative risk assessment (GQRA) generally forms part of an intrusive phase of site investigation, allowing for the sampling of both soil and groundwater. The intrusive investigation should target pollutant linkages identified in the Preliminary Conceptual Model, but should also investigate previously unidentified sources and contaminant pathways encountered during the site investigation works.

Human Health

Detailed guidance on human health risk assessment is available in the following:

- INFO-RA2-2: assessing risks to human health
 - Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
 - Updated technical background to the CLEA model - Science Report: SC050021/SR3
 - CLEA Software (Version 1.05) Handbook Science report: SC050021/SR4
 - Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008

Generic Assessment Criteria represent “screening concentrations” devised for a number of standard land-use scenarios. They are based conservative receptor and exposure parameters and provide a useful method of screening out sites where contaminants pose a negligible risk. GACs are available from a number of sources for the following land-use scenarios. These scenarios include:

- Residential end-use with consumption of homegrown produce.
- Residential end-use without consumption of homegrown produce.
- Residential Public Open Space (Landscaped Areas)
- Public Open Space (Parks)
- Allotments
- Commercial Development

The initial step of such a generic quantitative risk assessment is to compare site chemical data with appropriate UK generic assessment criteria. These following GACs are currently appropriate.

- Soil Guideline Values (SGVs) (Environment Agency 2009) are based on CLEA “default settings and therefore represent screening criteria based on minimal risk to human health. SGVs are available for arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for residential, allotments and commercial land-uses based on a sandy loam soil and a 6% soil organic matter (SOM) content.
- Soil Generic Assessment Criteria for Human Health Risk Assessment (EIC/AGS/CL:AIRE 2009) adopted CLEA default settings and therefore represent screening criteria based on minimal risk to human health. GACs were derived for 3 metals and 32 organic contaminants for four standard land uses at 1%, 2% and 6% SOM content.
- Suitable for Use Levels (S4ULs) (LQM/CIEH, Nathanail 2015) represent generic assessment criteria for each of the above standard land-uses, based on updated toxicological assessments and modified exposure parameters. They therefore represent screening criteria based on minimal risk to human health. S4ULs for organic compounds are available for 1%, 2% and 6% SOM. *(S4ULs Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3061. All rights Reserved.)*
- Category 4 Screening Levels (Defra March 2014) are primarily intended to be used to assist the classification of land under the revised Part 2A Statutory Guidance issued in 2012. The revised guidance introduced the concept of four categories of contaminated land (Category 1 (significant/high risk) – Category 4 (low risk). C4SLs are low risk levels which are not representative of significant possibility of significant harm (SPoSH) and, whilst not intended to mark the top of Category 4, should the C4SLs not be exceeded, land can be demonstrated as being in Category 4 and cannot be determined as contaminated land.

The GAC selected to form the basis of a Generic Risk Assessment are dependent on the existing or proposed land use as defined in the Conceptual Model (which identifies the critical receptor and exposure parameters) and other factors such as the SOM content of the near surface soils at the site.

Soil organic matter (SOM) is the fraction of soil composed of organic matter. It consists principally of decomposed plant remains. The presence of SOM is important in determining the fate and behaviour of a number of organic contaminants. Generally, the greater the SOM content of soil, the greater the sorptive capacity of the soil and the lower the mobility of certain contaminant phases. (Note: $TOC = SOM \times 0.58$; and $FOC = TOC/100$).

Generic Assessment Criteria adopted by IDG available, by regulators, upon request.

The CLEA model assumes a simple linear partitioning between the sorbed, dissolved and vapour phases. The theoretical upper boundaries to this behaviour are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous or vapour based saturation limit (the lower saturation limit). Assessment criteria which exceed the lower of the two saturation limits and where the vapour pathway is an important contributor to exposure are highlighted in red in the CLEA model. These values are depicted as shaded values in the IDG GAC Tables. In such cases the exposure from the vapour phase will be over predicted and where the vapour pathway is the only exposure route being considered the risk is likely to be negligible.

IDG Reports will therefore state the applicable land-use scenario, and the SOM content adopted for the assessment. In general, the initial assessment **assumes a low soil organic matter content (1% SOM)** to ensure that the assessment is appropriately conservative. Where contaminant concentrations exceed the adopted GAC, site-specific assessment (for example applying measured SOM contents of soils or development site-specific exposure parameters) will be undertaken to further evaluate the risk. It should be noted that exceedance of GAC does not necessarily mean that remediation will be required.

Interpretation of Results

Prior to undertaking any comparison of soil contamination data, the issue of the averaging area requires further consideration. IDG consider that contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, IDG gather and analyse sample results by “soil type”, or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage/leakage rather than from within a specified depth below the site surface.

In terms of brownfield redevelopment, this is considered an appropriate methodology which provides a representative sample population for statistical analysis which allows for the necessary relocation of soils during site development works.

Should any of the GAC criteria detailed above be exceeded, then three possible courses of action could be considered. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

- Undertake further statistical analysis to determine whether contaminant concentrations of inorganic contaminants within soil/fill actually present a risk (only applicable to assessing the risk to human health).
- Based on a Generic Quantitative Risk Assessment, advocate an appropriate level of remediation to “break” the pollutant linkage - for example the removal/relocation of the contaminated materials or the provision of a clean cover.
- Carry out a more a Detailed Quantitative Risk Assessment in order to further assess the risk.

Controlled Waters Receptors

Where the environmental setting of a site is considered moderately or highly “sensitive” in respect of controlled waters (i.e where a pollutant linkage potentially exists to a controlled waters receptor) a risk assessment will be undertaken. This initially comprises comparison of soil-leachate or groundwater concentrations to the appropriate water quality standard. Depending upon the specific characteristics and environmental setting of the site the appropriate standard is likely to be one of the following:

- Water Supply (Water Quality) Regulations 1989

- Environmental Quality Standards: The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive)(England and Wales) Directions 2010.
- The Surface Waters (Abstraction for Drinking Water) Regulations

It is not possible to derive generic GAC values for controlled waters, because distance to the receptor, ground permeability and hydraulic gradient are key factors in the assessment, and both are extremely site-specific. As a consequence should groundwater or soil leachate concentrations exceed the adopted water quality standards in a site with moderate or high sensitivity, a detailed quantitative risk assessment may be required.

Phytotoxic Effects

With respect to the assessment of potential **phytotoxic effects** of contaminants, IDG refer to available publications relating to allowable concentrations of heavy metals (copper and zinc) in arable soils which have been set by the Department of Environment¹. These values are detailed in the table below.

Allowable Concentrations of Heavy Metals in Arable Soils

Element	Limit According to pH of soil (mg/kg)			
	5.0 to <5.5	5.5 to <6.0	6.0 to 7.0	>7.0
Copper	80	100	135	200
Nickel	50	60	75	110
Zinc	200	200	200	300

IDG have reviewed the available data on Boron behaviour in soil, plant uptake and the relatively high precipitation rates typical in the UK. In the absence of any definitive value IDG have opted to be relatively conservative and have adopted a Boron Soil Screening Value of 5mg/kg. This value is considered protective of the majority of common landscape plants.

Hazardous Ground Gas

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents:

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating “traffic lights”. Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2006) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2007 – Code of Practice for the characterisation & remediation from ground gas in affected developments

Further information is presented in Generic Notes No. 5 – Hazardous Gas.

Waste Classification & WAC

Waste soils to be disposed off-site should be characterised by a general chemical testing for a broad suite to include pH, TOC, metals, speciated PAH and banded hydrocarbons. WAC testing is not required to characterise the waste. Chemical test result should be provided to the waste haulier and receiving landfill who will confirm the classification of the waste soils.

In the context of waste soils generated by remediation and/or groundwork activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated ‘natural’ soil, bricks, concrete, tiles & ceramics).

- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds).
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds).

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

From 16th July 2005, landfill operators require Waste Acceptance Criteria (WAC) laboratory data, should soil waste be classified as **hazardous**, and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

It should be noted that where non-hazardous waste is accepted at a non-hazardous landfill facility, WAC testing is not required.

Should off-site disposal of soils classified as hazardous waste be undertaken during redevelopment, then WAC analysis should be scheduled at an early stage in the remediation programme.

However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous. These contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

Key References

Environment Agency (2008), "Evaluation of models for predicting plant uptake of chemicals from soil" Science Report – SC050021/SR.

Environment Agency (2008), "Human health toxicological assessment of contaminants in soil". Science Report – SR2.

Environment Agency (2009), "Updated Technical Background to the CLEA Model (as amended 2009)". Science Report - SC050021/SR3.

Environment Agency (2009), "CLEA Software (Version 1.05) Handbook". Science Report - SC050021/SR4.

"Guidance on Comparing Soil Contamination Data with a Critical Concentration". CL:AIRE and CIEH (May 2008).

CL:AIRE (2010), "Soil Generic Assessment Criteria for Human Health Risk Assessment".

CL:AIRE (2013), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. SP1010 Final Project Report.

DEFRA (2014), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – SP1010 Policy Companion Document.

Nathanial (*et. al.*) (2015). The LQM/S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

Department of Environment (1996), "Code of Practice for Agricultural use of Sewage Sludge".

Generic Notes – ID Geoenvironmental Investigations

5. Hazardous Gas

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency).

IDG Investigations are undertaken in accordance with the following Standards and Guidance:

- BS8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon-dioxide ground gases for new buildings.
- BS10175:2011 +A2-2017 Investigation of potentially contaminated sites – Code of practice.
- CIRIA C665 (2007) Assessing risks posed by hazardous ground gases to buildings.
- CIRIA C716 Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination.
- CIRIA 735 (2014) Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.

In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 1. – Environmental Setting.

At preliminary stage, the assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group/Groundsure Limited, and the Local Authority. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal-bearing strata and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a “carrier” for hazardous gas.
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is

flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas Monitoring Procedure

IDG adopt a standard gas monitoring procedure. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of monitoring.
- Borehole gas emission rate.
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser.
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism.

Where samples of gas are required for laboratory analysis, Gresham Tubes or Tedlar Bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Monitoring Programme

The appropriate length of the monitoring programme is confirmed in accordance with BS8576:2013 (Figure 6).

Site Characterisation

Gas monitoring results are assessed in accordance with BS8485:2015.

Borehole gas flow rates (Q_{hg}) are calculated for each gas at borehole standpipe for each monitoring event. On completion of the monitoring programme a GSV is adopted for the site taking into account the monitoring data, conceptual model, hazardous gas source(s) and nature of pathway. Where the dataset is representative and comprehensive, the GSV should be at the maximum borehole Q_{hg} measured for all the monitoring events.

A worst case check (based on site wide highest flow rate and site wide highest gas concentration) should also be calculated for the site. The worst case Q_{hg} should be compared with the maximum borehole Q_{hg} .

Characteristic gas situation (CS) is determined using the Q_{hg} adopted for the site in accordance with BS8485:2015.

Table 1 – Characteristic Situation BS8485:2015

Characteristic Situation	GSV CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Typically <1% methane concentration and <5% carbon-dioxide concentration (otherwise consider and increase to CS2)	Natural soils with low organic content
2	<0.07 to <0.7	Typical measured flow rate <70 litre/hr (otherwise increase to Characteristic Situation 3)	Natural soil, high peat/organic content
3	0.7 to <3.5	Quantitative Risk Assessment required to evaluate scope of protection measures.	Old landfill, inert waste, mineworking flooded.
4	3.5 to <15		Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	15 to <70		Mineworking unflooded, inactive
6	>70		Recent landfill site

Notes:

Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr).

Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr).

Gas protection measures

A minimum “Gas Protection Score” is allocated for new buildings at the site. This is based on the characteristic situation of the site and the proposed building type. Low rise residential properties are generally classed as “Type A” buildings, whilst managed residential apartments are classed as “Type B buildings”.

The required gas protection measures, taking into account the proposed foundation and floor slab construction methods are selected to meet the required gas protection score. A combination of at least two of the following three types of gas protection measures are required to achieve the minimum gas protection score.

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present (Gas Protection Score 0-2.5).
- Ventilation measures (Gas Protection Score 0.5-4.0); and,
- Gas resistant membrane (Gas Protection Score 2). It is important to note that there are several requirements (including independent validation) that need to be fulfilled in order to achieve the score of 2.