

EMT Job No: 19/12143

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.			AR	Yes

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TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	No
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.			AR	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes		AR	Yes

Tier Environmental
Suite 513, Chadwick House
Warrington Rd
Birchwood
Warrington
WA3 6AE



Attention :	Adrian Read
Date :	5th August, 2019
Your reference :	TE1163
Our reference :	Test Report 19/11940 Batch 1
Location :	
Date samples received :	24th July, 2019
Status :	Final report
Issue :	1

Eighteen samples were received for analysis on 24th July, 2019 of which one were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

A handwritten signature in black ink, appearing to read 'B. Leslie'.

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Tier Environmental
Reference: TE1163
Location:
Contact: Adrian Read
EMT Job No: 19/11940

Solids: V=60g VOC jar. J=250g glass jar. T=plastic tub

Please see attached notes for all abbreviations and acronyms

Note:

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Element Materials Technology:

Ryan Butterworth
Asbestos Team Leader

[illegible]

Client Name: Tier Environmental

Reference: TE1163

Location:

Contact: Adrian Read

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 19/11940

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 19/11940

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH ₄ ⁺) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH ₄ ⁺) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.	Yes		AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	

EMT Job No: 19/11940

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Tier Environmental
Suite 513, Chadwick House
Warrington Rd
Birchwood
Warrington
WA3 6AE

Attention : Alex Preston
Date : 25th November, 2020
Your reference : TE1163
Our reference : Test Report 20/16020 Batch 1
Location :
Date samples received : 16th November, 2020
Status : Final report
Issue : 1

Nine samples were received for analysis on 16th November, 2020 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Tier Environmental

Reference: TE1163

Location:

Contact: Alex Preston

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16020

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

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If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

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Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

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As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

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BLANKS

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REPORTS FROM THE SOUTH AFRICA LABORATORY

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M	MCERTS accredited.
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ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 20/16020

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30/TM48	Calculation of Fe (III) based on Iron and Fe(II)	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.				
TM48	Determination of Ferrous Iron by reaction with Sodium Carbonate and Morfamquat Sulphate which is analysed spectrophotometrically.	PM0	No preparation is required.				
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.				
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM0	No preparation is required.				

APPENDIX N – GAS AND GROUNDWATER MONITORING RESULTS

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	1	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	02.09.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	ND	ND	ND	ND	9.5	9.5	ND	ND	ND	ND	10.9	10.9	ND	ND	0.30	2.61			Till & Kinnerton Sandstone		
WS05																			Made Ground & Till		
WS07	0.1	0.1	2.0	2.0	1.4	1.4	ND	ND	ND	ND	0.2	0.2	0.1	0.1	1.28	3.66			Made Ground & Till		
WS09																					
WS10	ND	ND	ND	ND	9.5	9.5	ND	ND	ND	ND	0.3	0.3	ND	ND	0.20	3.89			Made Ground & Till		
WS11																			Made Ground		
WS12																			Made Ground		
WS15	ND	ND	ND	ND	0.3	0.1	ND	ND	ND	ND	20.7	21.1	ND	ND	1.08	1.66			Till		
WS16	ND	ND	ND	ND	0.7	0.7	ND	ND	ND	ND	20.0	20.0	ND	ND	1.04	5.02			Till		
CP101	ND	ND	ND	ND	0.6	0.6	ND	ND	ND	ND	19.8	19.8	ND	ND	1.79	2.94			Made Ground, Till & Pennine Coal Measures		
CP102	ND	ND	ND	ND	3.0	3.0	3	3	ND	ND	13.8	13.8	0.1	0.1	8.19	8.82			Made Ground		
CP103	ND	ND	ND	ND	4.8	4.8	2	1	ND	ND	12.7	12.7	ND	ND	2.57	3.68					
CP104	ND	ND	ND	ND	7.1	7.1	ND	ND	ND	ND	10.6	10.6	ND	ND	2.42	5.97			Till & Pennine Coal Measures		
CP105D	0.1	0.1	2.0	2.0	10.1	5.8	ND	ND	ND	ND	9.2	14.1	ND	ND	0.20	10.56			Till & Pennine Coal Measures		
CP105S	0.1	0.1	2.0	2.0	0.2	0.2	ND	ND	ND	ND	20.8	20.8	ND	ND	DRY	2.00			Till & Pennine Coal Measures		
CP106D	0.1	0.1	2.0	2.0	0.7	0.7	ND	ND	ND	ND	19.5	19.5	-0.1	-0.1	9.69	10.55			Till & Pennine Coal Measures		
CP106S	0.1	0.1	2.0	2.0	3.9	3.9	ND	ND	ND	ND	16.2	16.2	ND	ND	DRY	1.95			Till & Pennine Coal Measures		
CP107D	0.1	0.1	2.0	2.0	0.7	0.7	ND	ND	ND	ND	19.8	19.8	-0.1	-0.1	5.87	13.87			Till & Kinnerton Sandstone		
CP107S	0.1	0.1	2.0	2.0	8.8	8.8	ND	ND	ND	ND	4.3	4.3	ND	ND	DRY	2.00			Made Ground		
CP108	ND	ND	ND	ND	1.5	1.5	13	13	ND	ND	16.5	16.5	ND	ND	0.40	8.10			Till & Kinnerton Sandstone		
WS101	ND	ND	ND	ND	6.6	6.6	ND	ND	ND	ND	11.2	11.6	ND	ND	0.50	3.54			Made Ground		
WS103	ND	ND	ND	ND	0.2	0.2	ND	ND	ND	ND	21.4	21.4	-0.1	ND	1.79	1.79			Made Ground		
WS104	ND	ND	ND	ND	0.5	0.4	ND	ND	ND	ND	21.3	21.3	-0.1	ND	1.35	2.84			Made Ground		
WS105	ND	ND	ND	ND	1.3	1.3	ND	ND	ND	ND	19.3	19.3	ND	ND	1.03	2.06			Made Ground		
WS106	0.1	0.1	2.0	2.0	5.4	5.4	ND	ND	ND	ND	6.0	6.0	ND	ND	4.80	5.02			Till & Pennine Coal Measures		
WS107	ND	ND	ND	ND	4.7	4.7	16	ND	ND	ND	20.5	20.5	6.8	ND	1.09	3.03			Till & Pennine Coal Measures		
WS108	ND	ND	ND	ND	2.7	2.7	ND	ND	ND	ND	17.6	17.6	ND	ND	DRY	2.78			Till		
WS110	ND	ND	ND	ND	2.1	2.1	ND	ND	ND	ND	18.4	18.4	ND	ND	DRY	4.06			Till		
WS111																			Till & Pennine Coal Measures		
TPBH1	ND	ND	ND	ND	0.1	0.1	ND	ND	ND	ND	20.9	20.9	ND	ND	1.28	3.66			Till		
RB102	ND	ND	ND	ND	0.2	0.1	ND	ND	ND	ND	21.1	21.1	ND	ND	1.40	3.02			Till		
Max	0.1	0.1	2.0	2.0	10.1	9.5	16.0	13.0	0.1	0.1	21.4	21.4	6.8	0.1	9.7	13.9			Made Ground		
Min	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.2	1.7			Made Ground		

METEOROLOGICAL AND SITE INFORMATION:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

☐	Calm	☒	Light	☐	Moderate	☐	Strong
☐	None	☐	Slight	☐	Cloudy	☒	Overcast
☐	None	☐	Slight	☐	Moderate	☒	Heavy
		1008	Before			1008	After
		☒	Falling	☐	Steady	☐	Rising
CH ₄	ND	CO ₂	ND	O ₂	20.8%		

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	2	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	07.09.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	ND	ND	ND	ND	9.2	9.2	ND	ND	ND	ND	10.1	10.6	ND	ND	DRY	2.65			Till & Kinnerton Sandstone		
WS05	ND	ND	ND	ND	3.3	3.3	ND	ND	ND	ND	8.0	8.8	ND	ND	1.12	2.41			Made Ground & Till	2 LITRES OF WATER PURGED	
WS07	0.1	ND	2.0	ND	0.9	0.9	ND	ND	ND	ND	0.6	0.7	0.1	0.1	1.75	3.81			Made Ground & Till		
WS09	ND	ND	ND	ND	6.1	5.9	ND	ND	ND	ND	12.6	12.7	0.2	ND	4.30	4.80			Made Ground & Till		
WS10	ND	ND	ND	ND	5.1	5.1	ND	ND	ND	ND	4.1	4.4	ND	ND	DRY	0.86			Made Ground & Till		
WS11																			Made Ground		
WS12																			Made Ground		
WS15	ND	ND	ND	ND	0.9	0.2	18	ND	ND	ND	19.7	20.5	ND	ND	1.08	1.88			Till		
WS16	ND	ND	ND	ND	0.4	0.2	1	ND	ND	ND	19.3	20.3	-0.6	ND	2.66	4.94			Till		
CP101	ND	ND	ND	ND	0.8	0.8	ND	ND	ND	ND	18.9	18.9	ND	ND	1.37	2.92			Made Ground, Till & Pennine Coal Measures	2 LITRES OF WATER PURGED	
CP102	ND	ND	ND	ND	5.5	5.5	1	ND	ND	ND	10.1	10.3	-0.2	ND	8.29	9.08			Made Ground	2 LITRES OF WATER PURGED	
CP103	ND	ND	ND	ND	3.1	3.1	2	1	ND	ND	14.0	14.2	ND	ND	8.45	8.62				Made Ground	
CP104	ND	ND	ND	ND	7.5	7.3	1	ND	ND	ND	9.3	10.0	ND	ND	2.42	5.97			Till & Pennine Coal Measures		
CP105D	ND	ND	ND	ND	0.6	0.6	ND	ND	ND	ND	20.0	20.0	0.2	0.2	10.01	10.62			Till & Pennine Coal Measures		
CP105S	ND	ND	ND	ND	1.6	1.5	ND	ND	ND	ND	19.1	19.2	0.1	0.1	DRY	2.00			Till & Pennine Coal Measures		
CP106D	ND	ND	ND	ND	0.1	0.1	ND	ND	ND	ND	20.6	20.6	0.2	0.2	9.49	10.60			Till & Pennine Coal Measures		
CP106S	ND	ND	ND	ND	2.3	2.3	ND	ND	ND	ND	18.3	18.4	ND	ND	DRY	1.95			Till & Pennine Coal Measures		
CP107D	ND	ND	ND	ND	0.6	0.5	ND	ND	ND	ND	19.8	19.9	0.2	0.2	6.77	13.70			Till & Kinnerton Sandstone		
CP107S																			Made Ground		
CP108	ND	ND	ND	ND	2.7	2.7	3	2	ND	ND	12.0	12.6	-0.1	-0.2	0.60	7.89			Till & Kinnerton Sandstone		
WS101	ND	ND	ND	ND	6.6	6.4	ND	ND	ND	ND	11.5	11.6	ND	ND	DRY	3.50			Made Ground		
WS103	ND	ND	ND	ND	0.3	0.3	ND	ND	ND	ND	20.4	20.5	ND	ND	ND	1.80			Made Ground		
WS104	ND	ND	ND	ND	0.3	0.3	2	1	ND	ND	20.7	20.7	0.0	0.0	ND	0.72			Made Ground		
WS105	ND	ND	ND	ND	1.1	1.1	ND	ND	ND	ND	20.0	20.0	ND	ND	1.07	2.00			Made Ground		
WS106	ND	ND	ND	ND	3.1	3.1	ND	ND	ND	ND	12.6	12.6	ND	ND	4.76	5.04			Till & Pennine Coal Measures		
WS107																			Till & Pennine Coal Measures		
WS108																			Till		
WS110	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20.6	20.7	ND	ND	1.33	3.71			Till		
WS111																			Till & Pennine Coal Measures		
TPBH1																			Till		
RB102	ND	ND	ND	ND	0.2	0.2	ND	ND	ND	ND	20.9	20.9	ND	ND	1.49	3.03			Till	2 LITRES OF WATER PURGED	
Max	0.1	0.1	2.0	0.1	9.2	9.2	18.0	2.0	0.1	0.1	20.9	20.9	0.2	0.2	10.0	13.7			Made Ground		
Min	0.1	0.0	2.0	0.0	0.1	0.1	1.0	1.0	0.0	0.0	0.6	0.7	-0.6	-0.2	0.6	0.7			Made Ground		

METEOROLOGICAL AND SITE INFORMATION:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

☐ Calm	☒ Light	☐ Moderate	☐ Strong
☐ None	☒ Slight	☒ Cloudy	☐ Overcast
☐ None	☒ Slight	☐ Moderate	☐ Heavy
	1019 Before		1019 After
	Falling	☒ Steady	☒ Rising
CH ₄	ND	CO ₂	ND
		O ₂	20.9%

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	3	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	25.09.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	0.1	0.1	2.0	2.0	12.4	12.6	ND	ND	ND	ND	8.2	8.4	-0.1	-0.1	ND	2.60			Till & Kinnerton Sandstone		
WS05	0.1	0.1	2.0	2.0	3.5	3.5	ND	ND	ND	ND	13.0	14.2	ND	ND	1.26	2.35			Made Ground & Till		
WS07	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	21.0	21.0	ND	ND	1.72	3.66					
WS09	0.1	0.1	2.0	2.0	0.9	0.9	ND	ND	ND	ND	2.2	2.2	-2.1	-0.1	2.00	2.92			Made Ground & Till		
WS10	0.1	0.1	2.0	2.0	12.2	10.7	ND	ND	ND	ND	0.2	0.2	-1.3	ND	ND	3.90			Made Ground & Till		
WS11																			Made Ground		
WS12																			Made Ground		
WS15	0.1	0.1	2.0	2.0	0.2	0.2	3	ND	ND	ND	20.1	20.1	0.3	0.3	1.75	1.09			Till		
WS16	0.1	0.1	2.0	2.0	2.5	2.3	ND	ND	ND	ND	16.1	16.1	-0.1	ND	2.60	4.94			Till		
CP101	0.1	0.1	2.0	2.0	1.5	1.5	ND	ND	ND	ND	16.1	16.1	ND	ND	1.10	2.75			Made Ground, Till & Pennine Coal Measures		
CP102	0.1	0.1	2.0	2.0	4.8	4.8	ND	ND	ND	ND	12.2	12.2	ND	ND	4.26	9.83					
CP103	0.1	0.1	2.0	2.0	ND	ND	ND	ND	ND	ND	20.7	20.7	ND	ND	2.80	3.81			Made Ground		
CP104	0.1	0.1	2.0	2.0	8.5	8.5	ND	ND	ND	ND	12.0	12.1	-0.1	ND	2.42	5.97			Till & Pennine Coal Measures		
CP105D	0.1	0.1	2.0	2.0	1.6	1.4	ND	ND	ND	ND	20.0	20.0	-1.3	-0.3	3.58	10.54			Till & Pennine Coal Measures		
CP105S	0.1	0.1	2.0	2.0	1.9	1.9	ND	ND	ND	ND	19.6	19.6	-3.0	ND	1.04	1.95			Till & Pennine Coal Measures		
CP106D	0.1	0.1	2.0	2.0	0.6	0.6	ND	ND	ND	ND	20.0	20.0	-0.4	-0.2	3.58	9.05			Till & Pennine Coal Measures		
CP106S	0.1	0.1	2.0	2.0	2.4	2.2	ND	ND	ND	ND	19.2	19.2	-0.3	-0.3	1.81	1.95			Till & Pennine Coal Measures		
CP107D	0.1	0.1	2.0	2.0	3.0	2.9	ND	ND	ND	ND	18.6	18.6	-0.3	-0.1	2.13	13.90			Till & Kinnerton Sandstone		
CP107S	0.1	0.1	2.0	2.0	2.6	2.6	ND	ND	ND	ND	18.9	18.9	-0.5	-0.5	2.77	2.89			Made Ground		
CP108	0.1	0.1	2.0	2.0	5.5	5.5	ND	ND	ND	ND	6.2	6.2	ND	ND	ND	7.78			Till & Kinnerton Sandstone		
WS101	0.1	0.1	2.0	2.0	9.4	9.4	ND	ND	ND	ND	6.4	6.4	ND	ND	2.40	2.40			Made Ground		
WS103	0.1	0.1	2.0	2.0	0.2	0.2	ND	ND	ND	ND	20.6	20.6	ND	ND	ND	1.05			Made Ground		
WS104	0.1	0.1	2.0	2.0	0.5	0.5	ND	ND	ND	ND	20.6	20.6	0.2	0.2	ND	0.71			Made Ground		
WS105	0.1	0.1	2.0	2.0	2.7	2.7	ND	ND	ND	ND	18.2	18.4	0.1	ND	1.98	2.88			Made Ground		
WS106	0.1	0.1	2.0	2.0	3.6	3.6	ND	ND	ND	ND	10.1	10.1	ND	ND	4.78	5.05			Till & Pennine Coal Measures		
WS107	0.1	0.1	2.0	2.0	1.2	0.7	ND	ND	ND	ND	20.0	20.3	ND	ND	ND	2.91			Till & Pennine Coal Measures		
WS108	0.1	0.1	2.0	2.0	8.7	8.7	ND	ND	ND	ND	11.5	11.5	ND	ND	1.91	2.00			Till		
WS110	0.1	0.1	2.0	2.0	2.5	2.5	1	ND	ND	ND	14.9	14.9	ND	ND	ND	2.18			Till		
WS111	0.1	0.1	2.0	2.0	1.7	1.7	ND	ND	ND	ND	18.9	18.9	ND	ND	ND	4.05			Till & Pennine Coal Measures		
TPBH1	0.1	0.1	2.0	2.0	1.6	1.6	ND	ND	ND	ND	19.0	19.0	0.2	0.1	1.80	3.00			Till		
RB102	0.1	0.1	2.0	2.0	5.6	5.6	ND	ND	ND	ND	14.7	14.7	ND	ND	2.35	2.73			Till		
Max	0.1	0.1	2.0	2.0	12.4	12.6	3.0	ND	ND	ND	21.0	21.0	0.3	0.3	4.8	13.9			Made Ground		
Min	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	0.2	0.2	ND	ND	ND	0.7			Made Ground		

METEOROLOGICAL AND SITE INFORMATION:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

☐ Calm	☒ Light	☐ Moderate	☐ Strong
☐ None	☒ Slight	☐ Cloudy	☐ Overcast
☒ None	☐ Slight	☐ Moderate	☐ Heavy
	☐ 1001 Before		☐ 1004 After
	☐ Falling	☐ Steady	☒ Rising
CH ₄	0.1%	CO ₂	0.1%
		O ₂	20.6%

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	4	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	12.10.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	0.1	0.1	2.0	2.0	11.1	11.1	ND	ND	ND	ND	9.0	9.2	ND	ND	ND	2.60			Till & Kinnerton Sandstone		
WS05	0.2	0.2	4.0	4.0	3.8	3.8	ND	ND	ND	ND	14.9	14.9	0.1	0.1	1.11	2.34			Made Ground & Till		
WS07	0.1	0.1	2.0	2.0	1.2	1.2	ND	ND	ND	ND	1.5	1.6	0.1	0.1	1.15	3.56			Made Ground & Till		
WS09	0.1	0.1	2.0	2.0	0.8	0.8	ND	ND	ND	ND	2.8	2.8	-1.9	ND	1.89	2.90			Made Ground & Till		
WS10	0.1	0.1	2.0	2.0	10.5	10.5	ND	ND	ND	ND	0.3	0.3	-1.8	ND	3.27	3.90			Made Ground		
WS11																			Made Ground		
WS12																			Till		
WS15															0.65	1.75			Till	Well flooded	
WS16	0.1	0.1	2.0	2.0	1.1	0.8	ND	ND	ND	ND	18.8	19.4	ND	ND	2.02	3.94			Made Ground, Till & Pennine Coal Measures		
CP101	0.1	0.1	2.0	2.0	1.9	1.7	ND	ND	ND	ND	17.0	17.0	0.4	ND	0.74	0.75			Made Ground		
CP102	0.2	0.2	4.0	4.0	0.6	0.6	ND	ND	ND	ND	19.6	19.6	0.3	ND	2.42	5.97			Till & Pennine Coal Measures		
CP103	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	20.6	20.6	ND	ND	2.52	5.99			Till & Pennine Coal Measures		
CP104	0.1	0.1	2.0	2.0	7.6	7.6	ND	ND	ND	ND	10.8	10.8	-0.1	ND	1.16	5.95			Till & Pennine Coal Measures		
CP105D	0.1	0.1	2.0	2.0	1.3	1.3	ND	ND	ND	ND	20.5	20.6	-0.2	-0.2	3.50	3.50			Till & Pennine Coal Measures		
CP105S	0.1	0.1	2.0	2.0	2.1	2.3	ND	ND	ND	ND	18.7	18.7	-1.1	ND	0.99	1.95			Till & Pennine Coal Measures		
CP106D	0.1	0.1	2.0	2.0	0.8	0.8	ND	ND	ND	ND	20.4	20.3	0.9	ND	3.47	9.05			Till & Kinnerton Sandstone		
CP106S	0.1	0.1	2.0	2.0	2.2	2.1	ND	ND	ND	ND	18.8	18.5	ND	-0.2	1.76	4.04			Made Ground		
CP107D	0.1	0.1	2.0	2.0	4.9	4.9	ND	ND	ND	ND	14.6	14.6	-0.4	ND	8.14	13.51			Till & Kinnerton Sandstone		
CP107S	0.1	0.1	2.0	2.0	7.8	7.8	ND	ND	ND	ND	8.6	8.6	ND	ND	2.22	2.69			Made Ground		
CP108	0.2	0.2	4.0	4.0	4.7	4.7	ND	ND	ND	ND	6.9	6.9	ND	ND	7.10	7.49			Made Ground		
WS101	0.1	0.1	2.0	2.0	9.3	9.2	ND	ND	ND	ND	7.0	7.0	ND	ND	1.22	2.50			Made Ground		
WS103	0.1	0.1	2.0	2.0	0.3	0.3	ND	ND	ND	ND	10.8	10.7	ND	ND	0.50	0.77			Made Ground		
WS104	0.1	0.1	2.0	2.0	1.4	1.4	ND	ND	ND	ND	19.5	19.3	0.2	ND	0.19	1.96			Till & Pennine Coal Measures		
WS105	0.1	0.1	2.0	2.0	2.9	2.9	ND	ND	ND	ND	18.6	17.9	ND	ND	0.77	1.92			Till & Pennine Coal Measures		
WS106													-0.1	-0.1	0.42	5.03			Till		
WS107	0.1	0.1	2.0	2.0	0.9	0.8	ND	ND	ND	ND	20.0	20.0	ND	ND	ND	2.90			Till		
WS108	0.1	0.1	2.0	2.0	8.9	8.9	ND	ND	ND	ND	12.3	12.3	0.1	ND	1.86	2.01			Till & Pennine Coal Measures		
WS110	0.1	0.1	2.0	2.0	2.9	2.9	ND	ND	ND	ND	12.5	12.5	ND	ND	ND	2.08			Till		
WS111	0.1	0.1	2.0	2.0	1.9	1.9	ND	ND	ND	ND	19.1	19.1	ND	ND	ND	4.05			Till		
TPBH1	0.1	0.1	2.0	2.0	4.9	4.9	ND	ND	ND	ND	14.6	14.6	6.2	0.2	1.07	3.64			Made Ground		
RB102	0.1	0.1	2.0	2.0	5.1	5.1			ND	ND	18.2	18.3	ND	ND	1.33	2.42			Made Ground		
Max	0.2	0.2	4.0	4.0	11.1	11.1	ND	ND	ND	ND	20.6	20.6	6.2	0.1	3.27	5.99					
Min	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	0.3	0.3	0.1	0.1	0.19	0.75					

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

X	Dry	X 1003	Moist	X X	Wet	1007 X	Snow		Frozen
	Calm		Light		Moderate		Strong		
	None		Slight		Cloudy		Overcast		
	None		Slight		Moderate		Heavy		
			Before				After		
			Falling		Steady		Rising		
					X				
CH₄ 0.0%		CO₂ 0.0%		O₂ 20.8%					

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	5	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	30.10.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	0.1	0.2	2.0	4.0	11.6	11.4	ND	ND	ND	ND	9.0	9.1	ND	ND	ND	2.60			Till & Kinnerton Sandstone		
WS05	0.2	0.2	4.0	4.0	3.4	3.4	ND	ND	ND	ND	15.1	15.2	0.1	0.1	1.06	2.52			Made Ground & Till		
WS07	ND	ND	ND	ND	0.1	0.1	ND	ND	ND	ND	20.3	20.3	ND	ND	1.02	3.59			Made Ground & Till		
WS09	0.2	0.2	4.0	4.0	0.8	0.7	ND	ND	ND	ND	3.0	3.0	-1.2	ND	1.79	2.89			Made Ground & Till		
WS10	0.1	0.1	2.0	2.0	10.9	10.9	ND	ND	ND	ND	0.6	0.6	-1.9	0.1	3.22	3.90			Made Ground		
WS11																			Made Ground		
WS12																			Till		
WS15															0.45	1.86			Till		
WS16	ND	ND	ND	ND	0.4	0.2	ND	ND	ND	ND	20.0	20.0	ND	ND	2.56	3.81			Made Ground, Till & Pennine Coal Measures		
CP101	0.1	ND	2.0	ND	1.8	1.8	ND	ND	ND	ND	11.3	11.3	12.4	ND	1.43	2.45			Made Ground		
CP102	ND	ND	ND	ND	2.5	2.5	ND	ND	ND	ND	16.9	16.9	ND	ND	3.91	9.78			Till & Pennine Coal Measures		
CP103	ND	ND	ND	ND	0.2	0.2	ND	ND	ND	ND	20.5	20.5	ND	ND	2.50	5.97			Till & Pennine Coal Measures		
CP104	ND	ND	ND	ND	7.7	7.7	ND	ND	ND	ND	6.6	6.6	ND	ND	1.22	5.82			Till & Pennine Coal Measures		
CP105D	ND	ND	ND	ND	0.3	0.3	ND	ND	ND	ND	20.4	20.5	-1.5	-1.5	3.50	10.55			Till & Pennine Coal Measures		
CP105S	ND	ND	ND	ND	3.8	3.8	ND	ND	ND	ND	17.9	17.9	-9.1	ND	1.01	1.95			Till & Pennine Coal Measures		
CP106D	0.1	0.1	2.0	2.0	7.3	7.3	ND	ND	2	ND	8.0	8.1	-0.2	-0.2	3.40	9.09			Till & Kinnerton Sandstone		
CP106S	0.1	0.1	2.0	2.0	5.0	5.0	ND	ND	ND	ND	6.4	6.4	ND	ND	1.71	4.02			Made Ground		
CP107D	ND	ND	ND	ND	4.6	4.6	ND	ND	ND	ND	15.0	15.0	0.1	ND	8.10	13.49			Till & Kinnerton Sandstone		
CP107S	ND	ND	ND	ND	7.9	7.9	ND	ND	ND	ND	8.8	8.8	-0.4	ND	2.17	2.68			Made Ground		
CP108	0.2	0.2	4.0	4.0	4.3	4.3	ND	ND	ND	ND	12.6	12.8	0.3	ND	1.85	2.02			Made Ground		
WS101	ND	ND	ND	ND	8.9	8.9	ND	ND	ND	ND	7.3	7.3	ND	ND	1.18	2.49			Made Ground		
WS103	ND	ND	ND	ND	0.9	0.9	ND	ND	ND	ND	11.0	11.0	ND	ND	0.50	0.77			Made Ground		
WS104	ND	ND	ND	ND	1.6	1.4	ND	ND	ND	ND	19.9	19.9	0.4	ND	0.19	1.96			Till & Pennine Coal Measures		
WS105	0.1	0.1	2.0	2.0	2.7	2.7	ND	ND	ND	ND	17.6	17.6	ND	ND	0.77	1.92			Till & Pennine Coal Measures		
WS106													ND	ND	0.32	5.01			Till		
WS107	0.1	ND	2.0	ND	6.7	6.7	ND	ND	ND	ND	11.4	11.5	ND	ND	ND	2.91			Till		
WS108	ND	ND	ND	ND	2.7	2.3	ND	ND	ND	ND	19.1	19.3	-8.2	-1.4	0.81	3.04			Till & Pennine Coal Measures		
WS110	ND	ND	ND	ND	2.8	2.8	ND	ND	ND	ND	14.4	14.5	0.3	ND	ND	2.08			Till		
WS111	0.1	ND	2.0	ND	1.8	1.8	ND	ND	ND	ND	18.7	18.9	ND	ND	ND	4.05			Till		
TPBH1	ND	ND	ND	ND	4.9	4.7	ND	ND	ND	ND	14.9	14.9	5.3	0.2	1.18	3.66			Made Ground		
RB102	ND	ND	ND	ND	5.3	5.3	ND	ND	ND	ND	17.9	17.9	ND	ND	1.25	2.42			Made Ground		
Max	0.2	0.2	4.0	4.0	11.6	11.4	ND	ND	ND	ND	20.5	20.5	12.4	0.1	3.91	9.78					
Min	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	0.6	0.6	0.1	0.1	0.45	1.86					

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

	Dry		Moist	X	Wet		Snow		Frozen
	Calm	X	Light		Moderate		Strong		
	None		Slight		Cloudy	X	Overcast		
	None		Slight	X	Moderate		Heavy		
		1006	Before			1008	After		
			Falling		Steady	X	Rising		
				X					
CH ₄	ND	CO ₂	ND	O ₂	20.6%				

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:		Job No:	TE1163		
Client:	Tritax Symmetry	Visit No:	6	of	6
Site:	Symmetry Park, Huyton	Operator:	ER		
Date:	23.11.2020	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady							
WS03																			Pennine Coal Measures		
WS04	0.1	0.1	2.0	2.0	2.1	2.1	ND	ND	ND	ND	8.9	9.0	ND	ND	DRY	2.60			Till & Kinnerton Sandstone		
WS05	0.4	0.2	8.0	4.0	3.1	3.0	ND	ND	ND	ND	15.2	15.2	0.2	0.2	1.13	2.30			Made Ground & Till		
WS07	ND	ND	ND	ND	1.6	1.5	ND	ND	ND	ND	0.9	0.9	0.1	ND	1.22	3.54			Made Ground & Till		
WS09	0.1	0.1	2.0	2.0	0.7	0.7	ND	ND	ND	ND	0.3	0.3	-0.2	ND	1.80	2.88			Made Ground & Till		
WS10	ND	ND	ND	ND	9.6	9.6	ND	ND	ND	ND	0.4	0.4	-2.0	ND	3.21	3.90			Made Ground		
WS11																			Made Ground		
WS12																			Till		
WS15	0.2	0.2	4.0	4.0	1.6	1.6	ND	ND	ND	ND	18.7	18.8	-0.2	ND	0.51	1.89			Till		
WS16	ND	ND	ND	ND	1.6	1.5	ND	ND	ND	ND	18.9	19.1	0.1	ND	2.07	3.94			Made Ground, Till & Pennine Coal Measures		
CP101	0.1	0.1	2.0	2.0	0.3	0.3	ND	ND	ND	ND	20.4	20.4	0.1	ND	2.50	5.96			Made Ground		
CP102															4.81	9.74			Till & Pennine Coal Measures		
CP103																			Till & Pennine Coal Measures		
CP104															1.20	5.90			Till & Pennine Coal Measures		
CP105D	0.2	ND	4.0	ND	1.6	1.6	ND	ND	ND	ND	20.6	20.6	-0.3	-0.3	ND	0.50			Till & Pennine Coal Measures		
CP105S	0.2	ND	4.0	ND	2.9	2.9	ND	ND	ND	ND	18.1	18.3	-1.6	ND	0.91	1.95			Till & Pennine Coal Measures		
CP106D	ND	ND	ND	ND	0.6	0.6	ND	ND	ND	ND	20.1	20.1	1.1	ND	3.53	9.01			Till & Kinnerton Sandstone		
CP106S	ND	ND	ND	ND	2.3	2.0	ND	ND	ND	ND	17.9	17.9	-0.2	ND	1.59	4.04			Made Ground		
CP107D	ND	ND	ND	ND	5.2	5.1	ND	ND	ND	ND	15.0	15.0	-0.3	ND	8.04	13.52			Till & Kinnerton Sandstone		
CP107S	ND	ND	ND	ND	8.4	8.4	ND	ND	ND	ND	8.2	8.2	ND	ND	2.29	2.50			Made Ground		
CP108	ND	ND	ND	ND	4.4	4.4	ND	ND	ND	ND	6.7	6.9	0.1	ND	7.17	7.50			Made Ground		
WS101	0.1	0.1	2.0	2.0	10.0	9.9	ND	ND	ND	ND	7.6	7.8	ND	ND	1.18	2.49			Made Ground		
WS103	ND	ND	ND	ND	0.4	0.4	ND	ND	ND	ND	14.8	14.8	ND	ND	0.43	0.77			Made Ground		
WS104	ND	ND	ND	ND	1.1	1.0	ND	ND	ND	ND	20.1	20.1	0.1	ND	0.23	1.97			Till & Pennine Coal Measures		
WS105	ND	ND	ND	ND	1.8	1.8	ND	ND	ND	ND	17.6	17.6	0.3	ND	0.69	1.90			Till & Pennine Coal Measures		
WS106	ND	ND	ND	ND	2.8	2.8	ND	ND	ND	ND	12.0	12.0	-0.1	0.1	4.66	5.03			Till		
WS107	ND	ND	ND	ND	0.7	0.7	ND	ND	ND	ND	19.8	19.8	ND	ND	ND	2.86			Till		
WS108	ND	ND	ND	ND	7.3	7.2	ND	ND	ND	ND	13.6	13.6	ND	ND	0.85	3.05			Till & Pennine Coal Measures		
WS110	ND	ND	ND	ND	2.8	2.8	ND	ND	ND	ND	13.3	14.0	ND	ND	ND	2.08			Till		
WS111	ND	ND	ND	ND	1.6	1.6	ND	ND	ND	ND	19.3	19.3	ND	ND	ND	4.05			Till		
TPBH1																			Made Ground		
RB102	0.1	0.1	2.0	2.0	5.6	5.2	ND	ND	ND	ND	18.0	18.0	ND	ND	1.31	2.29			Made Ground		
Max	0.4	0.2	8.0	4.0	10.0	9.6	ND	ND	ND	ND	20.4	20.4	1.1	0.2	4.81	9.74					
Min	0.1	0.1	2.0	2.0	0.3	0.3	ND	ND	ND	ND	0.3	0.3	0.1	0.1	0.51	1.89					

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

X X	Dry Calm None None	X X 1019	Moist Light Slight Slight Before Falling	X	Wet Moderate Cloudy Moderate Steady	1019	Snow Strong Overcast Heavy After Rising		Frozen
CH ₄	ND	CO ₂	ND	O ₂	20.6%				

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:	Gas monitoring and GW sampling	Job No:	TE1163		
Client:	DB Symmetry	Visit No:	1	of	3
Site:	Symmetry Park, Huyton	Operator:	Tom Magee		
Date:	02/08/2019	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady						
WS4	0.0	0.0	0.0	0.0	13.5	13.5	ND	ND	ND	ND	6.6	6.6	0.21	0.01	2.70	2.70	40.64	37.94		
WS5	0.0	0.1	0.2	2.0	1.0	0.2	ND	ND	ND	ND	13.2	19.2	0.01	0.01	1.10	2.50	38.16	37.06		
WS7	1.4	0.4	28.0	8.0	0.6	0.6	ND	ND	ND	ND	ND	ND	0.01	0.01	2.70	4.14	36.70	34.00		
WS16	0.1	0.1	2.0	2.0	4.6	4.3	ND	ND	ND	ND	14.5	14.2	0.01	0.01	2.88	3.93	24.99	22.11		
WS15	0.1	0.1	2.0	2.0	6.1	6.1	ND	ND	ND	ND	0.2	0.2	2.11	1.61	1.47	2.79	23.45	21.98		
WS9	0.7	0.2	14.0	4.0	0.5	0.5	ND	ND	ND	ND	ND	ND	0.10	0.10	1.87	3.04	33.82	31.95		
WS8	0.1	0.1	2.0	2.0	13.7	13.7	ND	ND	ND	ND	0.4	1.3	0.31	0.10	ND	3.82	33.92	DRY		
WS10	0.3	0.3	6.0	6.0	11.2	10.6	ND	ND	ND	ND	0.5	0.5	9.10	2.10	ND	ND	44.15	DRY		
WS12	0.0	0.1	0.0	2.0	0.0	0.0	ND	ND	ND	ND	13.2	20.7	8.40	0.10	0.26	1.60	35.71	35.45		
WS3	0.0	0.1	0.0	2.0	3.5	3.6	ND	ND	ND	ND	12.2	15.8	0.10	0.10	1.70	2.05	34.331	32.63		
Max	1.4	0.4	28.0	8.0	13.7	13.7	ND	ND	ND	ND	14.5	20.7	9.1	2.1	2.88	4.14	44.15	37.94		
Min	0.0	0.0	0.0	0.0	0.0	0.0	ND	ND	ND	ND	0.1	0.1	0.0	0.0	0.26	1.60	23.45	21.98		

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

	Dry	X	Moist		Wet		Snow		Frozen
X	Calm		Light		Moderate		Strong		
	None	X	Slight		Cloudy		Overcast		
X	None		Slight		Moderate		Heavy		
		1014	Before			1014	After		
			Falling		Steady	X	Rising		
CH₄	0.0%	CO₂	0.0%	O₂	20.7%				

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:	Gas monitoring and GW sampling	Job No:	TE1163		
Client:	DB Symmetry	Visit No:	2	of	3
Site:	Symmetry Park, Huyton	Operator:	Anthony Hughes		
Date:	12/08/2019	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady						
WS4	ND	ND	ND	ND	15.1	14.6	ND	ND	ND	ND	6.3	6.8	ND	ND	1.68	2.79	40.639	38.96		
WS5	ND	ND	ND	ND	2.1	2.0	ND	ND	ND	ND	3.2	8.6	ND	ND	0.81	2.54	38.16	37.35		GROUNDWATER
WS7	0.3	0.3	6.0	6.0	1.1	1.0	1	ND	ND	ND	0.3	0.3	ND	ND	2.82	4.13	36.695	33.88		
WS16	0.1	ND	2.0	ND	7.3	7.1	3	ND	ND	ND	5.7	6.1	ND	ND	2.99	3.98	24.992	22.00		
WS15	ND	ND	ND	ND	6.8	6.6	ND	ND	ND	ND	0.5	0.7	ND	ND	1.60	1.85	23.45	21.85		
WS9	ND	ND	ND	ND	0.7	0.7	ND	ND	ND	ND	0.2	0.2	ND	ND	2.60	3.10	33.82	31.22		GROUNDWATER
WS8	0.1	ND	2.0	ND	15.6	15.6	2	ND	ND	ND	1.1	1.1	ND	ND	ND	3.83	33.92	DRY		
WS10	0.3	0.3	6.0	6.0	12.4	12.0	4	ND	ND	ND	0.4	0.4	ND	ND	3.94	3.99	44.15	40.21		
WS12	ND	ND	ND	ND	1.4	1.2	ND	ND	ND	ND	18.1	18.1	5.2	ND	0.66	1.63	35.705	35.05		
WS11	ND	ND	ND	ND	5.7	5.5	ND	ND	ND	ND	15.2	15.4	ND	ND	2.60	3.01	37.049	34.45		
WS3	ND	ND	ND	ND	2.6	2.6	ND	ND	ND	ND	17.6	17.8	ND	ND	1.37	2.09	34.331	32.96		
Max	0.3	0.3	6.0	6.0	15.6	15.6	4.0	ND	ND	ND	18.1	18.1	5.2	0.1	3.94	4.13	#REF!	40.21		
Min	0.1	0.1	2.0	6.0	0.7	0.7	ND	ND	ND	ND	0.2	0.2	0.1	0.1	0.66	1.63	#REF!	21.85		

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

	Dry	X	Moist		Wet		Snow		Frozen
	Calm	X	Light		Moderate		Strong		
	None	X	Slight		Cloudy		Overcast		
X	None		Slight		Moderate		Heavy		
		1007	Before			1007	After		
		X	Falling		Steady		Rising		
CH ₄	ND	CO ₂	ND	O ₂	20.8%				

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:	Gas monitoring and GW sampling	Job No:	TE1163		
Client:	DB Symmetry	Visit No:	3	of	3
Site:	Symmetry Park, Huyton	Operator:	TA		
Date:	30/08/2019	Project Manager:	AP		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA				Response Zone	Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady						
WS4	ND	ND	ND	ND	4.5	4.2	ND	ND	ND	ND	15.1	15.3	ND	ND	2.65	2.76	40.639	37.99		
WS5	ND	ND	ND	ND	3.3	2.5	ND	ND	ND	ND	2.6	11.4	-0.6	ND	1.03	2.40	38.16	37.13		
WS7	0.1	0.1	2.0	2.0	1.0	1.0	1	ND	ND	ND	0.3	0.4	-0.2	ND	2.89	4.11	36.695	33.81		
WS16	ND	ND	ND	ND	3.4	3.2	ND	ND	ND	ND	12.7	12.9	-0.2	ND	2.74	3.95	24.992	22.25		
WS15	0.1	ND	2.0	ND	5.1	5.0	1	ND	ND	ND	5.1	5.5	ND	ND	1.86	1.90	23.45	21.59		
WS9	ND	ND	ND	ND	0.9	0.9	ND	ND	ND	ND	0.7	1.2	ND	ND	2.01	2.94	33.82	31.81		
WS8	ND	ND	ND	ND	13.4	13.4	1	ND	1	ND	2.0	2.6	ND	ND	ND	3.90	33.92	DRY		
WS10	0.2	0.2	4.0	4.0	12.9	12.3	ND	ND	ND	ND	0.5	0.6	ND	ND	3.90	3.95	44.15	40.25		
WS12	ND	ND	ND	ND	0.1	0.1	ND	ND	ND	ND	20.2	20.2	ND	ND	0.47	1.63	35.705	35.24		
WS11	ND	ND	ND	ND	6.1	5.7	ND	ND	ND	ND	15.1	15.3	ND	ND	1.75	1.85	37.049	35.30		
WS3	ND	ND	ND	ND	2.3	2.3	ND	ND	ND	ND	18.8	19.0	ND	ND	2.07	2.08	34.331	32.26		
Max	0.2	0.2	4.0	4.0	13.4	13.4	1.0	ND	1.0	ND	20.2	20.2	-0.2	0.1	3.90	4.11	44.15	40.25		
Min	0.1	0.1	2.0	2.0	0.1	0.1	ND	ND	ND	ND	0.3	0.4	0.1	0.1	0.47	1.63	23.45	21.59		

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

	Dry	X	Moist		Wet		Snow		Frozen
X	Calm		Light		Moderate		Strong		
X	None		Slight		Cloudy		Overcast		
X	None		Slight		Moderate		Heavy		
		1007	Before			1007	After		
			Falling	X	Steady		Rising		
CH₄	ND	CO₂	ND	O₂	20.5%				

APPENDIX O – ASBESTOS DETAILED QUANTITATIVE RISK ASSESSMENT



**ASBESTOS RISK ASSESSMENT
REPORT FOR SYMMETRY PARK,
HUYTON, MERSEYSIDE**

ISSUE 1.0

TE1163ARA1.0

22 OCTOBER 2020

FINAL

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DOCUMENT CONTROL

Project No. :	TE1163ARA1.0
Report Status:	FINAL
Issue No.:	1.0
Project Engineer:	Alex Preston
Date of Issue:	22/10/2020

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Issue No.	Description of Issue / Revision	Date of Issue	Reviewed By	Author
1.0	FINAL	22/10/2020	AR	AP



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1. INTRODUCTION

Tier Environmental was commissioned by Tritax Symmetry Ltd to undertake a detailed quantitative asbestos risk assessment for the Symmetry Park development located off Fox's Bank Lane, Cronton, L3 5SU. The redevelopment is to comprise 4 No. industrial warehouses each with associated car parking areas, surface water attenuation ponds and areas of soft landscaping. In the south and eastern areas of the Site it is proposed that the site will be redeveloped into a country park, comprising woodland, ephemeral lakes and footpaths. A large scale earthworks exercise (approximately 450,000m³ of cut/fill) is proposed to provide the appropriate development platforms and highway gradients.

The proposed layout of the Site is presented in UMC Architects Drawing No. 18128-F0006 Rev F, which is included within Appendix A to this report. At the time of writing the four proposed units are as follows:

- Unit 03 – located in the north-western part of the Site – 238,565ft² – approximate proposed final floor level – 33.00m AOD;
- Unit 04 – located in the south-western part of the Site – 290,500ft² - approximate proposed final floor level –36.50m AOD;
- Unit 02 – located in the northern part of the Site – 204,600ft² - approximate proposed final floor level – 37.50m AOD; and,
- Unit 01 –located in the eastern part of the site – 164,400ft² - approximate proposed final floor level – 41.200m AOD.

This report, which was designed to meet the requirements of all relevant current guidance including Land Contamination: Risk Management guidance, presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the defined objectives.

It has been assumed in the production of this report that the Site is comprises commercial/industrial land use in the north of the site and a public open space/park land us in the south of the site.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials, such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the findings of the desk study, ground conditions encountered during intrusive investigation works performed by Tier Environmental and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

This report has been prepared for the sole use of Tritax Symmetry Ltd. No other third party may rely upon or reproduce the contents of this report without the written approval of Tier Environmental. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.



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2. SITE DETAILS AND DESCRIPTION

Table 2-1. Current Site Overview.

Site name	Former Cronton Colliery
Site address	Halsneads Farm Livery Stables, Fox's Bank Lane, Cronton, L353SU. A site location plan is included as Drawing No. TE1163GIR1 within Appendix A.
National Grid Reference	SJ 47493 89537
Location description	The Site is located south of the M62 in a predominantly agricultural area. The closest town is Whiston which is 2.3 km North of the Site.
Approximate Site area	28.96ha
Site shape	Irregular with the longest axis in the east to west direction and the shortest axis being in the north to south direction.
General topography and ground levels	The Site is generally undulating with ground levels in the north of the site ranging from 44m AOD in the east to 24m AOD in the west. The southern area of the site is a plateau at 34m AOD with a steep slope towards the south to 25m AOD. Ground levels in the eastern area of the site generally decrease from 48m AOD in the centre to 40m AOD in the west and 34m AOD in the east and south.
Current land use	The Site is currently unoccupied with no above ground structures. The northern area of the Site is currently occupied by grazing and agricultural land. The southern and eastern areas of the Site are currently occupied by immature woodland on the regraded colliery spoil slopes. The area of the southern access road is covered with concrete hardstanding with bridge/embankment structure.
Existing structures	There are 3 No. methane vent pipes located within the centre of the site overlying the 3 No. old mine shafts used by the former colliery
Site ground surfaces	The northern agricultural section of the site is covered by arable land. The central and southerly sections are comprised of scrubland with exposed colliery spoil surficial gravelled expanses.
Sub-surface structures	Relict structures associated with historic site use as a colliery may be present in the southern area of the site. A total of 2 No. septic tanks are located within the site boundary, one south of Halsnead Lane and one north of Park Villas in the south of the Site. Additional unrecorded services should be anticipated.
Invasive plant species	Localised Himalayan balsam and Japanese knotweed have been recorded across the site. Further details can be found from the invasive plant survey undertaken.



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3. ASBESTOS RISK ASSESSMENT

3.1. Asbestos Risk Assessment

The presence of asbestos within the Made Ground soils presents a problem in that there is a risk of site users coming into contact with these soils during the proposed uses of the Site as commercial warehouses and a publicly accessible country park. It should be pointed out that, based upon current information; it is considered that the levels of asbestos are low and that the proposed landscaping areas will likely be covered by grass or shrub vegetation, which would reduce the exposure risk to a low level. Nevertheless, there must be a decision as to what must be done in order to ensure the safety of the future site users. The potential issues are highlighted below:

1. The site users must be protected, or it must be demonstrated that they are not at risk.
2. It must be ensured that Tritax Symmetry has been diligent in terms of their liabilities and cannot have been seen to be negligent.
3. Any work must be communicated in such a way that does not cause undue alarm to neighbouring site users or future site users.

In total, when the results of the laboratory testing on the imported topsoil materials are combined, asbestos has been reported in 8 No. of the 45 No. samples obtained (17.7% of the samples).

Tier Environmental consider that, on balance, it is appropriate to conduct further detailed risk assessment in accordance with CIRIA C733 to determine whether excavation and off-site disposal of the soils is required or whether it is possible to confirm that there is a minimal/tolerable risk and justification to retain the soils on Site. Justification for this is provided below:

- 82.3% of the samples have returned 'no asbestos detected' results;
- It is considered that the materials do not have gross contamination in that that no visual evidence of asbestos lagging, coating or fibres bundles were encountered during the soil sampling;
- Where detected the concentrations are consistently low (generally <0.005% w/w with one isolated concentration of 0.029% w/w);

Whilst in some cases, a qualitative argument relating to the absence of asbestos (or only sporadic presence of very low concentrations of low risk ACMs), pathway or receptors may be sufficient to demonstrate that remediation is not required. In other cases, the decision to remediate may not require quantitative risk assessment, if, for example a site exhibits gross contamination at the surface. It is considered that this site does not have gross contamination; such that no visual evidence of asbestos lagging, coating or free fibres was encountered during the site investigations to date. As asbestos fibre bundles have been reported in 17.7% of Made Ground from the samples obtained on Site it is considered that a site-specific assessment in accordance with CIRIA C733 is required in this instance.

Objectives and Approach

Taking into account the planned future use of the Site, the objectives of this appraisal were to undertake a site-specific human health risk assessment with regard to the concentration of identified asbestos fibres, in line with the principals stated in C733.

As no robust method of producing a Generic Assessment Criterion (GAC) is available or possible at present, quantitative risk assessments for asbestos-related soils need to characterise the nature and extent of asbestos contamination in soils. For this Site, this is achieved through a clear evaluation



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of the current or future land use, including likely receptors and the type, form, condition and concentrations of asbestos and ACMs in soils. From the characteristic value, it will be possible to estimate potential airborne fibre concentrations that may arise from such contamination and then use a range of risk assessment techniques which will enable lines of evidence to develop a realistic exposure scenario for the future commercial and public open space land use. As the development has different end land uses within different zones, the risk assessment will be conducted separately for each land use. The exposure scenarios will also utilise in-built conservatism and predict likely cumulative exposures for the maximum periods of time a working female adult, aged sixteen to sixty five years working at the warehouse unit (regarded here as the critical receptor for a commercial land use) or a female child, aged zero to 6 years visiting the country park (regarded here as the critical receptor for a public open space land use) are likely to spend at the site. This exposure will finally allow us to evaluate the significance of the associated risks and whether the soils at the site are indeed contaminated by asbestos fibres. In doing so, it is considered that such an assessment will be protective of a future maintenance workers whose exposure would be less than that of the critical receptor in this instance.

Asbestos Quantification Testing

In order to attempt to quantify the percentage of asbestos in any given soil sample, the following method is followed. The whole sample is tipped into a tray, weighed, dried, and weighed again. The sample is inspected under a x40 stereomicroscope and any visible ACM or clumps of fibres are removed and weighed.

These fibres are inspected under a Polarising Light Microscope to confirm the presence and type of asbestos in the sample (a bulk ID). This will be reported even if only a small number of fibres are found, and if this goes on to the full quantification method, the amount of asbestos may well be <0.001%.

For fibre quantification the residual sample is sieved and the <5mm fraction is dispersed in water for an hour. Replicate aliquots (at least four) are then removed, filtered, and the filters mounted onto microscope slides for counting and measuring using Phase Contrast Optical Microscopy. These results are then converted to a % by weight and added to the % of ACM found in the initial part of the method.

Concentration of Asbestos in Soils and Potential Fibre Release

Asbestos quantification testing has demonstrated that all of the samples where asbestos quantification has been conducted are <0.005% w/w with the exception of a single reported concentration of 0.029% w/w of bitumen products / chrysotile fibre bundles. The aim of this section of the risk assessment is to predict realistic airborne concentrations from the measured soil concentrations, backed up from published fibre release potential tests. The assessment has taken into account the potential for a future increase in fibre release as ACMs degrade in order to determine whether the measured concentrations are representative of the range of possible weather conditions and activities that could occur. Overall, the risk of the aforementioned further physical and chemical degradation of the chrysotile and microscopic chrysotile bitumen products is considered to be unlikely given the land use; however, the potential for fibre release given the pre-existing nature of the fibre bundles shall be considered.

Current risk models are based on airborne fibre concentrations and, in order to predict the potential fibre release from the soils at the site, information has been taken from the published literature. Addison et al. (1988) measured the release of airborne fibres from 'spiked' dry soils ("sandy", "intermediate" and "clay") containing between 0.001, 0.01, 0.1 and 1% free fibrous asbestos (3 types). The experiment used rotating drums to generate dust from dry soils and measured the dust concentrations in mg/m³ and asbestos fibre concentrations in f/ml. The effects of soil moisture were also assessed. The soil type at the site varies comprising:

- Generally – a black, dark grey sandy clayey angular to rounded, fine to coarse gravel of mudstone, coal and mixed anthropogenics.
- Grey sandy, gravelly clay. The gravel is angular to rounded, fine to coarse of mixed natural and anthropogenics.



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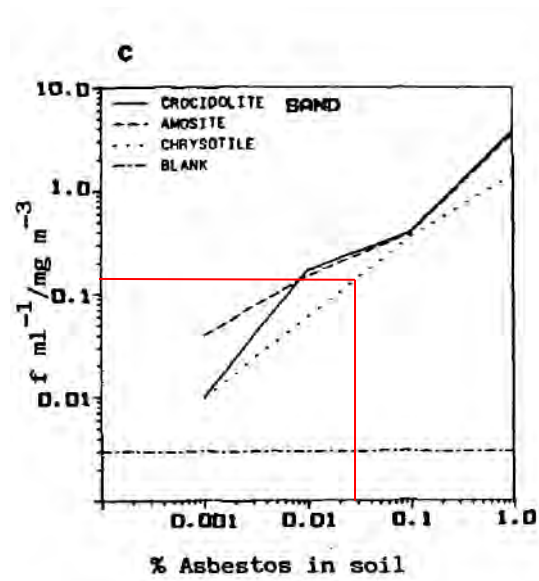
- Dark brown/black slightly sandy, gravelly LOAM

As a precautionary / conservative approach, the fibre release prediction has been taken to be sand. Further conservatism is built into these numbers, given that the laboratory experiments were very violent and produced much more dust/airborne fibre than would be expected from normal or anticipated site activities (particularly when the commentary provided in the 'Asbestos Risk Assessment' Section above is taken into consideration). When the correlation between normalised fibre concentrations in air and % of asbestos in soil is studied, it appears that the model also over predicts the concentrations of fibre release at low concentrations.

Taking into account that background urban dust (PM10) is generally taken to be at concentrations of around $20 \mu\text{g}/\text{m}^3$; however, in line with example 13.3 in CIRIA C733, the concentration of soil dust during gardening activities (considered to be consistent with landscape maintenance works that may take place on Site) in dry and dusty conditions was estimated to be $100 \mu\text{g}/\text{m}^3$ ($0.1 \text{ mg}/\text{m}^3$) based on ambient urban dust levels and ART modelling of shovelling of dry powders.

Figure 7 from Addison et al (1988) has been used to estimate the normalised airborne respirable fibre concentration (f/ml) for chrysotile and amosite asbestos (based on the asbestos screen results) assuming a sand soil type. Taking the maximum reported asbestos concentration in soil at the Site (0.029% w/w) the graph indicates a normalised fibre concentration of 0.13 f/ml per mg/m^3 for both chrysotile and amosite. As such, when the value derived for amosite / amosite is taken and the concentration of soil dust is taken into consideration then an airborne fibre concentration during such activities in a dry and dusty conditions has been estimated to be 0.013 f/ml (C_i) and assumed to be insignificant at other times.

Figure 3.1 Normalised airborne respirable fibre concentration (adapted from Figure 7 from Addison et al (1988))



Exposure Scenario for the Critical Receptor

It has been assumed that as the samples have been obtained from shallow soils that exposure may occur during general use, digging and landscape maintenance activities.

Hawarden weather station lies around 29 miles from the Site and is considered to be a relatively accurate representation of the average amount of days (24h) with precipitation during a month. The number of days when precipitation has surpassed 1mm per day (24h) it is defined as a day with precipitation. A review of Met Office data over a mean period of between 1981 and 2010, states the average number of dry days per year is 230. Data



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from the last year (2019 obtained from Hawarden weather station) states that the number of dry days for 2019 was 168. The data from 1981 – 2010 has been used as it accounts for more dry days per year and is taken from a larger data set therefore is the more conservative value to use.

Airborne asbestos fibres are only likely to be released when the ground conditions are dry and dusty. The number of dry days per year is used as an indicator for potential fibre release, however, although there was less than 1mm of rain reported on 230 days of the year this does not reflect the soil moisture content. It is estimated based on industry practice, that on 35% of the dry days each year the ground surface may be dry enough to allow fibre release in an outdoor environment therefore, a total of 81 days a year has been calculated for this Site.

As stated above the detailed risk assessment will be undertaken twice for each of the two proposed land uses (commercial and public open space – park). At the time of writing the final development layout and earthworks proposals are not finalised so a conservative approach with regards to sample locations has been applied. All samples obtained from across the entire site area have been reviewed for both end site uses disregarding sample locations or final material locations post earthworks. This approach is considered to build further conservatism into the model.

Commercial/Industrial End Land Use

The most critical receptor of a commercial/industrial land use is considered to be a working adult female (aged sixteen to sixty five years) where outdoor activity has, conservatively, been limited to one hour per day in accordance with Table 3.2 of the Updated technical background to the CLEA model (SR3, January 2009). Landscape maintenance workers are assumed, very conservatively, to conduct activities in landscaped areas under dry and dusty conditions for an average of 1 hour per day for 81 days per year ($F_i T_i$) consistent with the approach in example 13.3 in CIRIA C733.

In order to obtain a realistic but conservative estimate for the exposure scenario, it has been envisaged that a worst case commercial worker would be working adult with an exposure duration of 49 years.

Annual exposure is calculated in accordance with CIRIA C733:

$$E_i = C_i \times F_i \times T_i$$

Where E_i is annual exposure, C_i is the estimated concentration (f/ml) for the event, F_i is the frequency of the event per year, T_i is the period of time that the event lasts in hours.

On this basis of exposure in dry and dusty conditions an annual exposure has been calculated as $0.013 \text{ f/ml} \times 81 \text{ hours a year} = 1.053 \text{ f/ml.hours/year}$.

Cumulative Exposure for the Described Worst-Case Exposure Scenario

In order to complete the risk assessment, the site data and the information within the above exposure scenario has been assessed as the Cumulative Exposure (CE_i) for each event, expressed in fibre/ml/hrs, which is the sum of the relevant annual exposures.

$$CE_i = E_i \times Y_i$$

Where Y_i is equal to the number of years that exposure event i will occur.

Cumulative exposure has been calculated for a worst-case scenario of a commercial worker (49 years) in line with the approach in example 13.3 in CIRIA C733. As such, cumulative exposure in dry dusty conditions = $1.053 \text{ f/ml.hours/year} \times 49 \text{ years} = 51.597 \text{ fibre/ml.hours}$.



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In addition, exposure-risk models for asbestos are normally expressed in terms of f/ml.yrs; however, the models are based on occupational health studies (i.e. commercial). As such, we have assumed a commercial worker year, including 45hrs x 46 weeks, or around 2070hrs.

When the above is assessed, the cumulative exposure is under dry and dusty conditions is = 51.597/2070 fibre/ml.years = 0.0249 fibre/ml.years.

Age Adjustment Factor for Mesothelioma Risk

It is stated in CIRIA C773 that models for Mesothelioma risk suggest that individuals exposed in childhood area at greater risk than those exposed later in life, because their longer life expectancy post exposure gives longer for the disease to manifest itself. Therefore, CIRIA C773 section 14 outlines age adjustments (factor of safety) to adjust the risk dependent on the age at which exposure will commence.

In accordance with Table 14.2, CIRIA C773, an age-adjustment factor of 3 has been applied to the cumulative exposure in order to conservatively adjust the risk for exposures starting at 15 years old to account for 15 years old to account for a female working adults (age 16 to 65; the adjustment factor for age 15 has been used to build conservatism rather than the next factor which is based on age 20 workers) exposure from 0 to 80 No. years (Hodgson and Darnton, 2000).

When the factor of safety is applied, the cumulative exposure under dry conditions is = 0.00249fibre/ml.years * 3 = 0.0748 fibre/ml.years.

Lung Cancer

In contrast to Mesothelioma risk, lung cancer models suggest that there will be little or no increase in lung cancer whether exposure starts at 5 or 50.

To build in conservatism, a conservative exposure frequency has been modelled for an employee working the property for 49 No. years (49 years to represent an average time period in full time work, CLEA model) = 1.053 f/ml.hours/year x 49 years = 51.597 fibre/ml.hours.

In addition, exposure-risk models for asbestos are normally expressed in terms of f/ml.yrs; however, the models are based on occupational health studies. As such, we have assumed a commercial worker year, including 45hrs x 46 weeks, or around 2070hrs. When the above is assessed, the cumulative exposure under dry and dusty conditions for a lifelong resident is = 51.597/2070 fibre/ml.years = 0.0249 fibre/ml.years.

Public Open Space Park End Land Use

The most critical receptor of a public park land use is considered to be a female child aged zero to six years where outdoor activity has, conservatively, been limited to two hours per day in accordance with Table 1.2 of the Updated technical background to the CLEA model (SR3, January 2009). Landscape maintenance workers are assumed, very conservatively, to conduct activities in landscaped areas under dry and dusty conditions for an average of 1 hour per day for 81 days per year ($F_i T_i$) consistent with the approach in example 13.3 in CIRIA C773.

In order to obtain a realistic but conservative estimate for the exposure scenario, it has been envisaged that a worst case site user would be a female child with an exposure duration of 6 years.

Annual exposure is calculated in accordance with CIRIA C773:

$$E_i = C_i \times F_i \times T_i$$

Where E_i is annual exposure, C_i is the estimated concentration (f/ml) for the event, F_i is the frequency of the event per year, T_i is the period of time that the event lasts in hours.



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On this basis of exposure in dry and dusty conditions an annual exposure has been calculated as $0.013 \text{ f/ml} \times 162 \text{ hours a year} = 2.106 \text{ f/ml.hours/year}$.

Cumulative Exposure for the Described Worst-Case Exposure Scenario

In order to complete the risk assessment, the site data and the information within the above exposure scenario has been assessed as the Cumulative Exposure (CE_i) for each event, expressed in fibre/ml/hrs, which is the sum of the relevant annual exposures.

$$CE_i = E_i \times Y_i$$

Where Y_i is equal to the number of years that exposure event i will occur.

Cumulative exposure has been calculated for a worst-case scenario of a female child site user (6 years) in line with the approach in example 13.3 in CIRIA C733. As such, cumulative exposure in dry dusty conditions = $2.106 \text{ f/ml.hours/year} \times 6 \text{ years} = 12.636 \text{ fibre/ml.hours}$.

In addition, exposure-risk models for asbestos are normally expressed in terms of f/ml.yrs; however, the models are based on occupational health studies (i.e. commercial). As such, we have assumed a commercial worker year, including 45hrs x 46 weeks, or around 2070hrs.

When the above is assessed, the cumulative exposure is under dry and dusty conditions is = $12.636/2070 \text{ fibre/ml.years} = 0.006104 \text{ fibre/ml.years}$.

Age Adjustment Factor for Mesothelioma Risk

It is stated in CIRIA C773 that models for Mesothelioma risk suggest that individuals exposed in childhood area at greater risk than those exposed later in life, because their longer life expectancy post exposure gives longer for the disease to manifest itself. Therefore, CIRIA C733 section 14 outlines age adjustments (factor of safety) to adjust the risk dependent on the age at which exposure will commence.

In accordance with Table 14.2, CIRIA C733, an age-adjustment factor of 6.6 has been applied to the cumulative exposure in order to conservatively adjust the risk for exposures starting at 0 years old to account for a female child (age 0 to 6) exposure from 0 to 80 No. years (Hodgson and Darnton, 2000).

When the factor of safety is applied, the cumulative exposure under dry conditions is = $0.006104 \text{ fibre/ml.years} \times 6.6 = 0.0403 \text{ fibre/ml.years}$.

Lung Cancer

In contrast to Mesothelioma risk, lung cancer models suggest that there will be little or no increase in lung cancer whether exposure starts at 5 or 50.

To build in conservatism, a conservative exposure frequency has been modelled for a site user visiting the site for 6 years (CLEA model) = $2.106 \text{ f/ml.hours/year} \times 6 \text{ years} = 12.636 \text{ fibre/ml.hours}$.

In addition, exposure-risk models for asbestos are normally expressed in terms of f/ml.yrs; however, the models are based on occupational health studies. As such, we have assumed a commercial worker year, including 45hrs x 46 weeks, or around 2070hrs. When the above is assessed, the cumulative exposure under dry and dusty conditions for a lifelong resident is = $12.636/2070 \text{ fibre/ml.years} = 0.006104 \text{ fibre/ml.years}$.



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Risk Evaluation

There are several exposure-risk models that allow excess lifetime cancer risk (ELCR) to be predicted at a given cumulative exposure and each consists of a separate model for asbestos-related lung cancers and mesotheliomas. The current reference text for assessing the risks associated with exposure to asbestos is that of Hodgson and Darnton (2000), two HSE scientists who quantified the lung cancer and mesothelioma risks associated with occupational exposures to crocidolite, amosite and chrysotile. From their work, the mesothelioma risk depends on:

1. the type(s) of asbestos fibres (this study has identified only chrysotile, therefore this has been used in this assessment).
2. the cumulative exposure to airborne fibres.
3. the exposed person's age at the time of exposure (this has been assumed as 16 years for a commercial worker for a commercial land use or assumed to be a female child aged 0 for a public open space park land use. These are considered to be conservative estimates).

This exposure-risk model can be used to investigate the significance of potential exposures in terms of likely ELCR. The ELCR of 1:100,000 is generally considered the limit of minimal risk; however, uncertainties need to be treated carefully if unrealistically cautious assessments are to be avoided. Currently, no software implementing any of the models is widely available; however, the paper produced by Hodgson & Darnton (2000) provides a set of useful risk summary tables which can be used to conduct simple evaluations of risk in most cases.

Table 11, from Hodgson and Darnton (2000), suggests that the lifetime risk per 100,000 exposed for 0.01 f/ml/yrs is probably insignificant and the risk from lung cancer is also negligible. The calculated cumulative exposure for mesothelioma is 0.0403 fibre/ml.years for a public open space land use and 0.0748 fibre/ml.years for a commercial land use. The value derived for both land uses is within the same order of magnitude as 0.01 f/ml/yrs. For lung cancer the calculated cumulative exposure is 0.00610 fibre/ml.years for a public open space land and 0.0249 fibre/ml.years. Given the conservatism built into the model, as detailed above, it is considered the risk assessment is sufficient to demonstrate that the risk from mesothelioma from asbestos at the Site is likely to be insignificant but up to a maximum of 4 per 100,000 and for lung cancer is likely to be insignificant. Despite this, further discussion is provided below to provide additional confidence in this conclusion.

The release of airborne asbestos is also strongly influenced by soil moisture content, with the addition of 5% moisture reducing potential airborne asbestos by 80% to 95%, with no fibres being detected at above 25% moisture content. The average moisture content of the Made Ground samples across the site was reported as 17.35%. It is not unreasonable to assume as a worst case scenario that the soils could lose half of their natural moisture content, i.e. the Made Ground drying out to c. 8.68% in the summer months, close to the surface. This has the effect of reducing the risk estimation by a minimum of 80%, equating to a maximum 0.8 per 100,000 for mesothelioma (assuming a very worst case maximum excess lifetime risk of 4 per 100,000 exposed – more likely to be 0.2 per 100,000) and 0.2 per 100,000 for lung cancer, i.e. insignificant risk. It is therefore felt that the moisture content of the Made Ground will reduce the potential lifetime risk to insignificant (Risks below 1 in 100,000 were described by Hodgson and Darnton, 2000, as probably insignificant).

Conclusion of Site Specific Detailed Quantitative Asbestos in Soils Risk Assessment

When the above ELCR information and models are taken into account, the risk assessment suggests that the cumulative risk equates to negligible or insignificant risk from mesothelioma and lung cancer. As such, it may be assumed that the risk is equivalent to less than 1 per 100,000 limit, which is generally seen to be the limit of minimal risk. This assessment has shown that although there are asbestos fibres and microscopic ACM within bitumen products within the Made Ground soils, and even building a large amount of conservatism into the model, the risks posed to end users from shallow soils (with respect to asbestos) is negligible and below the ELCR of 1:100,000 people exposed. It is therefore considered that the shallow soils should be regarded as presenting a minimal/tolerable risk for the proposed land use and are therefore suitable for use.



**ASBESTOS RISK ASSESSMENT REPORT
FOR SYMMETRY PARK, HUYTON,
MERSEYSIDE**

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Date:	22/10/2020

3.2. Proposed Acceptable Concentrations For Forthcoming Earthworks

To create suitable development platforms and highways gradients a large scale earthworks (approximately 450,00m³) is proposed for the development. It is considered that any chrysotile asbestos concentrations reported from future verification testing in excess of those encountered in the recent site investigation works, or any different types of asbestos (e.g. crocidolite or amosite) will require further risk assessments to be undertaken in a manner consistent with the methodology laid out in this report. Therefore, any future chrysotile values at or below 0.029% w/w should be considered to acceptable concentrations that would result in a minimal/tolerable risk for materials to be re-used at the Site. It is proposed that, for the planned earthworks a sampling regime will be undertaken to suitably characterise the material throughout the works. If concentrations of asbestos are encountered above this value they should be identified and further assessed before re-use of the material is undertaken.



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MERSEYSIDE**

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Date:	22/10/2020

4. SITE CERTIFICATION

It has been demonstrated in this report that remediation works have been undertaken at the site either in accordance with the agreed remediation statement or that no residual risk has been demonstrated through further robust risk assessment. **It is therefore recommended that, that remaining planning conditions are discharged as the site is considered to be safe and suitable for the desired land use.**



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FOR SYMMETRY PARK, HUYTON,
MERSEYSIDE**

Project No:	TE1163ARA1.0
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Engineer:	Alex Preston
Date:	22/10/2020

5. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the investigations and further risk assessments. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval.



ASBESTOS RISK ASSESSMENT REPORT FOR SYMMETRY PARK, HUYTON, MERSEYSIDE

Project No: TE1163ARA1.0
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Engineer: Alex Preston
Date: 22/10/2020

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**ASBESTOS RISK ASSESSMENT REPORT
FOR SYMMETRY PARK, HUYTON,
MERSEYSIDE**

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Engineer: Alex Preston
Date: 22/10/2020

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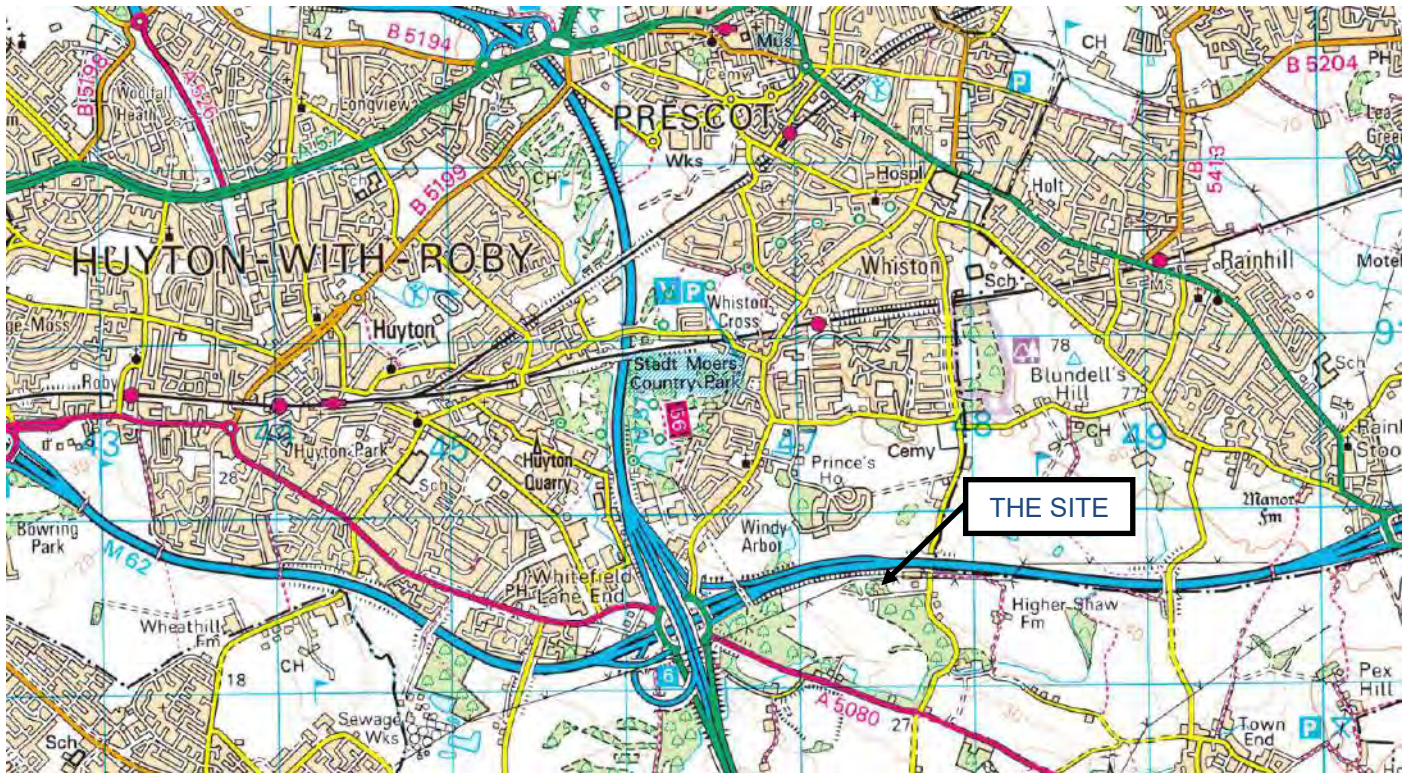
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APPENDIX A – FIGURES AND DRAWINGS



Contract Number	TE1163
Contract	Former Cronton Colliery Site
Client	DB Symmetry

Site Location Plan



Reproduced from the Ordnance Survey map with the permission of The Controller of Her Majesty's Stationary Office, © Crown Copyright. All rights reserved.

Scale	NTS		
Drawn by	JC	Approved	SL
Drawing Number	TE1163GIR1		



DO NOT SCALE

GENERAL NOTES:

- This drawing is to be read in conjunction with all other Architect's, Engineer's and Specialist's drawings, together with the appropriate specifications.
- It is the Contractor's responsibility to check all dimensions on site. Dimensions MUST NOT be scaled from this drawing. Any discrepancies to be brought to the immediate attention of the Architect in writing.
- All dimensions are in millimetres unless noted otherwise.
- All levels are in metres, unless noted otherwise.

LEGEND

- Proposed Retaining Wall
- (Retaining wall heights shown indicate the retained height. Design of retaining walls to be carried out by a specialist designer.)
- Existing Spot Level
- Proposed Spot Level
- E1=???m
E2=???m
H=???m
- E1: Top of Wall Elevation
E2: Bottom of Wall Elevation
H: Height of Wall
- Major Contour (0.500m intervals)
- Minor Contours (0.100m intervals)
- Extent of 1 in 3 slope
- Existing Overhead Electricity Pylons

2020 Locations:

- Trial Pit Location
- Rotary Borehole Location
- Window Sample Location
- Cable Percussive Location

2019 Locations:

- Trial Pit Location
- Window Sample Location

P1	24.08.20	MB	Planning Issue	PJB	PJB
REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS: PLANNING



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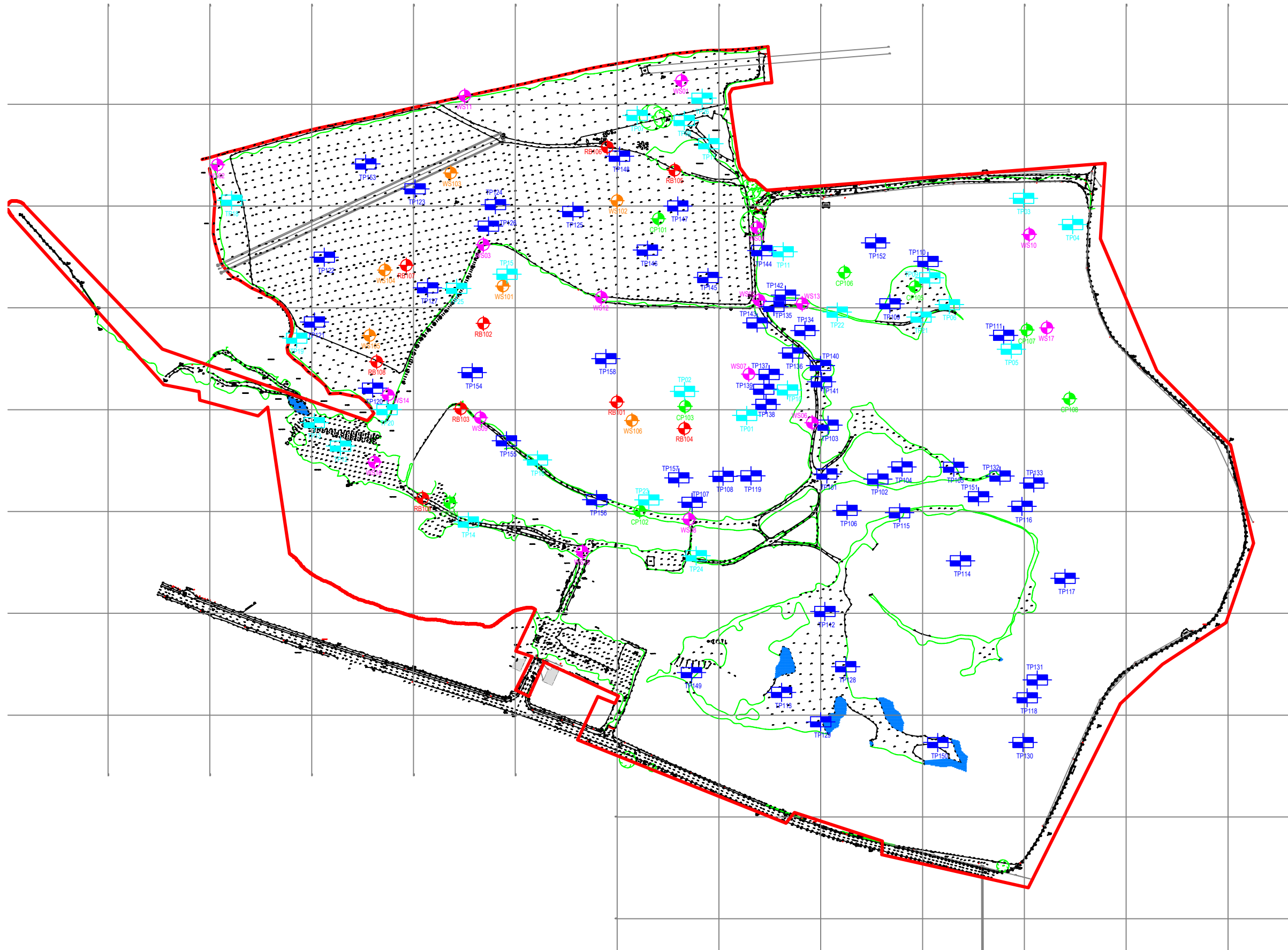
CLIENT: TRITAX SYMMETRY HUYTON LIMITED

ARCHITECT: UMC ARCHITECTS

PROJECT: SYMMETRY PARK HUYTON

TITLE: Exploratory Hole Location Plan & Earthworks Proposal

SCALE @ SIZE: 1:1250	CHECKED: P. J. Barlow	APPROVED: P. J. Barlow
CAD FILE: CADFILELON	DESIGN/DRAWN: MB	DATE: 22.10.20
PROJECT No: TE1163	DRAWING No: TE1163GIR3	REV: P1



Notes

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS TOGETHER WITH THE APPROPRIATE SPECIFICATIONS.

IT IS THE CONTRACTORS RESPONSIBILITY TO CHECK ALL DIMENSIONS ON SITE. DIMENSIONS MUST NOT BE SCALED FROM THIS DRAWING. ANY DISCREPANCIES TO BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT IN WRITING.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

ALL LEVELS ARE IN METRES, UNLESS NOTED OTHERWISE.

2020 Locations:

- Trial Pit Location
- Rotary Borehole Location
- Window Sample Location
- Cable Percussive Location

2019 Locations:

- Trial Pit Location
- Window Sample Location

A	AUG 2020	JR	EHLP	SL
Rev	Date	By	Description	Appd
Revisions				
Status				
FINAL				

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Client

DB SYMMETRY

Architect

NA

Project

Former Cronton Colliery
Site (Huyton)

Title

EXPLORATORY HOLE
LOCATION PLAN

Scale	Drawn	Revision
NTS	JR	
Date	Checked	A
OCT2020	ap	

Job No.	Drawing No.
TE1163	TE1163EHLP

APPENDIX B – GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter
SPT	Standard Penetration Test
SPZ	Source Protection Zone (see Appendix E)
SSAC	Site-Specific Assessment Criterion

SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX C – DEFINITIONS OF TERMS USED IN QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present and the risk is almost certain to occur , or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Negligible
	Unlikely	Moderate/Low	Low	Negligible	Negligible

APPENDIX D – CHEMICAL TEST SAMPLING

Samples were selected by a representative of Tier Environmental during the site investigation works in accordance with the sampling approach described elsewhere in this report.

Samples for chemical analysis

All samples for chemical analysis were placed into clean new containers as summarised in Table 1. Unless explicitly stated elsewhere in this report, no preservatives were used to eliminate the risk that preservatives cause contaminant dissolution or analytical interference. Containers for VOC analysis were fully filled to exclude headspace.

Soil samples were dispensed as soon as possible after collection using reusable stainless-steel spatulas, trowels or similar implements.

Ground water samples were collected from boreholes using single-use Teflon bailers or dedicated Waterra tubing with foot valves, except as otherwise noted within this report. Caution was taken to avoid excessive agitation during collection

New disposable gloves were used by the engineer for the collection of each sample.

Reusable equipment was washed down with distilled or deionised water between samples, except where tarry or similarly sticky materials were present. In such cases specific cleaning procedures were adopted as specifically described elsewhere in this report.

All sub-samples taken for chemical analysis were placed into refrigerators or cool boxes containing frozen ice packs immediately after aliquoting. All samples were transferred in cool boxes containing frozen ice packs to the relevant UKAS/MCERTS accredited laboratory as soon as possible. Recommended maximum holding times before analysis are summarised in Table 1.

Table 1. Sample containers and holding times.

Analysis	Container/special requirements	Max. holding time at 4°C before analysis
Soil and sediment samples		
VOCs	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner. <i>Must be fully filled.</i>	14 days
TPHCWG	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner PLUS 250-500 g brown or green glass jar with unwaxed cap liner. ¹ <i>The former must be fully filled.</i>	14 days
All other organics	250-500 g brown or green glass jar with unwaxed cap liner.	7 days
Inorganics	Air-tight 0.5-2.0 kg plastic container (250-500 g brown or green glass jar may also be used).	14 days ²
Water samples		
VOCs	40-50 ml glass vial with VOC resistant screw cap and inert liner. <i>Must be fully filled.</i>	14 days
TPHCWG	40-50 ml glass vial with VOC resistant screw cap and inert liner PLUS 500-1000 ml brown or green glass bottle with screw cap and unwaxed liner. ¹ <i>The former must be fully filled, the latter should be filled if possible.</i>	14 days
All other organics	500-1000 ml brown or green glass bottle with screw cap. <i>Fill if possible.</i>	7 days
Inorganics	500-1000 ml translucent or opaque screw cap plastic <i>or</i> brown or green glass bottles. <i>Fill if possible.</i>	14 days ³

¹ The smaller vessel is used for analysis of the volatile components within the TPH mixture and the larger one is for the non-volatile components.

² 14 days is set as a reasonable limit for all routine analyses of soil for those inorganic components vulnerable to chemical and/or biological breakdown. Samples for sulphate analysis are vulnerable to biological sulphate-reduction but can be held for up to 28 days. For total metals, a holding period of up to 6 months is acceptable.

³ 14 days applies for all routine analyses of most inorganic components that may be vulnerable to chemical and/or biological reactions. In the specific cases of sulphide, nitrite, nitrate and phosphate analyses, storage time must not exceed 48 hours. For total metals, a holding time of up to 6 months is acceptable.

Tier Environmental standard analytical suites

The analyses included with Tier Environmental's standard analytical suites for soil, soil leachate and water samples are presented in Table 2. Other individual analyses were specified as described within this report.

Table 2. Tier Environmental Standard Analytical Suites.

Parameter	Sample type					
	Soil		Leachate ¹		Water	
		LoD ² (mg/kg or as stated)		LoD (µg/l or as stated)		LoD (µg/l or as stated)
Metals and metalloids						
Arsenic	✓	1	✓	10	✓	10
Cadmium	✓	1	✓	5	✓	5
Chromium	✓	1	✓	5	✓	5
Mercury	✓	1	✓	1	✓	1
Lead	✓	1	✓	4	✓	4
Selenium	✓	2	✓	10	✓	10
Copper	✓	1	✓	1	✓	1
Nickel	✓	1	✓	50	✓	50
Zinc	✓	1	✓	8	✓	8
Other inorganics						
Ammonia (as NH ₄ -N)					✓	15
Total sulphate	✓	100			✓	50 mg/l
Water-soluble sulphate	✓	0.1 g/l				
Hardness (as CaCO ₃)					✓	1 mg/l
Organics						
Monohydric phenol	✓	1	✓	0.5	✓	0.5
Speciated PAHs (USEPA 16)	✓	0.1	✓	0.01	✓	0.01
Total Organic Carbon	✓	0.1 wt%				
Others						
Electrical conductivity					✓	NA
pH	✓	NA	✓	NA	✓	NA

NA - Not applicable

1 Leachate preparation according to NRA (1994), 10:1 liquid to solid ratio.

2 The table presents the desired limit of detection for the analysis. Higher LoDs may be reported on analytical data sheets due to interference between analytes within specific samples or if the laboratory needed to dilute samples to achieve results within the calibrated range for that instrument.

Analytical QA procedures

Introduction

Quality Assurance (QA) is a system of review and audit that assesses the effectiveness of that product and assures the producer and user that defined standards of quality have been met. If we consider site investigation and chemical analysis, QA is the management system that ensures these measures are in place and working as intended.

QA within the laboratory form part of relevant certification programmes (such as UKAS and MCERTS) and, indeed, will be undertaken in some form by any reputable analyst, whether for a certified technique or not. Laboratory QA/QC is beyond the control of Tier Environmental and will not be considered further in this document, although the relevant laboratory documentation can be obtained upon request. QA must also form part of the design and execution of a site investigation.

Two parameters often used to assess measurement quality objectives are bias and precision. Bias is a systematic deviation in the data. For example, a positive bias (concentrations higher than in reality) would be introduced if sampling bottles were a source of the analyte and this fact was unknown. Precision is the variation in the measurements around a central 'expected' value. This could be due both to real variability in the environmental medium being measured and random errors in the analytical process. Both precision and bias can be assessed by the use of appropriate blanks and replicates within the site investigation programme.

The objectives of the QA activities undertaken in this present site investigation were to recognise and quantify systematic bias within the analytical dataset and to obtain an indication of precision. In environmental samples, much of the observed variability is likely to result from heterogeneity in the sampled medium, particularly for soil and sediment samples.

Such QA practice within the sampling programme is required by current guidance (e.g., Environment Agency report P5-065/TR (2000); Environment Agency LFTGN02 (2002); BS 10175:2001).

Alternative QA procedures to the generic approach presented in this appendix may be specified for a project, provided case-specific justification is given.

QA checking procedure (data validation)

The responsible Engineer and Project Reviewer are required to undertake data validation and provide comment on data quality within the main body of the report(s) issued, when noteworthy matters arise. This QA checking should involve:

- Confirming that data reported by the laboratory have achieved the standards specified by the certification scheme (MCERTS or UKAS). This will be indicated on the analytical certificates issued by the laboratory.
- Checking that the limit of detection (LoD) and limit of quantification (LoQ) achieved by the laboratory for an individual analyte is appropriate for the purposes of the report. LoD and LoQ will vary dependent upon analyte concentrations, sample matrix properties and interference from co-contaminants.
- A check that the reported range of concentrations are reasonable for the analyte. For example, the dissolved concentration of an analyte in a water sample should not exceed saturation. If it does, then this merits further consideration (e.g., was colloidal organic matter or other solid-phase material present or could there have been unobserved free-phase organic liquid?) and explicit comment. At its simplest, there may be a unit error.

- Where analysis involves reporting of Tentatively Identified Compounds (TICs; normally by mass spectrometry), the reviewers should check that these might reasonably be expected at the site under consideration. The uncertainties in identification by MS mean that it is not uncommon that TICs are incorrectly assigned. In cases of doubt, the analytical laboratory can re-check the raw data and confirm.
- A review of the analytical precision by comparing data obtained for duplicate samples. There is no absolute threshold - variability is entirely dependent upon the sample matrix and manner in which the contaminant has entered the sample. Variability that cannot reasonably be assigned to such factors (for example a very high apparent variability in data for sediment-free water samples) should be reviewed with the laboratory. Variability that is attributable to the sample matrix can nevertheless provide important pointers to improve understanding of contaminant transport pathways and the risks posed by pollutant linkages (e.g., soil heterogeneity, the association of contamination with particular soil fractions, the presence of residual NAPL within soil pores or the role of suspended sediments in contaminant transport).
- Confirmation that no errors have been introduced by data transcription, unit conversion or corrections between preliminary and certificates issued by the laboratory. The reviewer should audit a proportion (typically 5-10%) of all data from the original (final) certificates of analysis through to the equivalent values in the report for those specific samples.

It is important to consult the analytical laboratory if apparent QA issues arise. Many apparent concerns can be adequately resolved on the basis of revisiting the raw analytical data or by obtaining a better understanding of the inherent limitations of the analysis for a particular matrix or sample type.

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present, and the risk is almost certain to occur, or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

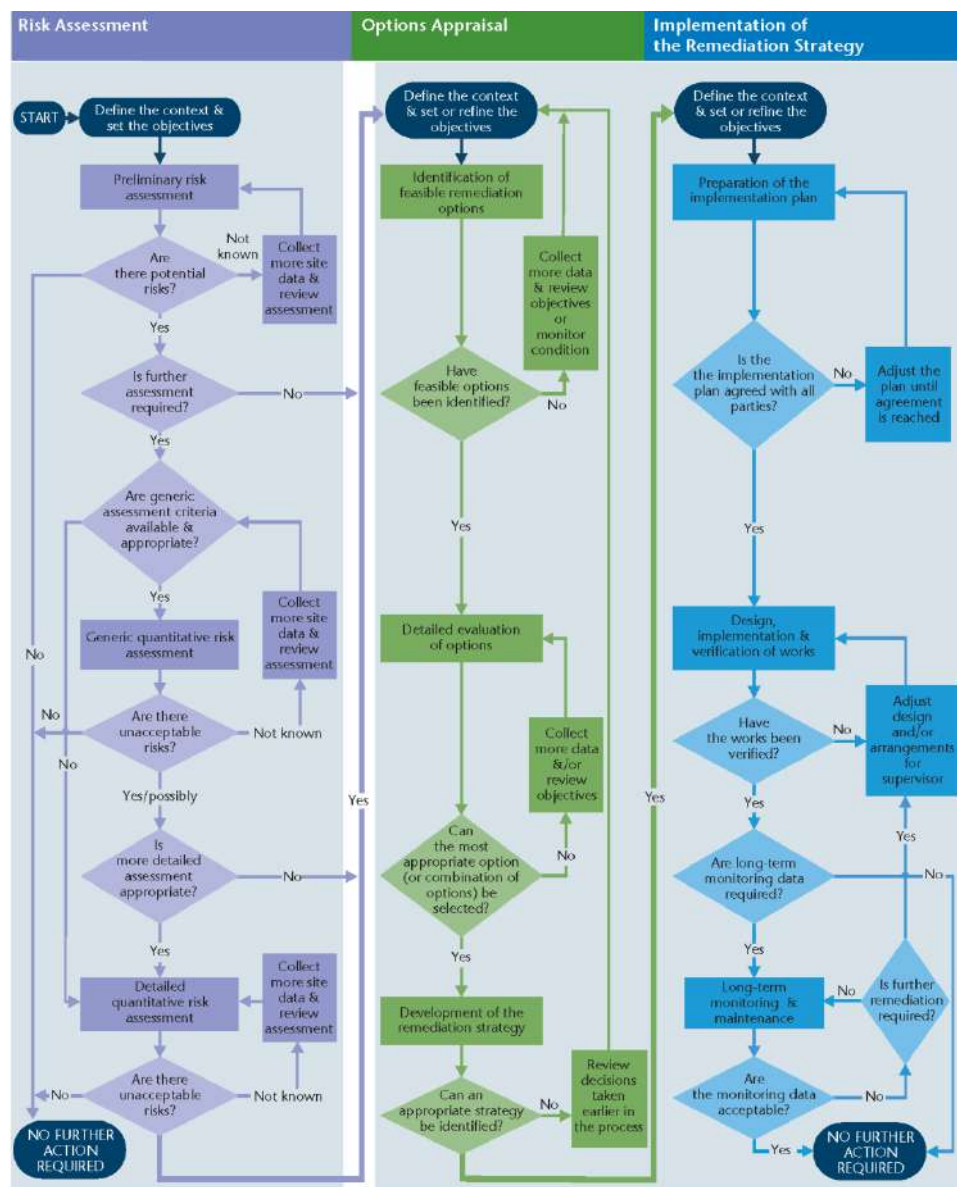
		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Negligible
	Unlikely	Moderate/Low	Low	Negligible	Negligible

APPENDIX E –HUMAN HEALTH RISK ASSESSMENT CRITERIA

Context

Contaminated Land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995 and associated guidance ("Part IIA"). These specify that a "suitable for use" approach is to be applied in the assessment of potentially contaminated land, implemented through a phased programme of site investigation and risk assessment appropriate to the site under consideration.

The assessment of potential risks posed by contaminated land is based upon the assessment of plausible contaminant source - pathway - receptor linkages ("pollutant linkages") for the current and/or proposed future use of the site. The process for the assessment of contaminated land adopted in this report is in line with guidance issued by DEFRA and Environment Agency (EA) 2004: "Model Procedures for the Management of Contaminated Land (CLR11)". The overall process for the management of land contamination is shown Figure 1 of CLR11 and reproduced below:



Note: The process may apply to one or more pollutant linkages each of which may follow a different route. For some linkages, it may be possible to stop at an early stage – others will progress all the way through the process. The level of complexity of each stage may also vary and in some cases may be very simple.

The risk assessment and subsequent investigation, remediation and verification must address all potential sources of pollutants that may be present on the site (the "hazards"), all receptors that may be harmed by these (e.g. human health, controlled waters, ecological receptors)

and the pathways by which the contamination may be transported from the contaminant source(s) to the receptor(s). This is defined within the conceptual model for the site, which represents the characteristics of the site in a form that shows the possible pollutant linkages. As further information becomes available (for example, through site investigation), so the conceptual model will be refined.

Remedial action can be specified at any phase within this assessment process to break the identified pollutant linkage. In determining whether or not to undertake further assessment or to undertake remediation, the potential cost-savings arising from a more thorough assessment of the pollutant linkages and more tightly defined remedial strategy must be considered against the direct costs involved in the work and the time that this will take to execute and gain regulatory approval.

A different approach to the statistical appraisal of data is required depending on whether the assessment is being undertaken to assess land as Contaminated Land in accordance with the regulations or whether the assessment is to assess whether the site is suitable for new development in accordance with the Planning regime. The statistical approach to assessment is discussed further in CL:AIRE:2009 "Guidance on Comparing Data with a Critical Concentration".

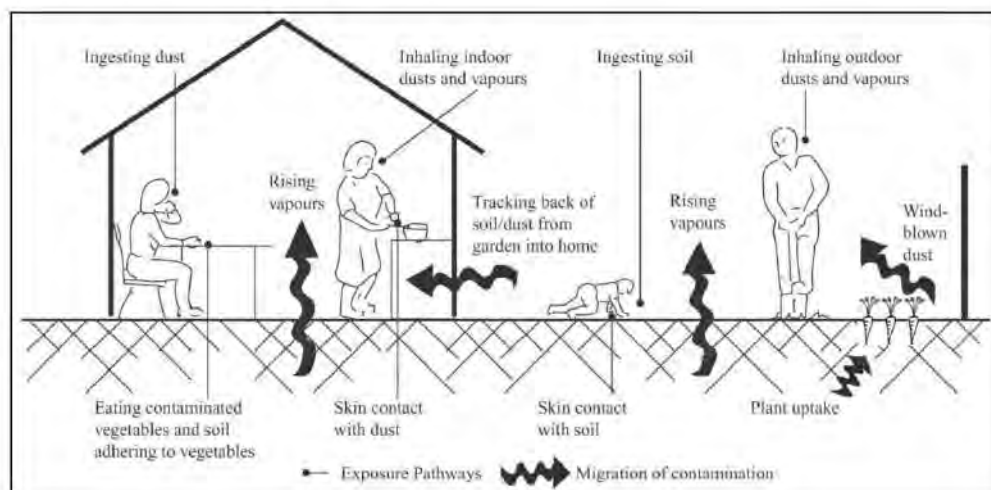
Some form of Detailed Quantitative Risk Assessment (DQRA) will be essential for those cases where appropriate GAC values cannot be established for the contaminant linkages under consideration.

Generic Assessment Criteria for Human Health Risk Assessment

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports and guidance. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. The initial documents (CLR7 – 10) were withdrawn and replaced with revised guidance issued by the Environment Agency including:

- “Using Soil Guideline Values”; SC050021/SGV Introductions, EA, 2009;
- “Human Health toxicology assessment of contaminants in soil”; SC050021/SR2, EA, 2009;
- “Update technical background to the CLEA model”; SC050021/SR3, EA, 2009;
- CLEA Software (Version) Handbook; SC050021/SR4; EA, 2008;
- Compilation of Data for priority Organic Contaminants for Derivation of Soil Guideline Values; Science Report SC050021/SR7, 2008; and,
- Guidance on Comparing Data with a Critical Concentration; CL:AIRE, 2009.

The CLEA model and associated guidance was developed to calculate an estimated tolerable daily intake (TDI) of contaminants for site users given a set of ‘typical’ human health exposure pathways which are detailed in “SR3: Updated technical background to the CLEA model” (Science Report SC050021/SR3, EA, 2009) and reproduced below.



- **Ingestion**
 - o Outdoor soil;
 - o Indoor dust;
 - o Home grown produce;
 - o Soil attached to home grown produce.
- **Dermal Contact**
 - o Outdoor soil;
 - o Indoor dust.
- **Inhalation**
 - o Outdoor dust;
 - o Indoor dust;
 - o Outdoor vapour;
 - o Indoor vapour.

It should be noted that the CLEA model does not include an exhaustive list of potential exposure pathways, e.g. certain compounds can pass through plastic water pipes into drinking water supply.

The potential significance of each of the exposure pathways is dependent upon the type of land use and the nature of the contaminant being considered. The CLEA model considers principal 'default' land use scenarios and makes a series of assumptions with regards to building type (where applicable), identification of the critical human receptor group, exposure frequency and duration. The definitions of the principal land use types given in SR3 (EA, 2009) are:

- **Residential land use:**

A typical residential property consisting of a two-story terraced house built on a ground-bearing slab of 0.15m thickness with a private garden consisting of lawn, flowerbeds, and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden. The critical receptor is a 0 – 6-year-old female.

Active exposure pathways are: ingestion of outdoor soil, ingestion of indoor dust, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and indoor dust and vapour.

- **Allotments**

A plot of open space commonly made available by the Local Authority to tenants to grow fruit and vegetables for their own consumption. There are usually several plots to a site and the overall site area may cover more than one hectare. The tenants are assumed to be the parents or grandparents and that young children make occasional accompanied visits to the plots. The critical receptor is a 0 – 6-year-old female and there is no building present on Site.

Active exposure pathways are ingestion of outdoor soil, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil; inhalation of outdoor vapour.

- **Commercial and industrial land use.**

A typical commercial or light industrial property consisting of a three-story office building (pre-1970) with a ground bearing floor slab at which employees spend most time indoors and are involved in office based or related light physical work. The critical receptor is a working female adult aged 16 – 65 years.

Active exposure pathways are ingestion of outdoor soil, ingestion of indoor dust; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and inhalation of indoor dust and vapour.

Soil Guideline Values

Based on the assumption of each land use type, the EA and DEFRA developed and published Soil Guideline Value (SGV) using the CLEA model for a number of principal contaminants and 'default' end-use scenarios of residential, allotments and commercial/industrial use. The primary purpose of the SGVs are as trigger value for the tolerable daily intake (TDI), below which it can be assumed that the soil does not pose an unacceptable risk to the identified receptor. Where soils contamination is present above this level further assessment may be required. SGVs were developed for the following contaminants:

- Heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury, nickel and selenium;
- Benzene, ethylbenzene, toluene and xylenes;
- Phenol;
- Dioxins and dioxin-like polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs) – 11 substances

LQM/CIEH Generic Assessment Criteria of Human Health Risk Assessment

In addition, in 2009 CIEH through LQM and EIC published generic assessment criteria (GACs) for 82 substances including metals, petroleum hydrocarbons, PAHs and explosive substances for a variety of soil types and the three 'default' land uses – (residential, allotments and commercial end-uses) as described in SR3 (EA, 2009). These have been superseded as described below.

Category 4 Screening Values

In 2013 "SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination" (CL:AIRE 2013) was issued which detailed findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived. This was supplemented in 2014 by "SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination – Policy Companion Document" (DEFRA, 2014). SP1010 proposed several updated toxicology information relating to contaminant behaviour updated assumptions relating to the modelling of human exposure to soil contaminants, derivation of separate C4SLs for residential with the consumption of home grown produce, residential without the consumption of home grown produce, and two new land uses: public open spaces near residential housing (POS resi) and public parks (POS park).

- **Public Open Space: Residential**

For public open space in close proximity to residential housing and the central green area around which houses are located, as on many housing estates from the 1930s to 1970s. It is also applicable for smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting. It is considered to be a generally grassed area up to 0.5ha with up to 50% bare soil. The land use is an important resource for children and the area is near the homes. The critical receptor is a female child age >3 - <9 years old (CLEA age class 4 – 9) as younger children are unlikely to play outdoors unsupervised.

Active exposure pathways are: ingestion of outdoor soil; ingestion of indoor dust; direct dermal contact with outdoor soil and indoor soil derived dust; inhalation of outdoor and indoor dust and inhalation of outdoor vapour.

- **Public Open Space: Park**

A public park is defined as an area of open space provided for recreational use and usually owned and maintained by the Local Authority. It is anticipated the park could be used for a wide range of activities, including the following:

- o Family visits and picnics;
- o Children's play area;
- o Sporting activities such as football on an informal basis (i.e. not a dedicated sports pitch); and
- o Dog walking.

The park is modelled as an area >0.5 ha of predominantly grasses open space with no more than 25% of exposed soil.

The critical receptor is a female child with CLEA age classes 1 – 6.

Active exposure pathway are: ingestion of outdoor soil; direct dermal contact with outdoor soil; inhalation of outdoor dust and inhalation of outdoor vapour.

Furthermore, the C4SLs are based on a different toxicological benchmark, the 'low level of toxicological concern' (LLTC). This difference in approach was adopted because the C4SLs were primarily intended for use under Part2A of the EPA 1990 to quickly screen out Category 4 sites where there is *"no risk or that the level of risk posed is low"*. SGVs and LQM GACs are based on the more conservative 'minimal or tolerable level of risk' as defined in SR2 (EA, 2009) and were derived for assessment of contamination for the Planning process.

Lead

The SGV for lead was withdrawn in 2011 and is not used in this report. The C4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling than the withdrawn SGV and derived in line with current science of lead toxicology.

LQM/CIEH Sutable 4 Use Levels (S4ULs)

The publication of the C4SLs resulted in considerable and inconclusive debate about the applicability of the lower level of protection of the C4SL, which are underlain by the LLTC, outside of the Part 2A context for which they were derived. In 2014 LQM/CIEH presented a Sutable 4 Use Levels (S4ULs), which incorporate the updated assumption exposure derived for the production of the C4SLs but within the context of deriving screening criteria above which further assessment of the risks or remedial action may be needed. The S4ULs replace the 82 substances, species and fractions and congeners contained in the previous LQM/CIEH GACs issued in 2009. Additionally, following changes and new land uses proposed in the C4SL research project, S4ULs have also been derived for the majority of substances for which the EA derived SGVs in 2009.

The GAC values adopted in this report are summarised in Table 1, below.

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Metals/metalloids																			
Arsenic	37			40			43			640			79			170			LQM (2014)
Beryllium	1.7			1.7			35			12			2.2			63			LQM (2014)
Boron	290			11000			45			240000			21000			46000			LQM (2014)
Cadmium	11			85			1.9			190			120			532			LQM (2014)
Chromium III	910			910			18000			8600			1500			33000			LQM (2014)
Chromium VI	6			6			1.8			33			7.7			220			LQM (2014)
Copper	2400			7100			520			68000			12000			44000			LQM (2014)
Lead	200			310			80			2330			630			1300			C4SL
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			LQM (2014)
Mercury (Inorganic)	40			56			19			1100			120			240			LQM (2014)
Methylmercury	11			15			6			320			40			68			LQM (2014)
Nickel	180			180			230			980			230			3400			LQM (2014)
Selenium	250			430			88			12000			1100			1800			LQM (2014)
Vanadium	410			1200			91			9000			2000			5000			LQM (2014)
Zinc	3700			40000			620			730000			81000			170000			LQM (2014)
Other																			
Total Sulphate	2,400			2,400			2,400			2,400			2,400			2,400			BRE (2005)
Water Soluble Sulphate (g/l)	0.5			0.5			0.5			0.5			0.5			0.5			BRE (2005)
PAHs																			

Acenaphthene	210	510	1100	3000 (57)	4700(141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	8300 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM (2014)
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	LQM (2014)
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	LQM (2014)
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.1	7.1	13	15	16	LQM (2014)
Benzo(g,h,i)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	LQM (2014)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	LQM (2014)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	LQM (2014)
Dibenz(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.61	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM (2014)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	63	6300	6400	LQM (2014)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	63000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	LQM (2014)
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	LQM (2014)
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	LQM (2014)
Phenanthrene	95	220	440	1300 (36)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM (2014)
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM (2014)
Coal Tar (BaP as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	LQM (2014)
BTEX and TPH																			

Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	LQM (2014)
Toluene	130	290	660	880 vap (869)	1900	3900	22	51	120	56000 vap (869)	110000 vap (1920)	180000 vap (4360)	56000	56000	56000	87000 vap (869)	95000 vap (1920)	100000 vap (4360)	LQM (2014)
Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 vap (518)	13000 vap (1220)	27000 vap (2840)	24000	24000	25000	17000 vap (518)	22000 vap (1220)	27000 vap (2840)	LQM (2014)
Xylene - o	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	42000	43000	17000 (478)	24000 (1120)	33000 (2620)	LQM (2014)
Xylene - m	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	41000	42000	43000	17000 (625)	24000 (1470)	32000 (3460)	LQM (2014)
Xylene - p	56	130	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	41000	42000	43000	17000 (576)	23000 (1350)	31000 (3170)	LQM (2014)
Aliphatic EC 5-6	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	600000	95000 (304)	130000 (558)	180000 (1150)	LQM (2014)
Aliphatic EC >6-8	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	620000	150000 (144)	220000 (322)	320000 (736)	LQM (2014)
Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	LQM (2014)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000(2 83)	LQM (2014)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4300 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	25000 (24)	25000 (59)	26000 (142)	LQM (2014)
Aliphatic EC >16-35	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aromatic EC 5-7	70	140	300	370	690	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (1220)	84000 (2260)	92000 (4710)	LQM (2014)
Aromatic EC >7-8	130	290	660	860	1800	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	LQM (2014)

Aromatic EC >8-10	34	83	190	47	110	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	LQM (2014)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	LQM (2014)
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	23	27	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	LQM (2014)
Aromatic EC >16-21	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM (2014)
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >44-75	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
VOCs																			
1,2-dichloroethane (1,2-DCA)	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	LQM (2014)
1,1,1- trichloroethane	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000 (1425)	76000 (2915)	100000 (6392)	LQM (2014)
1,1,2,2,tetrachloroet hane	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	LQM (2014)
tetrachloroethene	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	45	95	1400	1400	1400	810 (424)	1100 (951)	1500	LQM (2014)
tetrachloromethane (Carbon tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	LQM (2014)
Trichloroethene	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	LQM (2014)
Trichloromethane (chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	LQM (2014)
Chloroethene (Vinyl chloride)	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM (2014)

2,4,6 Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	LQM (2014)
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	LQM (2014)
HMX	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	LQM (2014)
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	LQM (2014)
Dieldrin	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	LQM (2014)
Atrazine	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	LQM (2014)
Dichlovos	0.032	0.066	0.014	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	LQM (2014)
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.8	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2500	LQM (2014)
alpha-Hexachlorocyclohexane	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	LQM (2014)
beta-hexachlorocyclohexanes	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	LQM (2014)
gamma-hexachlorocyclohexanes	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	LQM (2014)
Chlorobenzene	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	LQM (2014)
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	LQM (2014)
1,3-Dichlorobenzene	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	LQM (2014)
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	LQM (2014)
VOCs Continued																			

1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	LQM (2014)
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	LQM (2014)
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	LQM (2014)
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	LQM (2014)
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49 (39.4)	120 (98.1)	240 (235)	78	79	79	110 (39)	120	130	LQM (2014)
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	LQM (2014)
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7	640 (43)	770 (107)	830	100	100	100	190	190	190	LQM (2014)
Hexachlorobenzene	1.8 (0.2)	3.3 (0.5)	4.9	4.1 (0.2)	5.7 (0.5)	6.7 (1.2)	0.47	1.1	2.5	110 (0.2)	120	120	16	16	16	30	30	30	LQM (2014)
Phenol	280	550	1100	750	1300	2300	66	140	280	760 _{dir} (31000)	1500 _{dir} (35000)	3200 _{dir} (37000)	760 _{dir} (31000)	1500 _{dir} (35000)	3200 _{dir} (37000)	760 _{dir} (31000)	1500 _{dir} (35000)	3200 _{dir} (37000)	LQM (2014)
Chlorophenols (excluding pentachlorophenol)	0.87 (g)	2	4.5	94	150	210	0.13 (g)	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	LQM (2014)
Pentachlorophenol	0.22	0.52	1.2	27 (16.4)	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	LQM (2014)
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	LQM (2014)
Hexachlorobutadiene	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	LQM (2014)

(g) derived based on 2,3,4,6-tetrachlorophenol; dir - based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only); (vap) calculated for vapour phase only. SOM – Soil Organic Matter; (4.5) solubility.

**APPENDIX P – PREVIOUS SITE INVESTIGATION REPORTS (AVAILABLE UPON
REQUEST)**

APPENDIX Q – COMPLYING WITH CONTROL OF ASBESTOS REGULATION 2012

Complying with Control of Asbestos Regulations (CAR): Risk Assessments, Licensing and Training

This appendix outlines CAR risk assessments and where they should be applied in relation to assessing and remediating brownfield sites. The information below details the different classifications of work with asbestos under CAR, summarises the legal requirements for asbestos awareness training for all involved in the investigation and management of asbestos containing soil (ACS), and details the potential requirements for suitable proficiency training relating specifically to ACS.

CAR RISK ASSESSMENTS

A CAR Risk Assessment is required for any work which may expose employees to asbestos. It is recommended that a precautionary approach is adopted if there is any doubt about risks associated with asbestos.

There are three main activities for potential asbestos exposure during work on brownfield sites:

- Site reconnaissance visits;
- Site investigation works; and
- Site remediation.

CAR risk assessments are needed at each stage but may be incorporated during the site investigation stage into the overarching health and safety risk assessments.

The CAR risk assessment must:

- Identify the type of asbestos to which employees are liable to be exposed, where possible, or assume it is present in different forms;
- Determine the type and extent of exposures to asbestos that may occur during the work
- Identify the steps to be taken to prevent exposure or reduce it to the lowest level reasonably practicable; and,
- Consider the effects of control measures that have been or will be taken.

The CAR risk assessment should include any information used to inform the risk assessment such as asbestos reports or desk study information. In the event that this information is not available, the assessor should be assumed that all forms of asbestos may be present on Site.

For all investigation and remediation of ACSs, a detailed written work plan should be produced and followed as detailed on the HSE website and in the CAR.

The CAR risk assessments for specific investigations or remediation projects, will determine whether or not work is 'licensable work' (LW), notifiable non-licensable work' (NNLW) or 'non-licensed work' (NLW). In addition, training requirements are also defined by the CAR risk assessment.

Some examples of control measures that apply during site reconnaissance, site investigation works and site remediation are given below and should be applied depending on the asbestos risks identified for the Site at each stage of investigation:

- Avoiding stirring up dust;
- Cleaning footwear after site works;
- Removing and bagging any overalls for disposal/laundry;
- Respirators and hygiene facilities for high risk sites;
- Segregated welfare units;
- Wetting ground
- Minimising soil disturbances;
- Implementation or retention of capping/break layers;
- Implementation of awareness training;
- Air monitoring;
- Managing stockpiles;
- Area segregation;
- Wheel washing
- Road washing/cleaning

It is important to note that during Site reconnaissance visits, Site investigation works and Site remediation that asbestos should not be considered in isolation and control measures are likely to form part of a wider health and safety precautions.

Respiratory protective equipment (RPE)

RPE is the last line of defence and its requirement would be defined by the CAR risk assessment. HSE (2013b) advises that RPE should have an assigned protection factor of 20 or more for all work with asbestos. In certain instances, full face-piece, positive pressure respirators with a protection factor of 40 are necessary (to EN 12942:1998, TM3).

Suitable types of RPE for most **short** duration non-licensed asbestos work:

- Disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3)
- Half mask respirator (to standard EN140) with P3 filter
- Semi-disposable respirator (to EN405) with P3 filter

These filters are not suitable for people with beards/stubble or for long or continuous use.

LICENSING

CAR defined certain types of activities involving asbestos as 'licensable work' (LW) or as 'notifiable non-licensable work' (NNLW). All other work would be 'non-licensable work' (NLW).

LW is defined as:

- work where exposure is not 'sporadic and low intensity'
- work where the risk assessment cannot demonstrate that the control limits (four hour and 10 minute limits) will not be exceeded
- work on asbestos coating
- work on AIB or insulation where risk assessment is either of first two points above or not of short duration (where short duration is defined for any work liable to disturb asbestos as taking less than two hours per week (including ancillary work) and no one person carries out that work for more than one hour').

NNLW includes work with:

- AIB or asbestos insulation of short duration that is not licensable
- fire-damaged asbestos cement or asbestos cement damaged so as to create significant dust and debris
- asbestos ropes, yarns, woven cloths in poor condition or handling cutting or breaking up the materials
- asbestos papers, felts and cardboard in poor condition, unencapsulated or not bound into another material.

Work with weathered asbestos cement, air monitoring and collecting samples of ACM in buildings would not normally be notifiable.

It is impossible to specify definitively what activities will and will not be licensable. This decision should be made as part of the CAR risk assessment. CAR is not primarily aimed at work with ACSs and there is little published information on airborne asbestos concentrations during work with ACSs. Nevertheless, CAR will require some remediation projects, and occasionally site investigations, to be LW. Investigations on other sites may involve NNLW. The decision as to whether work is LW or NNLW should be made during the CAR risk assessment by those in charge of the brownfield site investigations and remediation projects.

TRAINING REQUIREMENTS

Asbestos health and safety courses are offered by a number of providers in the UK. Training courses that include the problem of identifying ACMs in soil should be undertaken at regular intervals by those involved in the investigation, assessment and management of sites where ACs are known or suspected. It is the role of the employer to identify the level of training required for an employee based on their role, experience and duties. Reference to Regulation 10 of CAR should be referred to for more information on training requirements.

Recognising asbestos within soils is challenging due to the heterogeneity of such soils and the discolouration of asbestos by smeared soil. Specific training for ground workers should include understanding fibre release potential, potential control measures in the field, how to take representative ACSs safely, sample labelling and what analytical tests are available and when they should be implemented.

Health and safety training required under CAR includes asbestos awareness, non-licensable work (including notifiable non-licensable work) and licensable work with asbestos.

In addition to health and safety training, some staff involved in the technical identification on site of ACMs, sampling and analysis may require technical proficiency training (competency training).

Training vs. Competence

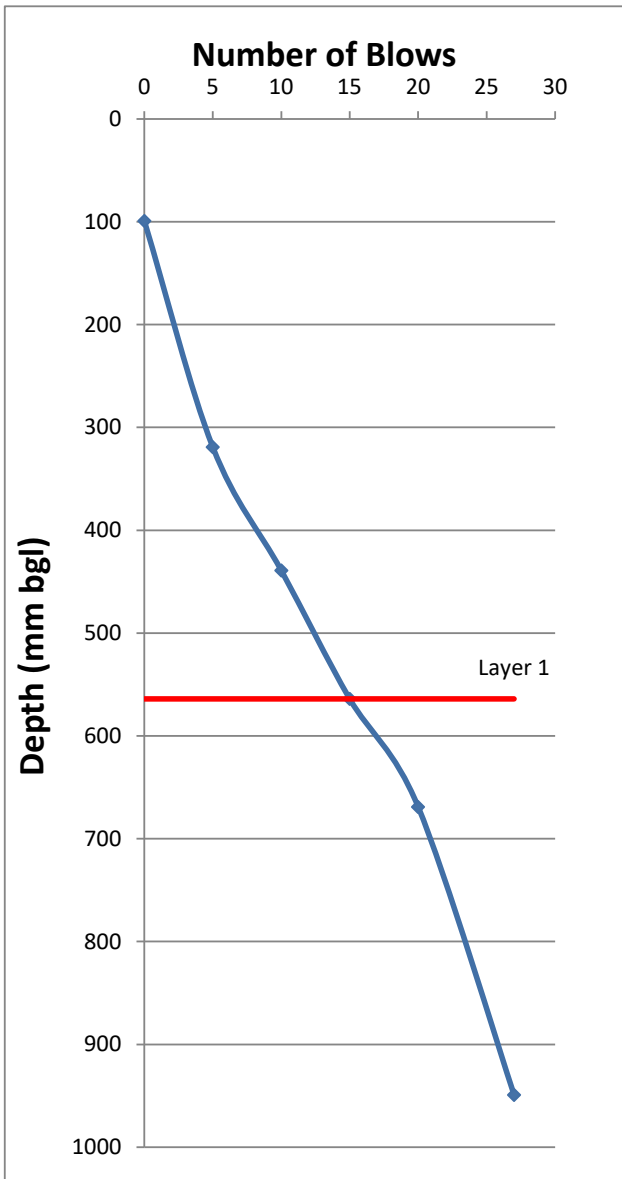
HSE (2005) identifies that 'training alone does not make people competent. Training must be consolidated by practical experience so that the person becomes confident, skilful and knowledgeable in practice on the job'. It is critical that ACS surveyors demonstrate competency with details of relevant field experience alongside training and examples of previous works/references.

APPENDIX R – DCP RESULTS

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

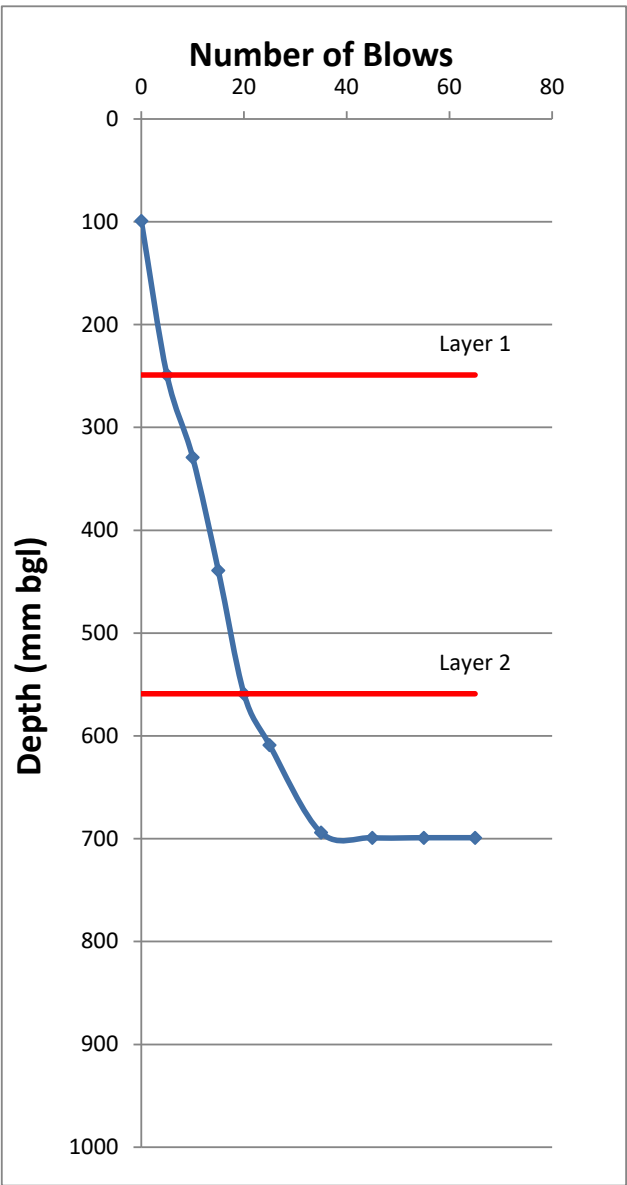
Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP1
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

Based on the Kleyn and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	99	564	15	31.00	5.36
2	564				
3					
4					
5					

[illegible]

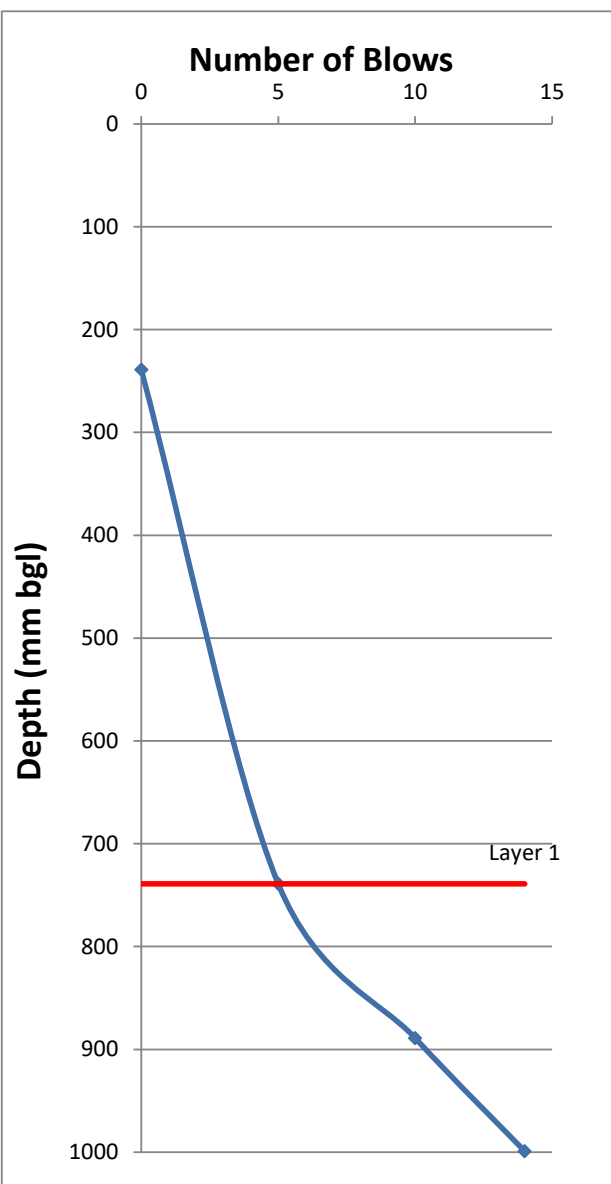
[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	99	249	5	30.00	5.59
2	249	559	20	20.67	8.99
3	559				
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP4
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

Based on the Kleyn and Van Heerden Model

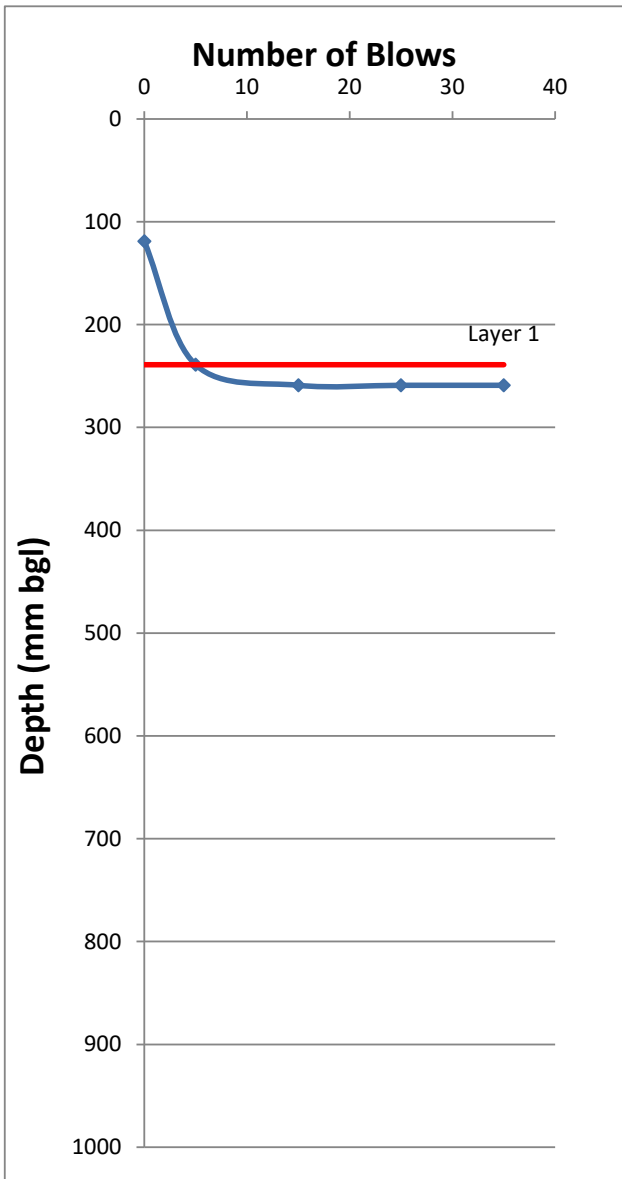
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	239	739	5	100.00	1.21
2	739				
3					
4					
5					

[illegible]

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP6
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

Based on the Kleyn and Van Heerden Model

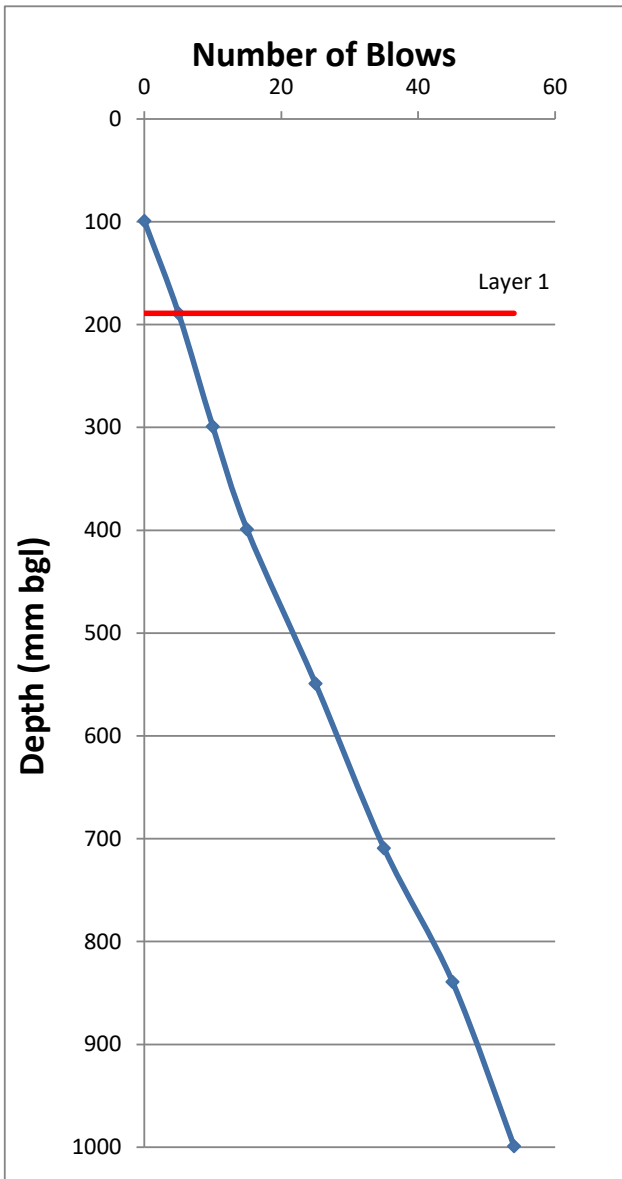
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	119	239	5	24.00	7.43
2	239				
3					
4					
5					

[illegible]

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP8
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

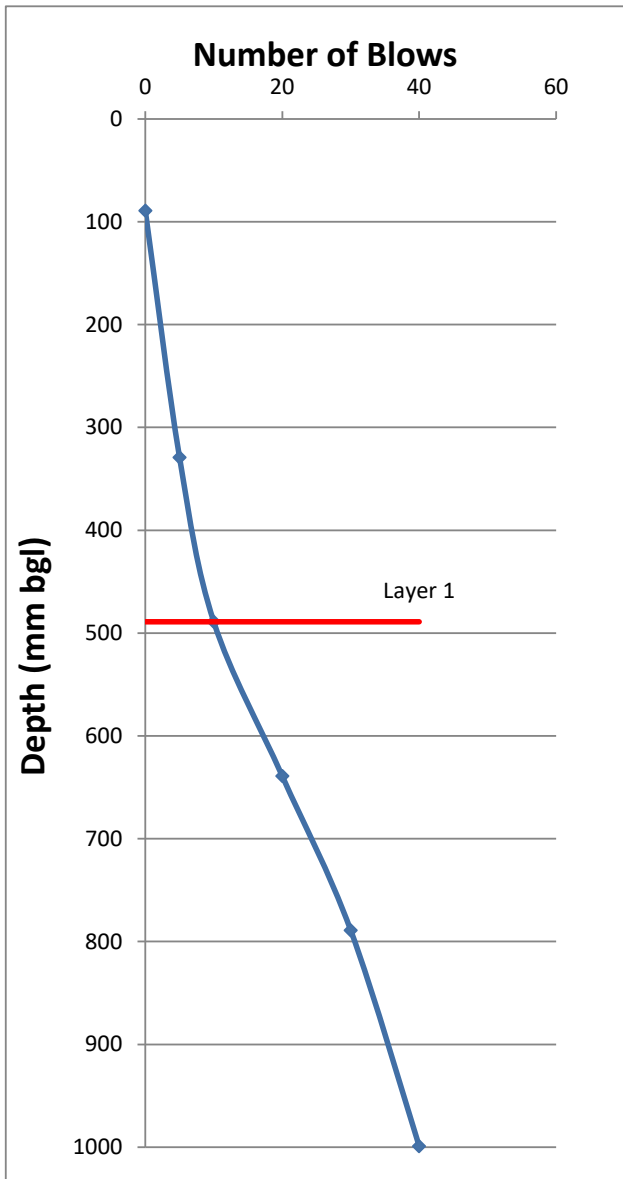
Based on the Kleyn and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	99	189	5	18.00	10.72
2	189				
3					
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP9
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

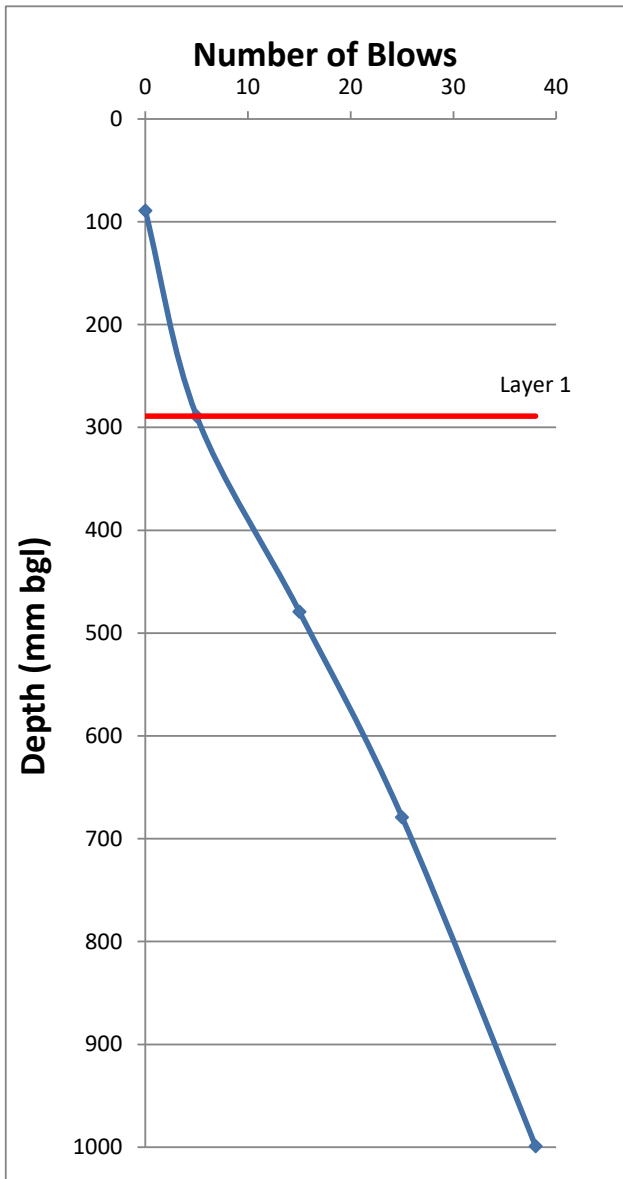
Based on the Kleyn and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	89	489	10	40.00	3.88
2	489				
3					
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

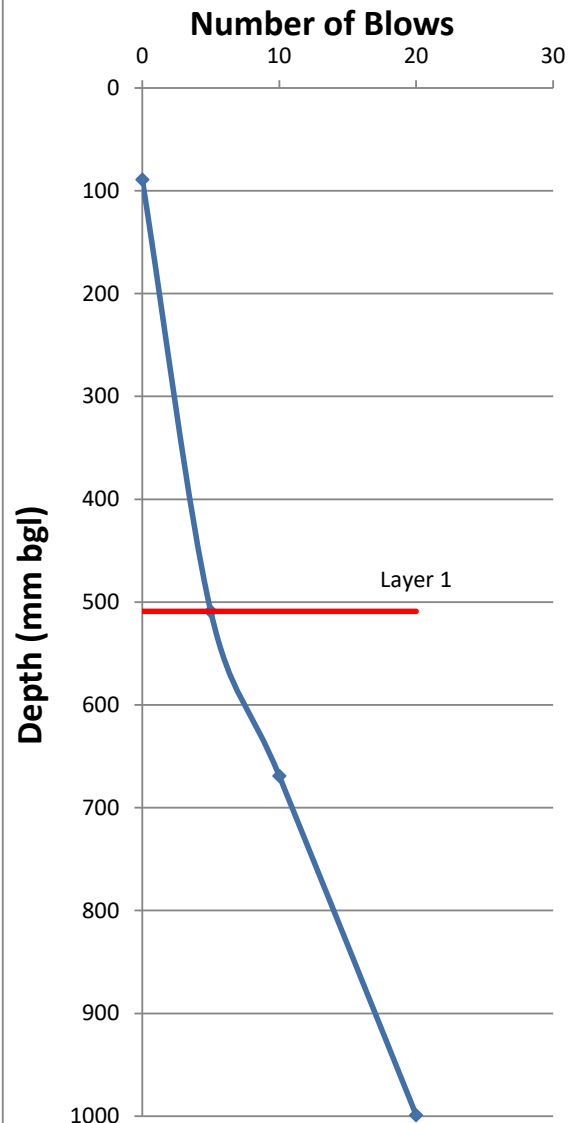
JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP10
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

Based on the Kleyn and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	89	289	5	40.00	3.88
2	289				
3					
4					
5					

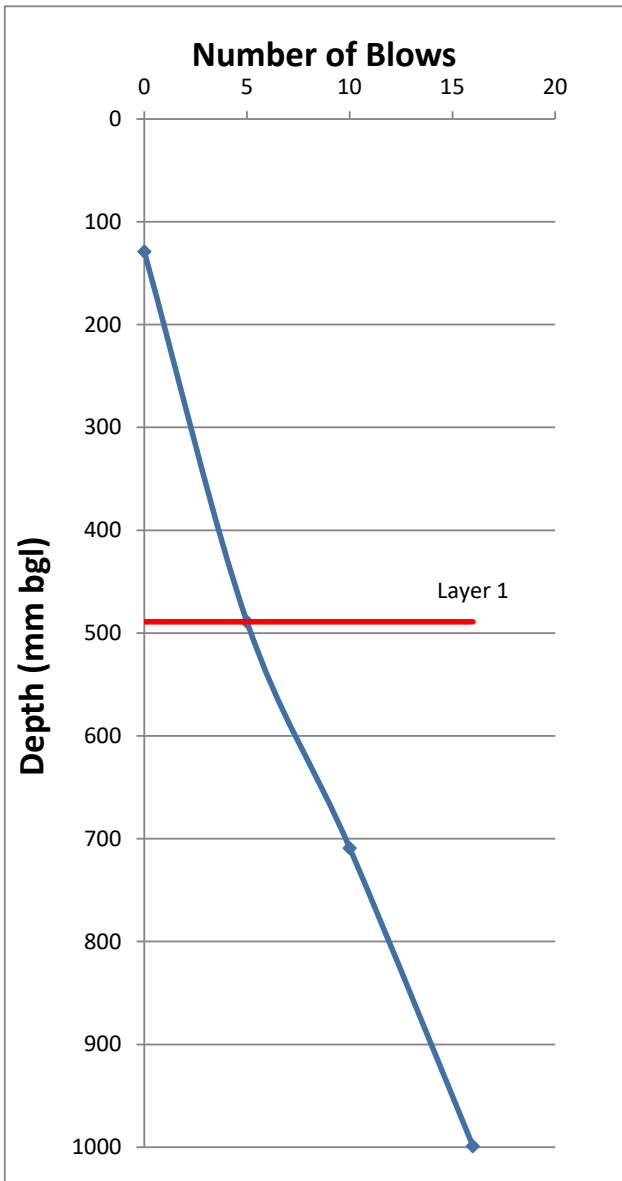
[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	89	509	5	84.00	1.51
2	509				
3					
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1163
Site:	Symmetry Park, Huyton
Location	DCP12
Test Date	28/09/2020
Zero Error mm	1
Cone Angle	
Layers Removed	

[illegible]

Based on the Kleyn and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	129	489	5	72.00	1.83
2	489				
3					
4					
5					

[illegible]

APPENDIX S – UXO MAP

