

South Tyneside Hospital
Phase 4 Validation
Topsoil Contamination Assessment Report
S180824/VAL
South Tyneside NHS Foundation Trust

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PHASE 4 VALIDATION TOPSOIL CONTAMINATION ASSESSMENT REPORT

SOUTH TYNESIDE HOSPITAL

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1 INTRODUCTION

1.1 Authorisation

Solmek have been commissioned by Billinghurst George and Partners on behalf of South Tyneside NHS Foundation Trust to undertake a topsoil capping validation for a sterile area within South Tyneside Hospital, South Tyneside. A site location plan is presented in Appendix A, Figure 1.

The site has been developed with a new boiler house and Energy Centre with areas of hardstanding including access for vehicles.

The following reports have already been issued in respect of the site:

- *Phase 2 Site Investigation Report, Proposed Energy Centre, South Tyneside Hospital (S121041, December 2012)*
- *Phase 3 Remediation Statement, South Tyneside Hospital, (S180824, August 2018)*

Reference should be made to the above reports for details of the site's environmental/contamination setting, geotechnical assessment, expected underlying geological conditions and rationale for the site investigation works.

This report summarises the testing of the topsoil capping based on the recommendations within the Remediation Statement.

1.2 Scope of Works

The site has been developed with a new boiler house and Energy Centre with areas of hardstanding including access for vehicles. No new areas of soft landscaping are proposed in the development.

This report has been prepared for the use of the Local Authority in its capacity as Regulatory Authority. The principal purpose of this report is to allow planning condition(s) relating to contamination to be addressed and be discharged. Excess made ground has been generated to achieve finished levels for the proposed hardstanding and access road associated with the boiler house and Energy Centre. This has then been transported and buried in a soft landscaped area to the south of the hospital complex and covered by a layer of topsoil capping (Appendix A, Figure 2).

The remediation statement objectives were to test six samples of the topsoil to access its suitability for use as a capping material.

The fieldwork and testing were generally carried out according to the recommendations of BS5930: 2015 "Code of Practice for Ground Investigations". The information provided in this report is based on the investigation fieldwork and is subject to the comments and approval of the various regulatory authorities.

There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Solmek reserve the right to alter conclusions and recommendations should further information be available or provided. Any schematic representation or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

2 SITE DESCRIPTION

The location of where the made ground was placed currently comprises an undeveloped area of grassed open space. The site is bound to the north by a single lane access road that circles the hospital grounds and to the east by hospital parking areas. The southern and western boundaries are open comprising further undeveloped areas surfaced with turf.

At the time of the site visit the area comprised a roughly rectangular, slightly raised low mound of topsoil. The area was partially grassed in places and stockpiles of topsoil were present along the northern boundary of the area ready to be placed across the top of the mound.

2.1 Fieldwork

The fieldwork was carried out commencing on 13th December 2018 and comprised:

- 6no. hand excavated pit sampling points were undertaken to depths of 0.20mbgl.
    - The rationale for the positioning of the trial pits was to accurately appraise the topsoil material already placed as well as the topsoil stockpile before placement.

Selected photographs of the site are presented in Appendix A.

Plans showing the location of all the sampling points can be found in Appendix A, Figure 3.

3 GROUND CONDITIONS

A summary of the ground conditions encountered is given below.

3.1 Made Ground

The topsoil was described as sandy and slightly gravelly. The gravel fraction generally comprised sandstone and mudstone with rare brick fragments. The topsoil was encountered to a depth of 0.20mbgl.

3.2 Natural Deposits

No encountered.

3.3 Groundwater

No groundwater was encountered during the sampling.

4 CONTAMINATION TESTING RESULTS AND ANALYSIS

Excess made ground has been generated to achieve finished levels for the proposed hardstanding and access road associated with the boiler house and Energy Centre. This has then been transported and buried in a soft landscaped area.

4.1 Contamination Testing and Rationale

To provide information upon the possibility of ground contamination six made ground topsoil samples (Sample 1 to Sample 6 inclusive) from 0.00-0.20mbgl were selected for shallow contamination testing.

The samples selected are considered to provide coverage of the mounded area. The samples were selected for the following tests based on Section 3.1 of the Remediation Statement:

- 6no Metals, semi-metals, non-metals, inorganic determinands
- 6no Asbestos identification screenings
- 6no Speciated Polyaromatic Hydrocarbons (PAHs)
- 6no Total Petroleum Hydrocarbon Criteria Working Group fractions (TPH CWG)

4.2 Test Results

Based on Section 3.1 of the Remediation Statement, the test results have been compared to a series of LQM/CIEH Suitable 4 Use Levels (S4UL) based on a commercial land use. The latest LQM/CIEH S4UL were published in December 2014. In the absence of LQM/CIEH S4UL, Category 4 Screening Levels (March 2014), EA CLEA Thresholds (from Version 1.06, May 2011) and EA Upper Tier Threshold values have been adopted. The value for lead has been compared with the Category 4 Screening Level (March 2014) developed by Contaminated Land: Applications In Real Environments (CL:AIRE).

The test results are presented in Appendix C, and a summary is provided below in Tables 1 and 2.

TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS (COMMERCIAL)

Determinant	Units	Number of Samples above Level of Detection	Minimum Level	Maximum Level	Commercial Value	Number of Results Exceeding Threshold Value
Metals						
Cadmium	mg/kg	6	0.20	0.50	190	0
Chromium III	mg/kg	6	22	36	8600	0
Copper	mg/kg	6	30	77	68000	0
Inorganic Mercury	mg/kg	6	0.27	0.60	1100	0
Nickel	mg/kg	6	23	45	980	0
Lead	mg/kg	6	100	260	2300*	0
Zinc	mg/kg	6	67	190	730000	0
Semi metals and non metals						
Arsenic	mg/kg	6	13	24	640	0
Boron	mg/kg	6	0.81	1.50	240000	0
Selenium	mg/kg	6	0.79	1.10	12000	0
Inorganic chemicals						
Cyanide (total)	mg/kg	3	<0.50	0.90	1580**	0
W.S. Sulphate	mg/l	4	<10	36	2000^	0
Other						
pH	pH	6	6.9	8.3	<5.5^	0

* *Category 4 Screening Levels, March 2014*
** *CLEA Software Version 1.06 (pH7 and 1%SOM)*
^ *EA Threshold Values*

4.3 Metals, Semi Metals and Non-Metals

No samples indicated raised levels of contamination above the S4UL threshold values.

4.4 Inorganic Chemicals

Soluble sulphates (potentially aggressive to foundation concrete) were recorded between <10 and 36mg/l. None of the samples were elevated above levels affecting human health.

The results of the pH testing were between 6.9 and 8.3. These pH levels are consistent with slightly acidic to slightly alkaline conditions.

4.5 Organic Chemicals

The organic thresholds vary depending on the levels of soil organic matter (SOM). A conservative SOM of 1.00% has been used to determine the S4UL thresholds. Table 2, below, summarises the results.

TABLE 2: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS (COMMERCIAL)

Determinand	Units	Number of Samples above LOD	Minimum Level	Maximum Level	S4UL 1% SOM	S4UL 2.5% SOM	S4UL 6% SOM	Number of Results Exceeding Threshold Value
TPH Aliphatic Fractions								
C5-6	mg/kg	0	<1.00	-	**3200**	5900	12000	0
C6-8	mg/kg	0	<1.00	-	**77800**	17000	40000	0
C8-10	mg/kg	2	<1.00	21	**2000**	4800	11000	0
C10-12	mg/kg	2	<1.00	7.70	**9700**	23000	47000	0
C12-16	mg/kg	2	<1.00	13	**59000**	82000	90000	0
C16-35	mg/kg	2	<1.00	55	**1600000**	1700000	1800000	0
TPH Aromatic Fractions								
C5-7 (Benzene)	mg/kg	0	<1.00	-	**26000**	46000	86000	0
C7-8 (Toluene)	mg/kg	0	<1.00	-	**56000**	110000	180000	0
C8-10	mg/kg	2	<1.00	10	**3500**	8100	17000	0
C10-12	mg/kg	2	<1.00	2.3	**16000**	28000	34000	0
C12-16	mg/kg	2	<1.00	22	**36000**	37000	38000	0
C16-21	mg/kg	2	<1.00	18	**28000**	28000	28000	0
C21-35	mg/kg	2	<1.00	44	**28000**	28000	28000	0

Speciated PAH								
Naphthalene	mg/kg	2	<0.10	3.30	**190**	460	1100	0
Acenaphthylene	mg/kg	2	<0.10	1.50	**83000**	97000	100000	0
Acenaphthene	mg/kg	2	<0.10	1.70	**84000**	97000	100000	0
Fluorene	mg/kg	2	<0.10	2.20	**63000**	68000	71000	0
Phenanthrene	mg/kg	3	<0.10	28	**22000**	22000	23000	0
Anthracene	mg/kg	3	<0.10	6.40	**520000**	540000	540000	0
Fluoranthene	mg/kg	6	0.29	31	**23000**	23000	23000	0
Pyrene	mg/kg	6	0.34	26	**54000**	54000	54000	0
Benz' (a)anth' ene	mg/kg	3	<0.10	15	**170**	170	180	0
Chrysene	mg/kg	3	<0.10	20	**350**	350	350	0
Benz' (b)fluor' ene	mg/kg	3	<0.10	18	**44**	44	45	0
Benz' (k)fluor' ene	mg/kg	3	<0.10	9.40	**1200**	1200	1200	0
Benz' (a)pyrene	mg/kg	3	<0.10	11	**35**	35	36	0
Id' (123cd)pyrene	mg/kg	3	<0.10	7.00	**500**	510	510	0
Diben(ah)anth'ene	mg/kg	3	<0.10	3.40	**3.5**	3.6	3.6	0
Benz (ghi)per' ene	mg/kg	3	<0.10	6.60	**3900**	4000	4000	0
Total PAH	mg/kg	5	<2.00	190	**1000***	1000*	1000*	0
Other								
Phenol	mg/kg	0	<0.30	-	**760**	1500	3200	0
* *EA Threshold Values*								

None of the samples were above the commercial S4UL thresholds for PAH and TPHCWG.

4.6 Asbestos

From the six samples subject to asbestos screening, no asbestos fibres were recorded.

4.7 Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to "identify and remove unacceptable risks to human health and the environment" and to "seek to ensure that contaminated land is made suitable for its current use". Part 2A uses a risk-based approach to defining contaminated land whereby the "risk" is interpreted as "the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land" and by "the scale and seriousness of such harm or pollution if it did occur".

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated. The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."* To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include "land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health." Categories 3 and 4 "encompass land which is not capable of being determined on such grounds".

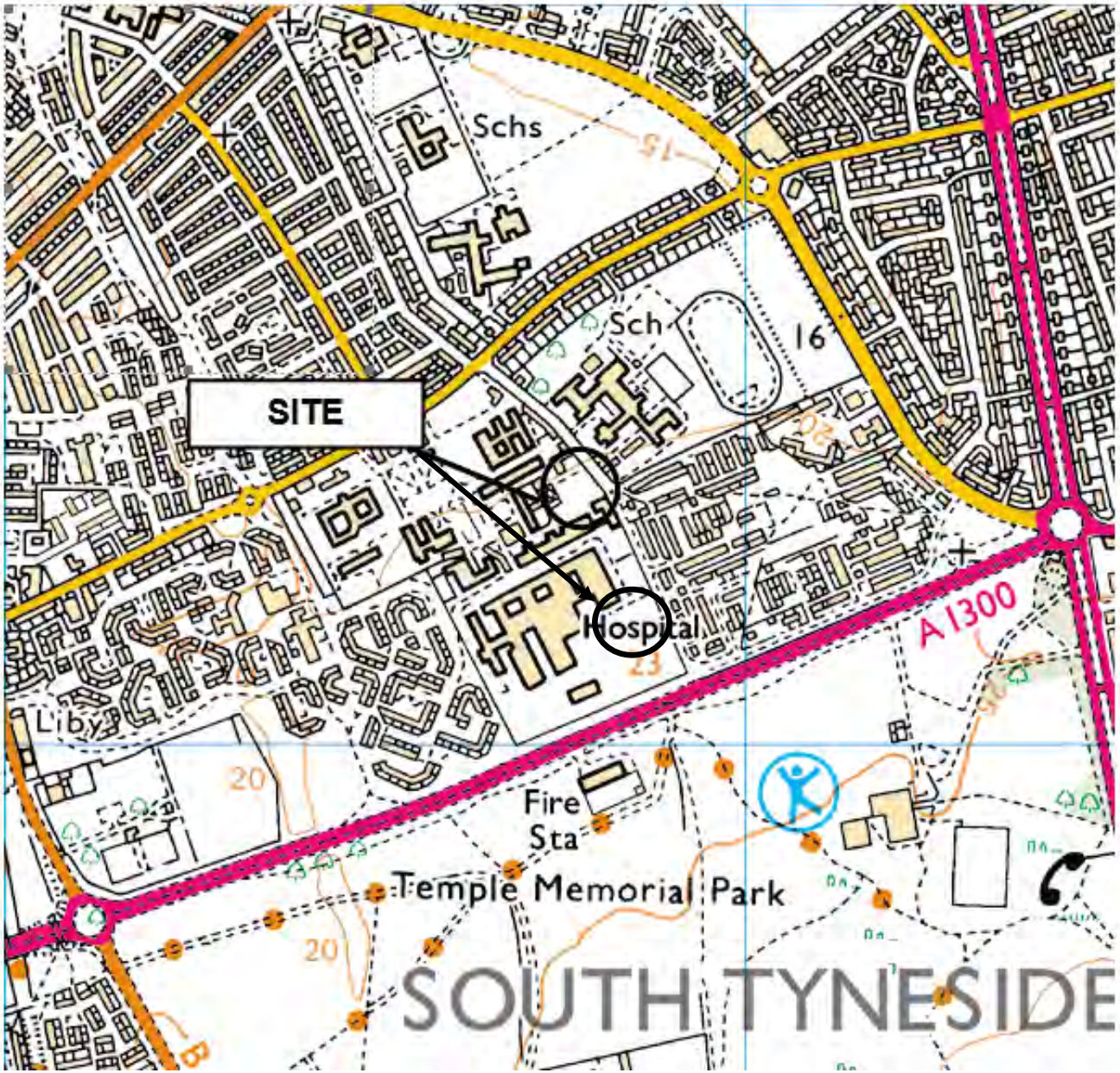
See Appendix C for additional notes on contamination guidelines.

4.8 Users of the Site

To establish if the levels of contaminants present on site may pose a risk to the health of the current and future users of the site the results of the contamination testing have been compared to a series of LQM/CIEH S4ULs based on a commercial land use. The results indicate that the concentrations of the metals, semi-metals, non-metals, and organic determinants within the topsoil across the area tested are below the threshold values for long term risk to human health.

Given the levels of contaminants recorded it is considered that they are unlikely to pose a risk to the current and future users of the site. The topsoil material is therefore deemed suitable for use as a capping medium and can therefore be placed across of the remainder of the mounded area.

APPENDIX A



Title
Site Location Map

Project
South Tyneside Hospital

Client
South Tyneside NHS Foundation

Date
January 2019

Fig No.
Figure 1

Scale
Do Not Scale

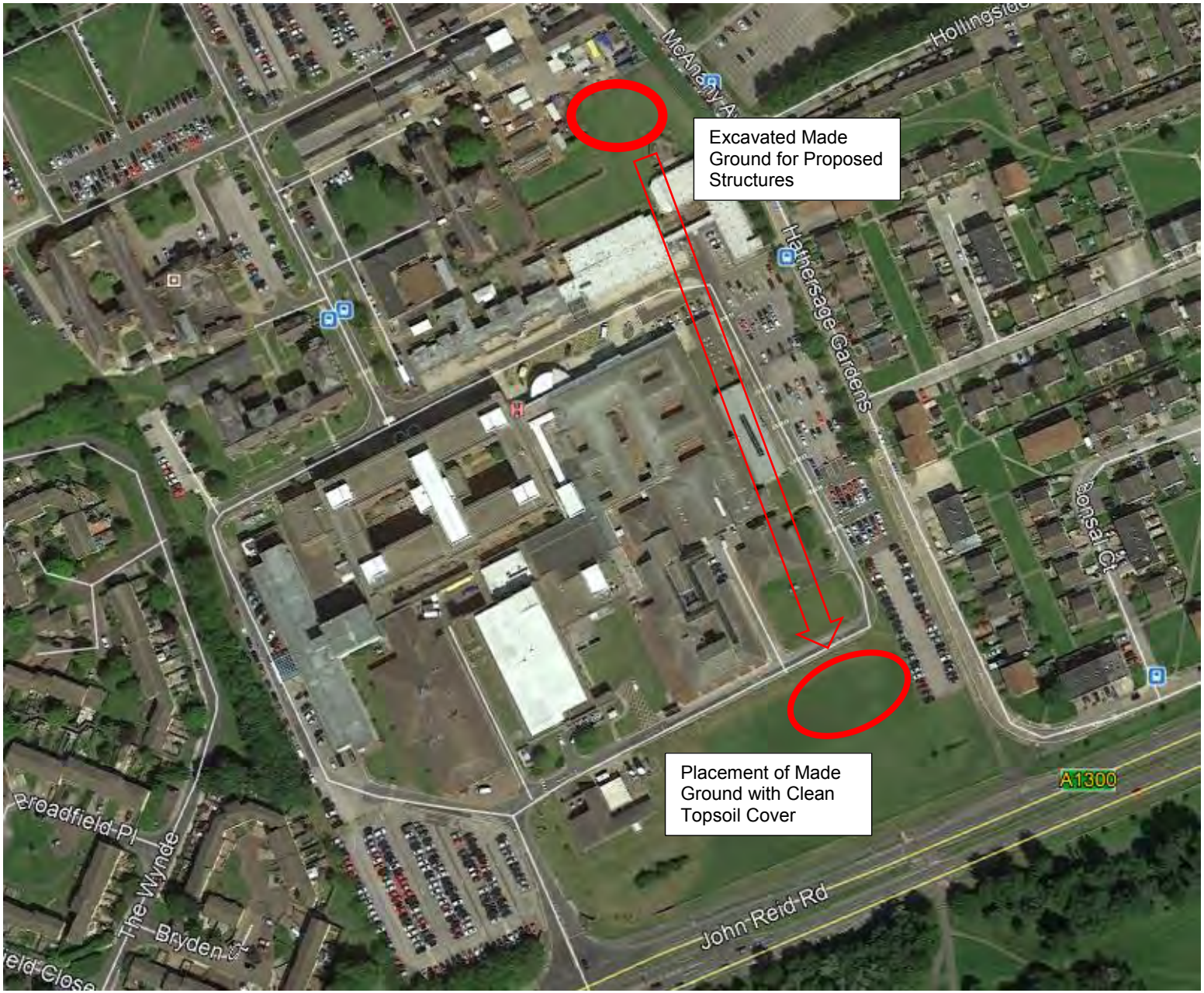
Key

N

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SOLMEK



Title
Made Ground Placement

Project
South Tyneside Hospital

Client
South Tyneside NHS Foundation

Date
January 2019

Fig No.
Figure 2

Scale
Do Not Scale

Key

N

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SOLMEK



Title
Sampling Location Plan

Project
South Tyneside Hospital

Client
South Tyneside NHS Foundation

Date
January 2019

Fig No.
Figure 3

Scale
Do Not Scale

Key

Sample Point

N

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SOLMEK



Title
View South East Across Mound

Project
South Tyneside Hospital

Client
South Tyneside NHS Foundation

Date
January 2019

Fig No.
Figure 4

Scale
Do Not Scale

Key

Sample Point

N

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SOLMEK



Title
View West Across Mound

Project
South Tyneside Hospital

Client
South Tyneside NHS Foundation

Date
January 2019

Fig No.
Figure 5

Scale
Do Not Scale

Key

Sample Point

N

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SOLMEK

APPENDIX B

Chemtest
The right chemistry to deliver results
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Final Report

Report No.:	18-39709-1
Initial Date of Issue:	03-Jan-2019
Client	Solmek Ltd
Client Address:	12 Yarm Road Stockton-on-Tees TS18 3NA
Contact(s):	Adrian Cutts Kathryn Watkin Office
Project	S180824 South Tyneside Hospital Topsoil Validation

Quotation No.:		**Date Received:**	17-Dec-2018
Order No.:	SOL2633	**Date Instructed:**	17-Dec-2018
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	21-Dec-2018
Date Approved:	03-Jan-2019		

A[redacted]

Details: Martin Dyer, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: S180824 South Tyneside Hospital Topsoil Validation

Client: Solmek Ltd				**Chemtest Job No.:**	18-39709	18-39709	18-39709	18-39709	18-39709	18-39709
Quotation No.:				**Chemtest Sample ID.:**	743340	743341	743342	743343	743344	743345
				Sample Location:	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.0	0.0	0.0	0.0	0.0	0.0
				Bottom Depth (m):	0.2	0.2	0.2	0.2	0.2	0.2
				Date Sampled:	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	27	33	18	17	16	23
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown,	Brown	Brown
Other Material	N	2040		N/A	Roots10%	Roots,10%	Stones	Stones	Stones	NONE
Soil Texture	N	2040		N/A	Loam	Clay	Clay	Clay	Sand	Clay
pH	M	2010		N/A	6.9	7.6	7.8	8.3	7.9	8.0
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.5	0.84	0.81	0.94	0.98	0.97
Sulphate (2:1 Water Soluble) as SO4	M	2120	mg/l	10.000	27	< 10	15	18	36	< 10
Cyanide (Total)	M	2300	mg/kg	0.50	0.90	0.60	0.60	< 0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	13	15	13	24	21	18
Cadmium	M	2450	mg/kg	0.10	0.32	0.35	0.20	0.39	0.50	0.32
Chromium	M	2450	mg/kg	1.0	23	28	22	24	36	27
Copper	M	2450	mg/kg	0.50	34	42	30	67	77	49
Mercury	M	2450	mg/kg	0.10	0.30	0.34	0.27	0.60	0.55	0.41
Nickel	M	2450	mg/kg	0.50	24	28	23	41	45	33
Lead	M	2450	mg/kg	0.50	110	130	100	250	260	170
Selenium	M	2450	mg/kg	0.20	0.92	1.1	0.79	0.92	1.0	1.0
Zinc	M	2450	mg/kg	0.50	90	110	67	150	190	120
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	21	14	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	7.7	4.9	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	13	9.6	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	14	12	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	41	38	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	96	78	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	10	6.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	2.3	1.5	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	22	11	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	18	14	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	37	44	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: S180824 South Tyneside Hospital Topsoil Validation

Client: Solmek Ltd				**Chemtest Job No.:**	18-39709	18-39709	18-39709	18-39709	18-39709	18-39709
Quotation No.:				**Chemtest Sample ID.:**	743340	743341	743342	743343	743344	743345
				Sample Location:	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.0	0.0	0.0	0.0	0.0	0.0
				Bottom Depth (m):	0.2	0.2	0.2	0.2	0.2	0.2
				Date Sampled:	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018	12-Dec-2018
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	89	76	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	190	150	< 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.8	3.3
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.5	0.73
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.7	0.59
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.2	1.4
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	3.1	28	6.8
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.26	6.4	1.3
Fluoranthene	M	2700	mg/kg	0.10	1.2	0.29	1.4	3.1	31	11
Pyrene	M	2700	mg/kg	0.10	1.6	0.34	1.5	2.3	26	11
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.2	15	5.8
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.6	20	6.8
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	2.6	18	7.4
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.2	9.4	3.4
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	2.0	11	4.7
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.0	7.0	3.8
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.27	3.4	1.7
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.60	6.6	4.8
Total Of 16 PAH's	M	2700	mg/kg	2.0	2.8	< 2.0	2.9	19	190	75
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX C

SOLMEK NOTES ON CONTAMINATION GUIDANCE (REF: VERSION 1/2019)

UK BACKGROUND

Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to *"identify and remove unacceptable risks to human health and the environment" and* to *"seek to ensure that contaminated land is made suitable for its current use".*

Part 2A uses a risk based approach to defining contaminated land whereby the "risk" is interpreted as *"the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land"* and by *"the scale and seriousness of such harm or pollution if it did occur".*

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated. The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."*

A conceptual model is used to develop and communicate the risks associated with a particular site.

To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include *"land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health."*

Categories 3 and 4 *"encompass land which is not capable of being determined on such grounds".*

PRELIMINARY CONCEPTUAL MODEL

Preliminary Conceptual Models are undertaken in accordance with CIRIA C552. The Preliminary Conceptual Model assesses the consequence and the likelihood of a risk being realised to provide a risk classification, using the tables detailed below.

CONSEQUENCE OF RISK BEING REALISED (Based on C552 CIRIA, 2001)

Classification	Definition	Example
Severe	Short-term (acute) risk to human health, the environment, an element of the development or other aspect with is likely to result in *significant harm*, damage or both.	High concentrations of cyanide on the surface of an informal recreational area. Major spills of contaminants from site into controlled water. High concentrations of explosive gas in the subsurface environment that have a clear unobstructed pathway into buildings.
Moderate	Chronic damage to human health, a plausible chance that an event will occur, although the timeline is not immediate to be in the short-term.	Appreciable concentration of contamination that over the longer-term will cause significant harm i.e. high lead concentration in topsoil. Shallow mine workings that are potentially unstable but may remain in a satisfactory or stable conditions for a number of years.
Mild	Low level pollution of non-sensitive water, a feasible hazardous scenario although the timeline of such occurring can probably be considered in 10's of years.	The effect of high sulphate concentrations on structural concrete. Pollution of non-classified groundwater.
Minor	Harm, although not necessarily significant to human health, or with respect to other aspects of the development, which are considered implausible in terms of occurrence, or will have little consequential impact.	The presence of contaminants at such low concentrations that protective equipment is required during site works. Any damage to structures is minimal and will not be structural in characteristics.

PROBABILITY OF RISK BEING REALISED (C552 CIRIA, 2001)

Classification	Definition
High Likelihood	There is a viable pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence that the receptor has been harmed or polluted.
Likely	There is a viable pollutant linkage and all elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a viable pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a viable pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

RISK CLASSIFICATION MATRIX (C552 CIRIA, 2001)

Risk = Probability x Consequence		Consequence			
		Severe	**Moderate**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

HUMAN RECEPTORS

Human exposure to contaminants present in soils can occur via several pathways. Direct exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion (or deliberate soil ingestion in the case of some children). Other indirect pathways include human ingestion of plants grown in contaminated soil or contaminated ground or surface water. Contaminants associated with wind blown dust can affect humans on surrounding sites.

VEGETATION

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, lead, nickel, and zinc.

To establish if the levels of contaminants present on a site may pose a risk to vegetation the results of the contamination testing are compared to a series of threshold values published in 'Code of Good Agricultural Practice for the Protection of Soil'.

GROUNDWATER AND SURFACE WATER RECEPTORS

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology. Surface watercourses may also accumulate contamination as contaminated sediments are deposited within the water body.

Where the site investigated overlies major/principal aquifers (and in some cases minor/secondary aquifers depending on certain conditions), groundwater Source Protection Zones and areas in close proximity to groundwater abstractions, contamination test results have been compared with the Water Supply (Water Quality) Regulations 1989 and The Water Supply (Water Quality) Regulations 2000.

Should a surface water receptor, such as a fresh water environment (river, canal, stream, lake etc), or marine environment be considered sensitive in relation to a site, then test results are compared with DEFRA & SEPA Environmental Quality Standards (2004). Many of the Environmental Quality Standards are hardness ($CaCO_3$) depended. Where no hardness values are available, Solmek assume conservative values (of between 0 and 50mg/l).

In the absence of vulnerable ground and surface water environments, Solmek may compare any test results with the Environment Agency Leachate Quality Threshold Values.

DETAILED QUANTITATIVE RISK ASSESSMENT (DQRA)

In line with CLR 11- Model Procedures, a DQRA for groundwater/human health may be required following a Phase 2 investigation and before the preparation of a Phase 3 Remediation Strategy. For human health DQRA, a site specific assessment criteria is undertaken using CLEA Software Version 1.06. For groundwater DQRA, the Environment Agency Remedial Targets Worksheet Version 3.1 is used.

WASTE ACCEPTANCE CRITERIA

The WAC testing relates to materials that are to be exported from a site/development to landfill, and do not directly relate to human health specifically. The WAC test categorises materials as either inert waste, non-reactive hazardous waste, and hazardous waste.

The testing results are generally presented as certificates which can be used by site owners/contractors etc, which should be presented to the accepting waste facility or waste contractor.

CONSTRUCTION MATERIALS

Materials at risk from possible soil contaminants include inorganic matrices such as cement and concrete and also organic material such as plastics and rubbers. Acid ground conditions and high levels of sulphates can accelerate the corrosion of building materials. Where pH and soluble sulphate analysis has been undertaken, Solmek compare the test results with the guidelines presented within BRE Special Digest 1, 2005 (3rd Edition) 'Concrete in Aggressive Ground'. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

The levels of potential contaminants should be compared to thresholds supplied in the UK Water Industry Research (UKWIR) publication "Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites" (January 2011). A Brownfield Site is defined in the document as "Land or premises that have not previously been used or developed that may be vacant or derelict". It should be noted that Brownfield sites may not be contaminated. The guidance does not apply to Greenfield Sites however water companies may have their own assessment criteria which should be checked by the developer. The table below outlines the pipe material selection threshold concentrations.

	Pipe Material (Threshold concentrations in mg/kg)					
Parameter group	**PE**	**PVC**	**Barrier pipe (PE-AL-PE)**	**Wrapped Steel**	**Wrapped Ductile Iron**	**Copper**
Extended VOC suite by purge and trap or head space and GC-MS with TIC	0.5	0.125	Pass	Pass	Pass	Pass
+ BTEX + MTBE	0.1	0.03	Pass	Pass	Pass	Pass
SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C5-C10)	2	1.4	Pass	Pass	Pass	Pass
+ Phenols	2	0.4	Pass	Pass	Pass	Pass
+ Cresols and chlorinated phenols	2	0.04	Pass	Pass	Pass	Pass
Mineral oil C11-C20	10	Pass	Pass	Pass	Pass	Pass
Mineral oil C21-C40	500	Pass	Pass	Pass	Pass	Pass
Corrosive (Conductivity, Redox and pH)	Pass	Pass	Pass	Corrosive if pH <7 and conductivity >400µS/cm	Corrosive if pH <5, Eh not neutral and conductivity >400µS/cm	Corrosive if pH <5 or >8 and Eh positive
Specific suite identified as relevant following site investigation						
Ethers	0.5	1	Pass	Pass	Pass	Pass
Nitrobenzene	0.5	0.4	Pass	Pass	Pass	Pass
Ketones	0.5	0.02	Pass	Pass	Pass	Pass
Aldehydes	0.5	0.02	Pass	Pass	Pass	Pass
Amines	Fail	Pass	Pass	Pass	Pass	Pass

REQUIREMENTS OF PARTIES WITHIN THE DEVELOPMENT PROCESS

Interested parties involved in the development process may use the data in different ways and there may be varying views and interpretation of the factual data. Local Authority staff may have a view on contamination and human health and the wider environment. The Environment Agency are concerned principally with the protection of Controlled waters. Building insurers, funders and purchasers may be primarily concerned with issues of potential commercial blight. Purchasers are also not always fully informed, and perceptions on issues associated with risk can affect the decision to purchase. Developers and construction organisations will focus on financial aspects of dealing with the contamination in the context of the development and construction programme.

RISKS & LIABILITIES FROM CONTAMINATION

In simple terms, risks associated with contamination may be considered in terms of 1) statutory risks and 2) development related risks. If contamination is severe or forms a potential hazard based on its potential to affect groundwater, surface water or human health, a statutory risk may be present, and as such, if the risk is not reduced, criminal proceedings may be instigated by a government body or local authority.

If the contamination is less severe or not considered to be mobile, it may be considered a commercial liability which could, in theory remain untreated, but which may at a later date affect the value of the property, or, with changing legislation, become a statutory risk. Commercial liabilities could give rise to civil proceedings by third parties if there are grounds for action.

♠Solmek conditions of offer, notes on limitations & basis for contract (ref: version1/2019)

These conditions accompany our tender and supercede any previous conditions issued. Solmek will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of Solmek. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from Solmek. A charge may be levied against such approval, the same to be made at the discretion of Solmek. Solmek was a trading name of Hymas Geoenvironmental Ltd.

Solmek cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. Solmek are not responsible for the action negligent of otherwise of subcontractors or third parties.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, ground gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Solmek cannot be held liable for any unrecorded or unforeseen obstructions between exploratory boreholes and trial pits. This includes instances where previous structures on the site (buried man made structures) or the presence of boulder clay (cobbles and/or boulder obstructions) have been anticipated. All types of piling operations should make allowance for obstructions within the construction budget to accommodate this. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2001 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, Solmek cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by Solmek in the course of investigation is the property of Solmek, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. Solmek reserve the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. The presence or otherwise of Japanese Knotweed or other invasive plants can be difficult to identify especially during winter months. If Japanese Knotweed or other invasive species are suspect, it should be confirmed by an ecologist. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning Solmek you understand and accept that you/your agent have a contractual relationship with Solmek & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Solmek are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete, and Solmek has not allowed for this. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming Solmek agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We reserve the right to pursue full payment of the invoice prior to release of any information including reports. We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. Solmek are exempt from the CIS Scheme. Solmek offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. Solmek are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by Solmek. Solmek give notice that consequential loss as a direct or indirect result of Solmek's activities or omission of the same are excluded.