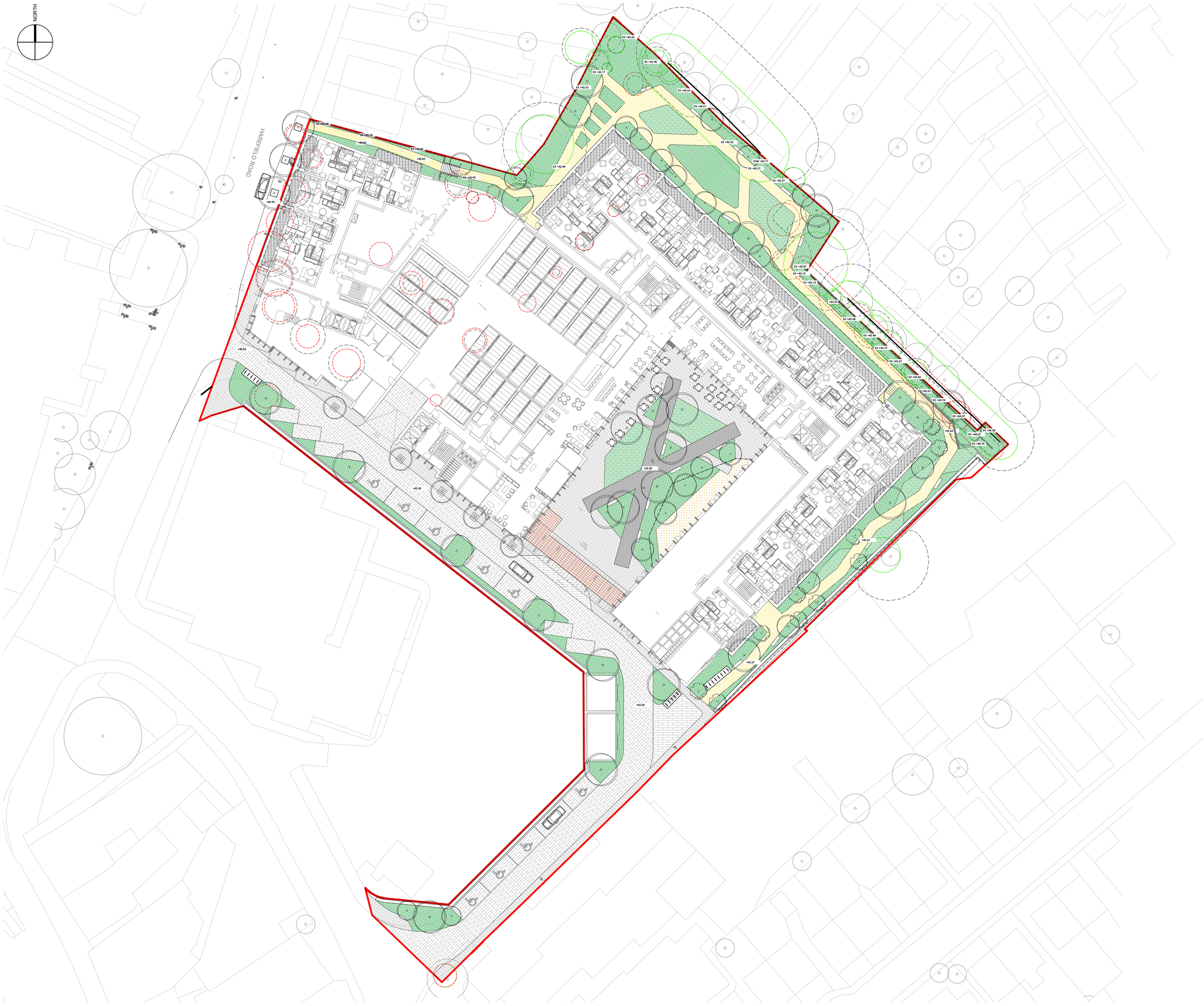


GENERAL NOTES.

This drawing remains the copyright of Andy Sturgeon Garden Design Limited.
All dimensions to be checked prior to commencement of any works, and/or preparation of any shop drawings on site.
Any dimensional discrepancies and alterations to be referred to the designer.

DO NOT SCALE FROM THIS DRAWING.

KEY

- Project Boundary
- Existing trees removed
- Existing trees retained
- Proposed Trees x58
- Proposed Multi-stem trees x10
- Paving type 1 - 693m2 Permeable
- Paving type 2 - Permeable
- Paving type 3 - 70m2
- Paving type 4 - 65m2 Permeable
- Paving type 5 - 175m2 Permeable
- Paving type 6 - Permeable
- Paving type 7 - Permeable
- Proposed Planting - 1252m2
- Feature hedge - 310lm
- Lawn - 217m2
- Retaining wall
- Proposed fence
- Proposed bench

Iss	Date	Issue notes	Drawn by	Checked by	Approved by
P03	13.08.20	Updated inline with architecture proposals	JW	EE	AS
P02	04.08.20	First Issue	EE	EE	AS
P01	30.06.20	First Issue	JW	EE	AS

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project no.	drawing no.	issue
596	_P_00_100	P03

client: Guild Living

project: Uxbridge

drawing: Ground Floor Masterplan

scale: 1:300@A1 1:600@A3

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 of 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 – EXPLORATORY HOLE LOGS

Trial Pit Log

Trialpit No **HDP01**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: - Level: 42.80	Date 19/10/2017
Location: Uxbridge		Dimensions (m): Depth 1.20	Scale 1:25
Client: Watkin Jones & Son			Logged CJ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES					MADE GROUND: Brown and light brown, clayey, gravelly, fine to coarse SAND. Gravel is subangular to rounded, fine to coarse of chert, brick, concrete and ceramic with a moderate proportion of root material present. Occasional subangular cobbles of brick and polystyrene. MADE GROUND
				1.20	41.60		End of pit at 1.20 m

Remarks: 1) Hand dug pit to 1.20m bgl for service clearance purposes. 2) Terminated in Made Ground. 3) No groundwater ingress encountered.

Stability:

Rotary Core Log

Borehole No. **TBH01**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		0.01	ES							MADE GROUND: Tarmacadam.
		0.20	ES				0.19	42.25		MADE GROUND
		0.50	DIST				0.50	41.94		MADE GROUND: Brown, slightly clayey, very sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including limestone. Occasional tarmacadam fragment.
		0.60	ES							MADE GROUND
		1.00	BULK							Very dense, light brown and brown, very sandy GRAVEL of subangular to well rounded, fine to coarse mixed natural lithologies including chert. A moderate to high proportion of subangular to rounded cobbles of mixed natural lithologies including chert.
		1.00	DIST							
		1.20	D							
		1.50	DIST							
		2.00	DIST							
		2.00	D							
		2.50	DIST							
		2.50	ES							
		3.00	D							
		3.00	DIST							
		3.00	BULK							
		3.50	DIST							
		4.00	D							
		4.00	DIST							
		4.50	DIST							
		5.00	DIST							
		5.00	D							
		5.50	DIST							
		6.00	ES							
		6.00	DIST							
		6.50	D							
		6.50	DIST				6.70	35.74		Firm to stiff consistency, brown (7.5YR, 4/3) with weak red (10R 5/3) and mottled light grey (2.5Y, 7/1) CLAY. LAMBETH GROUP
		7.00	ES							
		7.00	DIST							
		7.50	DIST							
		8.00	DIST				8.00	34.44		Very stiff consistency, light grey (2.5Y, 7/1) and mottled very dusky red (5R, 2.5/4) and light brown (7.5YR, 6/4), slightly sandy CLAY with rare clay stone. LAMBETH GROUP
		8.00	BULK							
		8.00	D							
		8.50	DIST							
		9.00	DIST							
		9.50	U							
		9.50	DIST							
		10.00	DIST							

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Rotary Core Log

Borehole No. **TBH01**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		10.50	DIST							
		11.00	DIST				11.00	31.44		Stiff consistency, brown (7.5YR, 5/2) and mottled light grey (7.5YR, 7.1), slightly sandy CLAY. LAMBETH GROUP
		11.00	D							
		11.50	DIST							*Becoming light grey (7.5YR, 7/1) and speckled brown (7.5YR, 5/4) from 11.50m bgl.*
		12.00	DIST							
		12.50	U				12.50	29.94		
		12.50	DIST							Very high strength, firm to stiff consistency, reddish brown (2.5YR, 4/3) and mottled dark reddish brown (2.5YR, 3/4) and grey (7.5YR, 5/1) slightly silty, slightly sandy CLAY. Fractures are medium to widely spaced, horizontal, smooth, planar. LAMBETH GROUP
		13.00	DIST							
		13.50	DIST							
		14.00	DIST							
		14.50	DIST							
	▼	15.00	DIST							*Becoming very stiff consistency from 15.00m bgl.*
		15.60 - 16.00	U							
		16.65 - 16.71	D							
		18.00 - 18.41	U							
							18.75	23.69		Reddish brown (5YR, 4/4), clayey, slightly silty, fine to medium SAND. LAMBETH GROUP
										No recovery between 19.43m and 20.19m bgl.

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Rotary Core Log

Borehole No. **TBH01**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		20.19 - 20.29	D							*Becoming soft consistency, sandy clay from 20.28m bgl with occasional subrounded gravel of claystone.*
							20.52	21.92		Weak strength, grey, thinly laminated CLAYSTONE. LAMBETH GROUP
		20.95 - 21.00	D							*Becoming firm consistency, light grey (5YR, 7/1) and mottled olive yellow (2.5YR, 6/6), silty clay from 20.63m bgl.*
							21.15	21.29		*Becoming very soft consistency from 21.00m to 21.15m bgl.*
		21.50 - 21.55	D							Very stiff consistency, reddish brown (5YR, 4/4) and mottled light grey (7.5R, 7/1), slightly silty CLAY. Fractures are closely to widely spaced, smooth planar, horizontal with occasional soft shell. LAMBETH GROUP
		22.00 - 22.38	U							
							22.66	19.78		No recovery between 22.66m and 23.15m bgl.
		23.15 - 23.22	D				23.15	19.29		Very stiff consistency, reddish brown (5YR, 4/4) and mottled bluish grey (GLEY2 5/1), very thinly laminated CLAY. LAMBETH GROUP
		23.41 - 23.76	D				23.41	19.03		Yellowish red (5YR, 4/6), clayey, silty, fine to medium SAND. LAMBETH GROUP
										A band of stiff consistency, slightly sandy clay from 23.76m to 23.87m bgl.
										No recovery between 24.00m and 24.71m bgl.
		25.00 - 25.32	D							*A band of firm consistency, sandy clay from 24.84m to 24.92m bgl.*
							25.87	16.57		Light olive brown (2.5Y, 5/6) and mottled grey (2.5Y, 5/1), fine to medium, clayey, silty fine to medium SAND. LAMBETH GROUP
		26.38 - 26.74	U							*Becoming very silty from 26.04m bgl.*
		26.95 - 27.00	D							*Becoming very stiff consistency, dark grey (10YR, 4/1) with olive brown (2.5Y, 4/4) mottling, slightly silty, slightly sandy clay from 26.38m bgl.*
							27.05	15.39		Very stiff consistency, light grey (GLEY1 N 7/) CLAY. Fractures are closely to widely spaced, planar, undulating, smooth, horizontal. LAMBETH GROUP
		27.54 - 27.85	U							
										Becoming very dark grey from 28.18m bgl.
		29.74 - 29.89	U							
							29.85	12.59		
							30.00	12.44		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Rotary Core Log

Borehole No. **TBH01**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							30.34	12.10		Very stiff consistency, very dark brown (10YR, 2/2), and mottled very dark grey (10YR, 3/1) CLAY. Gravel is angular to subangular, medium to coarse of flint. LAMBETH GROUP
							30.45	11.99		Firm consistency, dark bluish grey (GLEY2, 4/1), CLAY. LAMBETH GROUP
										Structureless CHALK composed of soft consistency, white and light grey (GLEY/N, 7/) clayey slightly gravelly SILT . Gravel is subangular of low density chalk with occasional small nodular flints. Grade Dm Putty Chalk. CHALK
										End of borehole at 30.45 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Borehole Log

Borehole No. **TBH01**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.01	ES		0.19	42.25		MADE GROUND: Tarmacadam.
		0.20	ES					MADE GROUND
		0.50	DIST		0.50	41.94		MADE GROUND: Brown, slightly clayey, very sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including limestone. Occasional tarmacadam fragment.
		0.60	ES					MADE GROUND
		1.00	BULK					Very dense, light brown and brown, very sandy GRAVEL of subangular to well rounded, fine to coarse mixed natural lithologies including chert. A moderate to high proportion of subangular to rounded cobbles of mixed natural lithologies including chert.
		1.00	DIST					
		1.20	D					
		1.20		0 (12,13/0 for 0mm)				
		1.50	DIST					
		2.00	D					
		2.00	DIST					
		2.00		0 (15,10/0 for 0mm)				
		2.50	DIST					
		2.50	ES					
		3.00	DIST					
		3.00	BULK					
		3.00	D					
		3.00		N=63 (11,/13,21,22,7)				
		3.50	DIST					
		4.00	D					
		4.00	DIST					
		4.00		50 (20,/50 for 225mm)				
		4.50	DIST					
		5.00	DIST					
		5.00	D					
		5.00		N=49 (11,12/11,12,14,12)				
		5.50	DIST					
		6.00	DIST					
		6.00	ES					
		6.50	DIST		6.70	35.74		Firm to stiff consistency, brown (7.5YR, 4/3) with weak red (10R 5/3) and mottled light grey (2.5Y, 7/1) CLAY.
		6.50	D					LAMBETH GROUP
		6.50		N=29 (9,11/10,7,6,6)				
		7.00	ES					
		7.00	DIST					
		7.50	DIST					
		8.00	BULK		8.00	34.44		Very stiff consistency, light grey (2.5Y, 7/1) and mottled very dusky red (5R, 2.5/4) and light brown (7.5YR, 6/4), slightly sandy CLAY with rare clay stone.
		8.00	DIST					LAMBETH GROUP
		8.00	D					
		8.00		N=16 (3,3/4,4,4,4)				
		8.50	DIST					
		9.00	DIST					
		9.50	DIST					
		9.50	U	Ublow=84				
		10.00	DIST					

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Borehole Log

Borehole No. **TBH01**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.50	DIST					
		11.00	D		11.00	31.44		Stiff consistency, brown (7.5YR, 5/2) and mottled light grey (7.5YR, 7.1), slightly sandy CLAY. LAMBETH GROUP
		11.00	DIST					
		11.00		N=46 (6,7/9,11,12,14)				
		11.50	DIST					*Becoming light grey (7.5YR, 7/1) and speckled brown (7.5YR, 5/4) from 11.50m bgl.*
		12.00	DIST					
		12.50	DIST		12.50	29.94		Very high strength, firm to stiff consistency, reddish brown (2.5YR, 4/3) and mottled dark reddish brown (2.5YR, 3/4) and grey (7.5YR, 5/1) slightly silty, slightly sandy CLAY. Fractures are medium to widely spaced, horizontal, smooth, planar. LAMBETH GROUP
		12.50	U	Ublow=94				
		13.00	DIST					
		13.50	DIST					
		14.00	DIST					
		14.50	DIST					
	▼	14.50		N=50 (17,/9,13,16,12)				
	▽	15.00	DIST					*Becoming very stiff consistency from 15.00m bgl.*
		15.60 - 16.00	U					
		16.65 - 16.71	D					
		18.00 - 18.41	U					
					18.75	23.69		Reddish brown (5YR, 4/4), clayey, slightly silty, fine to medium SAND. LAMBETH GROUP
								No recovery between 19.43m and 20.19m bgl.

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Borehole Log

Borehole No. **TBH01**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		20.19 - 20.29	D					
								Becoming soft consistency, sandy clay from 20.28m bgl with occasional subrounded gravel of claystone.
					20.52	21.92		Weak strength, grey, thinly laminated CLAYSTONE. LAMBETH GROUP
		20.95 - 21.00	D					*Becoming firm consistency, light grey (5YR, 7/1) and mottled olive yellow (2.5YR, 6/6), silty clay from 20.63m bgl.*
		21.00		N=50 (8,10/50 for 250mm)	21.15	21.29		*Becoming very soft consistency from 21.00m to 21.15m bgl.*
		21.50 - 21.55	D					Very stiff consistency, reddish brown (5YR, 4/4) and mottled light grey (7.5R, 7/1), slightly silty CLAY. Fractures are closely to widely spaced, smooth planar, horizontal with occasional soft shell. LAMBETH GROUP
		22.00 - 22.38	U					
					22.66	19.78		No recovery between 22.66m and 23.15m bgl.
		23.15 - 23.22	D		23.15	19.29		Very stiff consistency, reddish brown (5YR, 4/4) and mottled bluish grey (GLEY2 5/1), very thinly laminated CLAY. LAMBETH GROUP
		23.41 - 23.76	D		23.41	19.03		Yellowish red (5YR, 4/6), clayey, silty, fine to medium SAND. LAMBETH GROUP
		24.00		50 (25 for 130mm/50 for 100mm)				*A band of stiff consistency, slightly sandy clay from 23.76m to 23.87m bgl.*
								No recovery between 24.00m and 24.71m bgl.
		25.00 - 25.32	D					*A band of firm consistency, sandy clay from 24.84m to 24.92m bgl.*
					25.87	16.57		Light olive brown (2.5Y, 5/6) and mottled grey (2.5Y, 5/1), fine to medium, clayey, silty fine to medium SAND. LAMBETH GROUP
		26.38 - 26.74	U					*Becoming very silty from 26.04m bgl.*
		26.95 - 27.00	D					*Becoming very stiff consistency, dark grey (10YR, 4/1) with olive brown (2.5Y, 4/4) mottling, slightly silty, slightly sandy clay from 26.38m bgl.*
					27.05	15.39		Very stiff consistency, light grey (GLEY1 N 7/) CLAY. Fractures are closely to widely spaced, planar, undulating, smooth, horizontal. LAMBETH GROUP
		27.54 - 27.85	U					
								Becoming very dark grey from 28.18m bgl.
		29.74 - 29.89	U					
					29.85	12.59		
		30.00		N=50 (5,4/6,6,8,30)	30.00	12.44		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Borehole Log

Borehole No. **TBH01**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.44	Scale 1:50
Client: Watkin Jones & Son		Dates: 09/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					30.34 30.45	12.10 11.99		Very stiff consistency, very dark brown (10YR, 2/2), and mottled very dark grey (10YR, 3/1) CLAY. Gravel is angular to subangular, medium to coarse of flint. LAMBETH GROUP Firm consistency, dark bluish grey (GLEY2, 4/1), CLAY. LAMBETH GROUP Structureless CHALK composed of soft consistency, white and light grey (GLEY/N, 7/) clayey slightly gravelly SILT . Gravel is subangular of low density chalk with occasional small nodular flints. Grade Dm Putty Chalk. CHALK End of borehole at 30.45 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.1m bgl after 20 minutes. 5) Water strike at 15.00m bgl, rising to 14.80m bgl after 20 minutes. 6) Borehole terminated at target depth of 30.00bgl.

Rotary Core Log

Borehole No. **TBH02**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							0.30	42.41		MADE GROUND: Reinforced concrete slab. MADE GROUND
		0.50	ES							MADE GROUND: Very dark brown and black, ashy, gravelly, fine to medium SAND. Gravel is subangular, fine to coarse of brick and glass.
		0.80	D				0.85	41.86		MADE GROUND
		1.00	D							MADE GROUND: Soft consistency, dark brown and mottled light brown, sandy, gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of brick and glass.
		1.00	ES				1.20	41.51		MADE GROUND
		1.20	D							Light brown and brown, sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including flint and chert. A moderate to high proportion of subangular to rounded cobbles of mixed natural lithologies. LYNCH HILL GRAVEL MEMBER
		1.50	D							
		2.00	ES							
		2.00	D							
		2.50	D							
		3.00	D							
		3.50	D							
		4.00	D							
		4.50	D							
		5.00	D							
		5.00 - 6.00	B							
		5.50	D							
		6.00	D							
		6.50	D							*Becoming very sandy from 6.50m to 7.00m bgl.*
		7.00	D							
		7.50	D							
		8.00	D							
		8.50	D							
		9.00	D							
		9.50	D				9.20	33.51		Very soft consistency, dark greyish brown, silty, sandy to very sandy CLAY. LAMBETH GROUP
		9.50 - 10.50	B							
		10.00	D							

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Rotary Core Log

Borehole No. **TBH02**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		10.50	D				10.40	32.31		Very stiff consistency, light greenish grey (GLEY1, 6/1) and mottled weak red (10R, 5/4) and light reddish brown (2.5YR, 6/3), slightly sandy CLAY. Fractures are closely to widely spaced, smooth planar, smooth undulating, horizontal. LAMBETH GROUP
		11.00	D							
		11.50	D							
		12.00	D							
		12.50	U							*Becoming light bluish grey (GLEY 2 7/1) and brownish yellow (10YR, 6/6) with light reddish brown (2.5yr, 6/3) speckling from 12.50m bgl.*
		13.50	D							
		14.00	D							
		15.00	D							*Becoming soft to firm consistency from 15.00m to 15.58m bgl.*
		16.18 - 16.58	U				16.18	26.53		Very stiff consistency, reddish brown (5YR, 4/4), slightly mottled bluish grey (GLEY2, 6/1) CLAY. Fractures are widely spaced, smooth planar, horizontal. LAMBETH GROUP
										Becoming very soft consistency from 17.00m to 17.31m bgl.
		17.90 - 17.96	D							
		18.95 - 19.00	D							*Becoming dark reddish brown (2.5YR, 3/3), weak red (7.5YR, 5/4) and bluish grey (GLEY2, 6/1), very slightly sandy from 18.75m bgl.*
		19.35 - 19.46	D				19.21	23.50		Olive brown (2.5Y, 4/4), clayey, silty, fine SAND. LAMBETH GROUP
		19.60 - 19.91	U							*Becoming soft to firm consistency, silty, sandy clay from 19.64m bgl.*
							19.85	22.86		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Rotary Core Log

Borehole No. **TBH02**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
										Stiff consistency, yellowish red (5Y, 5/6), slightly sandy CLAY. LAMBETH GROUP
		21.00 - 21.32	U							
		21.40 - 21.50	D							*Claystone from 21.31m bgl.* *Becoming clayey, silty, fine sand from 21.40m bgl.*
		22.50 - 22.55	D				22.46	20.25		*Becoming firm consistency, sandy clay from 22.35m bgl.* Stiff consistency, reddish brown (5YR, 4/3) and mottled light bluish grey (GLEY2, 7/1) CLAY. LAMBETH GROUP
		23.44 - 23.82	U							*A band of very dark greyish brown (2.5Y, 3/2) clay from 23.00m to 23.24m bgl.*
		24.00 - 24.06	D				24.06	18.65		No recovery between 24.06m and 25.12m bgl.
		25.20 - 25.40	D				25.12	17.59		Stiff consistency, reddish brown (5YR, 4/3), slightly sandy CLAY. LAMBETH GROUP
							25.62	17.09		*Becoming clayey, silty, fine sand from 25.17m bgl.* No recovery between 25.62m and 26.24m bgl.
		26.50 - 26.60	D				26.24	16.47		Yellowish brown (10YR, 5/6) and mottled light greenish grey (GLEY1, 7/1), clayey slightly sandy SILT. Fractures are widely spaced, smooth undulating. LAMBETH GROUP
		26.80 - 26.85	D							*Becoming very stiff consistency clay from 26.74m bgl.*
		27.22	D							
		27.67	D							
		28.00 - 28.44	U				28.00	14.71		Very stiff consistency, dark bluish grey (GLEY2, 4/1) and mottled dark grey (GLEY1, 4/N), slightly silty CLAY. LAMBETH GROUP
		29.04 - 29.44	U							
							29.74	12.97		Firm consistency, dark greyish brown (2.5Y, 3/2)
							30.00	12.71		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Rotary Core Log

Borehole No. **TBH02**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description
				TCR	SCR	RQD				
										CLAY with rare subangular gravel of flint. Occasional organic matter observed. LAMBETH GROUP
										End of borehole at 30.00 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Borehole Log

Borehole No. **TBH02**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.30	42.41		MADE GROUND: Reinforced concrete slab. MADE GROUND
		0.50	ES					MADE GROUND: Very dark brown and black, ashy, gravelly, fine to medium SAND. Gravel is subangular, fine to coarse of brick and glass.
		0.80	D		0.85	41.86		MADE GROUND
		1.00	ES					MADE GROUND: Soft consistency, dark brown and mottled light brown, sandy, gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of brick and glass.
		1.00	D		1.20	41.51		MADE GROUND
		1.00		50 (21,/50 for 225mm)				Light brown and brown, sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including flint and chert. A moderate to high proportion of subangular to rounded cobbles of mixed natural lithologies. LYNCH HILL GRAVEL MEMBER
		1.20	D					
		1.50	D					
		2.00	ES					
		2.00	D					
		2.00		0 (25,/0 for 0mm)				
		2.50	D					
		3.00	D					
		3.00		N=50 (20,/15,15,17,3)				
		3.50	D					
		4.00	D					
		4.00		50 (19,/50 for 225mm)				
		4.50	D					
		5.00	D					
		5.00		N=40 (22,15/21,19,0,0)				
		5.00 - 6.00	B					
		5.50	D					
		6.00	D					
		6.50	D					*Becoming very sandy from 6.50m to 7.00m bgl.*
		6.50		N=50 (19,/12,13,13,12)				
		7.00	D					
		7.50	D					
		8.00	D					
		8.00		N=41 (14,/10,11,11,9)				
		8.50	D					
		9.00	D					
					9.20	33.51		Very soft consistency, dark greyish brown, silty, sandy to very sandy CLAY. LAMBETH GROUP
		9.50	D					
		9.50		N=24 (6,/5,5,7,7)				
		9.50 - 10.50	B					
		10.00	D					

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Borehole Log

Borehole No. **TBH02**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.50	D		10.40	32.31		Very stiff consistency, light greenish grey (GLEY1, 6/1) and mottled weak red (10R, 5/4) and light reddish brown (2.5YR, 6/3), slightly sandy CLAY. Fractures are closely to widely spaced, smooth planar, smooth undulating, horizontal. LAMBETH GROUP
		11.00 11.00	D	N=44 (7,/9,11,11,13)				
		11.50	D					
		12.00	D					
		12.50	U					*Becoming light bluish grey (GLEY 2 7/1) and brownish yellow (10YR, 6/6) with light reddish brown (2.5yr, 6/3) speckling from 12.50m bgl.*
		13.50	D					
		14.00 14.00	D	N=49 (11,/9,12,14,14)				
		15.00	D					*Becoming soft to firm consistency from 15.00m to 15.58m bgl.*
		16.18 - 16.58	U		16.18	26.53		Very stiff consistency, reddish brown (5YR, 4/4), slightly mottled bluish grey (GLEY2, 6/1) CLAY. Fractures are widely spaced, smooth planar, horizontal. LAMBETH GROUP
								Becoming very soft consistency from 17.00m to 17.31m bgl.
		17.90 - 17.96 18.00	D	N=52 (7,11/52 for 295mm)				
		18.95 - 19.00	D					*Becoming dark reddish brown (2.5YR, 3/3), weak red (7.5YR, 5/4) and bluish grey (GLEY2, 6/1), very slightly sandy from 18.75m bgl.*
		19.35 - 19.46	D		19.21	23.50		Olive brown (2.5Y, 4/4), clayey, silty, fine SAND. LAMBETH GROUP
		19.60 - 19.91	U					*Becoming soft to firm consistency, silty, sandy clay from 19.64m bgl.*
					19.85	22.86		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Borehole Log

Borehole No. **TBH02**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Stiff consistency, yellowish red (5Y, 5/6), slightly sandy CLAY. LAMBETH GROUP	
		21.00 - 21.32	U						21
		21.40 - 21.50	D					*Claystone from 21.31m bgl.* *Becoming clayey, silty, fine sand from 21.40m bgl.*	
									22
		22.50		N=50 (7,14/50 for 270mm)	22.46	20.25		*Becoming firm consistency, sandy clay from 22.35m bgl.*	
		22.50 - 22.55	D					Stiff consistency, reddish brown (5YR, 4/3) and mottled light bluish grey (GLEY2, 7/1) CLAY. LAMBETH GROUP	
		23.44 - 23.82	U					*A band of very dark greyish brown (2.5Y, 3/2) clay from 23.00m to 23.24m bgl.*	23
		24.00 - 24.06	D		24.06	18.65		No recovery between 24.06m and 25.12m bgl.	24
					25.12	17.59			25
		25.20 - 25.40	D					Stiff consistency, reddish brown (5YR, 4/3), slightly sandy CLAY. LAMBETH GROUP	
		25.50		N=50 (7,14/50 for 270mm)	25.62	17.09		*Becoming clayey, silty, fine sand from 25.17m bgl.* No recovery between 25.62m and 26.24m bgl.	26
					26.24	16.47		Yellowish brown (10YR, 5/6) and mottled light greenish grey (GLEY1, 7/1), clayey slightly sandy SILT. Fractures are widely spaced, smooth undulating. LAMBETH GROUP	
		26.50 - 26.60	D					*Becoming very stiff consistency clay from 26.74m bgl.*	27
		26.80 - 26.85	D						
		27.22	D						
		27.67	D						
		28.00 - 28.44	U		28.00	14.71		Very stiff consistency, dark bluish grey (GLEY2, 4/1) and mottled dark grey (GLEY1, 4/N), slightly silty CLAY. LAMBETH GROUP	28
		29.04 - 29.44	U						29
		29.50		N=50 (5,8/50 for 295mm)	29.74	12.97		Firm consistency, dark greyish brown (2.5Y, 3/2)	
					30.00	12.71			30
								Continued on next sheet	

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Borehole Log

Borehole No. **TBH02**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.71	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								CLAY with rare subangular gravel of flint. Occasional organic matter observed. LAMBETH GROUP
								End of borehole at 30.00 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Terminated at target depth of 30.00m bgl. 5) Water strike at 12.00m bgl, rising to 10.70m bgl after 20 minutes. 6) Water strike at 20.60m bgl, rising to 5.40m bgl after 20 minutes. 7) Loss of flush from 16.50m to 18.00m bgl (driller's log).

Rotary Core Log

Borehole No. **TBH03**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	B				0.20	42.25		MADE GROUND: Tarmacadam.
		0.30	ES							MADE GROUND
		0.50	D							MADE GROUND: Light brown, gravelly, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of brick, concrete and glass.
		1.00	D				1.00	41.45		MADE GROUND
		1.50	D							Light brown and brown, very sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including chert. A moderate to high proportion of subangular to subrounded cobbles of mixed natural lithologies. LYNCH HILL GRAVEL MEMBER
		2.00	D							
		2.00 - 3.00	B							
		2.50	D							
		3.00	D							
		3.50	D							
		4.00	D							
		4.50	D							
		5.00	D							
		6.00	D							
		6.00 - 7.00	B							
		6.50	D							
		7.50	D							
		8.00	D							
							8.30	34.15		Firm consistency, brown (10YR, 5/3), slightly silty, slightly sandy CLAY. LAMBETH GROUP
							9.00	33.45		Firm to stiff consistency, dark grey (10YR, 1/4), silty, sandy CLAY. LAMBETH GROUP
							9.40	33.05		Very stiff consistency, reddish grey (7.5R, 5/1), weak red (7.5R, 4/3) and reddish brown (5YR, 5/4), slightly sandy CLAY.
		9.50	D							
		9.50	U							

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Rotary Core Log

Borehole No. **TBH03**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
										LAMBETH GROUP
		10.50	D							
		11.00	D							
		11.00 - 12.00	B							
		12.00	D				12.00	30.45		Very stiff consistency, light reddish brown (5YR, 6/3) and mottled pinkish grey (5YR, 6/2) and yellow (10YR, 7/6), slightly sandy CLAY. LAMBETH GROUP
		12.50	D							
		12.50	U							
		13.50	D				13.50	28.95		Very stiff consistency, very pale brown (10YR, 7/4), light grey (10YR, 7/1), slightly sandy CLAY. Fractures are widely spaced, horizontal, smooth planar. LAMBETH GROUP
		14.00	D							*Becoming pale red (2.5YR, 6/2) and mottled dusky red (10R, 3/2) from 14.00m bgl.*
		15.00	D							*Light bluish grey (GLEY2, 7/1) motteling from 15.00m bgl.*
		15.22 - 15.30	D							
		15.27 - 15.66	U							
		17.00 - 17.08	D							
		17.53 - 17.98	U							
		19.00 - 19.42	U							
							19.32	23.13		Brown (7.5YR, 4/4), slightly silty, fine SAND. LAMBETH GROUP
		20.00 - 21.00	BULK							

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Rotary Core Log

Borehole No. **TBH03**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
										Becoming slightly clayey from 20.81m bgl.
		21.16 - 21.27	D							*Becoming slightly clayey, silty, fine sand from 21.05m bgl.*
							21.37	21.08		Stiff to very stiff consistency, dark reddish brown (5YR, 3/4) and mottled light reddish brown (5YR 6/4) and bluish grey , slightly sandy CLAY. Fractures are widely spaced, smooth planar and smooth undulating, horizontal to 45°. LAMBETH GROUP
		22.00 - 22.28	D							
		22.55 - 23.00	U							
		23.27 - 23.41	D				23.27	19.18		Brown (7.5YR, 5/3), and light brownish grey (10YR, 6/2), clayey, silty, fine SAND with occasional bands <10cm of firm to stiff consistency, slightly sandy CLAY. LAMBETH GROUP
		23.50 - 25.00	BULK							
							25.00	17.45		No recovery between 25.00m and 26.17m bgl.
										Becoming stiff consistency, slightly sandy clay from 25.50m bgl. (SPT at 25.00m bgl)
							26.17	16.28		Very stiff consistency, grey (5Y, 6/1), and mottled olive grey (5YR, 4/2), silty CLAY. LAMBETH GROUP
		26.54 - 27.00	U							
		27.15 - 27.20	D							*Becoming stiff consistency and sandy from 27.05m bgl.* *Becoming very stiff consistency clay from 27.10m bgl.*
		27.58 - 28.00	U							
		28.53 - 28.61	D							*Becoming bluish grey (GLEY2, 5/1) from 28.44m bgl.* *No recovery between 28.61m and 29.33m bgl.*
		29.31 - 29.77	U							*Angular to subangular, fine to coarse gravels of chalk and flint from 29.51m bgl.*
							30.00	12.45		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Rotary Core Log

Borehole No. **TBH03**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							30.45	12.00		*A 15mm band of very dark grey (GLEY 3/N) flint from 29.89m bgl.* Structureless CHALK composed of very soft consistency, light grey (GLEY1, 7/N) and light bluish grey (GLEY2, 8/1), silty, slightly gravelly CLAY. Gravel is subangular of low density chalk with occasional small nodular flints. Grade Dm Putty Chalk. LAMBETH GROUP

End of borehole at 30.45 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Borehole Log

Borehole No. **TBH03**

Sheet 1 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	B		0.20	42.25		MADE GROUND: Tarmacadam.
		0.30	ES					MADE GROUND
		0.50	D					MADE GROUND: Light brown, gravelly, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of brick, concrete and glass.
		1.00	D		1.00	41.45		MADE GROUND
		1.00		44 (20,/10,13,21,)				Light brown and brown, very sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including chert. A moderate to high proportion of subangular to subrounded cobbles of mixed natural lithologies. LYNCH HILL GRAVEL MEMBER
		1.50	D					
		2.00	D					
		2.00		N=50 (22,/15,17,16,2)				
		2.00 - 3.00	B					
		2.50	D					
		3.00	D					
		3.00		N=50 (14,/12,14,14,10)				
		3.50	D					
		4.00	D					
		4.00		50 (18,/50 for 225mm)				
		4.50	D					
		5.00	D					
		5.00		N=50 (19,/12,17,15,6)				
		6.00	D					
		6.00 - 7.00	B					
		6.50	D					
		6.50		N=50 (22,/13,16,18,3)				
		7.50	D					
		8.00	D					
		8.00		N=19 (6,/4,5,5,5)				
					8.30	34.15		Firm consistency, brown (10YR, 5/3), slightly silty, slightly sandy CLAY. LAMBETH GROUP
					9.00	33.45		Firm to stiff consistency, dark grey (10YR, 1/4), silty, sandy CLAY. LAMBETH GROUP
					9.40	33.05		Very stiff consistency, reddish grey (7.5R, 5/1), weak red (7.5R, 4/3) and reddish brown (5YR, 5/4), slightly sandy CLAY.
		9.50	U	Ublow=79				
		9.50	D					

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Borehole Log

Borehole No. **TBH03**

Sheet 2 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								LAMBETH GROUP	
		10.50	D						
		11.00	D						11
		11.00		N=48 (11,/11,11,12,14)					
		11.00 - 12.00	B						
		12.00	D		12.00	30.45		Very stiff consistency, light reddish brown (5YR, 6/3) and mottled pinkish grey (5YR, 6/2) and yellow (10YR, 7/6), slightly sandy CLAY. LAMBETH GROUP	12
		12.50	U	Ublow=100					
		12.50	D						13
		13.50	D		13.50	28.95		Very stiff consistency, very pale brown (10YR, 7/4), light grey (10YR, 7/1), slightly sandy CLAY. Fractures are widely spaced, horizontal, smooth planar. LAMBETH GROUP	
		14.00	D						14
		14.00		N=50 (18,/12,13,13,12)				*Becoming pale red (2.5YR, 6/2) and mottled dusky red (10R, 3/2) from 14.00m bgl.*	
		15.00	D					*Light bluish grey (GLEY2, 7/1) motteling from 15.00m bgl.*	15
		15.22 - 15.30	D						
		15.27 - 15.66	U						16
		16.50		N=54 (7,/10,15,10,19)					
		17.00 - 17.08	D						17
		17.53 - 17.98	U						
									18
		19.00 - 19.42	U						19
					19.32	23.13		Brown (7.5YR, 4/4), slightly silty, fine SAND. LAMBETH GROUP	
		20.00 - 21.00	BULK						20

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Borehole Log

Borehole No. **TBH03**

Sheet 3 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		21.00		N=45 (9,8/10,10,12,13)				*Becoming slightly clayey from 20.81m bgl.*
		21.16 - 21.27	D					*Becoming slightly clayey, silty, fine sand from 21.05m bgl.*
					21.37	21.08		Stiff to very stiff consistency, dark reddish brown (5YR, 3/4) and mottled light reddish brown (5YR 6/4) and bluish grey , slightly sandy CLAY. Fractures are widely spaced, smooth planar and smooth undulating, horizontal to 45°. LAMBETH GROUP
		22.00 - 22.28	D					
		22.55 - 23.00	U					
		23.27 - 23.41	D		23.27	19.18		Brown (7.5YR, 5/3), and light brownish grey (10YR, 6/2), clayey, silty, fine SAND with occasional bands <10cm of firm to stiff consistency, slightly sandy CLAY. LAMBETH GROUP
		23.50 - 25.00	BULK					
					25.00	17.45		No recovery between 25.00m and 26.17m bgl.
		25.50		N=69 (11,14/69 for 255mm)				*Becoming stiff consistency, slightly sandy clay from 25.50m bgl. (SPT at 25.00m bgl)*
					26.17	16.28		Very stiff consistency, grey (5Y, 6/1), and mottled olive grey (5YR, 4/2), silty CLAY. LAMBETH GROUP
		26.54 - 27.00	U					
		27.15 - 27.20	D					*Becoming stiff consistency and sandy from 27.05m bgl.* *Becoming very stiff consistency clay from 27.10m bgl.*
		27.58 - 28.00	U					
		28.53 - 28.61	D					*Becoming bluish grey (GLEY2, 5/1) from 28.44m bgl.* *No recovery between 28.61m and 29.33m bgl.*
		29.31 - 29.77	U					*Angular to subangular, fine to coarse gravels of chalk and flint from 29.51m bgl.*
		30.00		N=35 (4,3/4,7,12,12)	30.00	12.45		

Continued on next sheet

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Borehole Log

Borehole No. **TBH03**

Sheet 4 of 4

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type CP+RC
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 12/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					30.45	12.00		*A 15mm band of very dark grey (GLEY 3/N) flint from 29.89m bgl.* Structureless CHALK composed of very soft consistency, light grey (GLEY1, 7/N) and light bluish grey (GLEY2, 8/1), silty, slightly gravelly CLAY. Gravel is subangular of low density chalk with occasional small nodular flints. Grade Dm Putty Chalk. LAMBETH GROUP End of borehole at 30.45 m

31 32 33 34 35 36 37 38 39 40

Remarks

1) Terminated in natural strata. 2) Cable percussion from ground level to 15.00m bgl. 3) Rotary geo-bore from 15.00m to 30.00m bgl. 4) Water strike at 6.00m bgl, rising to 5.20m bgl after 2 minutes. 5) Loss of flush from ground level (driller's log).

Borehole Log

Tier Environmental

Borehole No. **TWS01**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.49	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.25	42.24		MADE GROUND: Reinforced concrete slab (5mm rebar)
		0.40	ES		0.36	42.13		MADE GROUND
					0.45	42.04		MADE GROUND: Light brown, sandy GRAVEL of subangular to subrounded, fine to coarse brick, concrete and natural lithologies.
		1.20	ES					MADE GROUND
					1.30	41.19		MADE GROUND: Dark orangey brown and brown, clayey, sandy GRAVEL of subangular to subrounded, fine to coarse brick and mixed natural lithologies including flint.
								MADE GROUND
								Orangey brown and light brown, clayey, sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including flint.
								LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.30 m

Remarks

1) Terminated at refusal in natural ground. 2) No groundwater ingress encountered. 3) Borehole stable. 4) Refusal on cobble of natural lithology.

AGS

Borehole Log

Borehole No. **TWS02a**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.39	Scale 1:50
Client: Watkin Jones & Son		Dates: 18/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.23	42.16		Hardstanding concrete. CONCRETE
					0.77	41.62		MADE GROUND: Soft consistency, yellowish brown and mottled dark greenish brown, silty, gravelly CLAY. Occasional cobbles of brick and glass. Gravels are subangular, fine to coarse of chert. MADE GROUND
								Lead pipe at 0.58m bgl.
								End of borehole at 0.77 m

Remarks

1) Terminated in hand dug pit in Made Ground. 2) Possible lead pipe at 0.58m bgl. 3) No groundwater ingress encountered. 4) Borehole stable. 5) Terminated due to possible service being located.

Borehole Log

Borehole No. **TWS03**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WLS
Location: Uxbridge		Level: 42.46	Scale 1:50
Client: Watkin Jones & Son		Dates: 18/10/2017 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.28	ES		0.17	42.29		Made Ground: Concrete Slab. CONCRETE
		0.31			0.25	42.21		Made Ground: Light orange brown very sandy GRAVEL of subangular ,medium to coarse natural lithologies. MADE GROUND
		0.60	ES		0.60	41.86		MADE GROUND: soft consistency slightly sandy gravelly CLAY. Gravel is subangular, fine to coarse of natural lithologies. MADE GROUND
					1.30	41.16		*Becoming stiff consistency from 0.30m bgl.* yellowish brown slightly silty, clayey GRAVEL. Gravel is angular to rounded, fine to coarse of natural lithologies including flint. LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.30 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Borehole stable. 4) Refusal on cobble of natural lithology.

Borehole Log

Borehole No. **TWS04**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.45	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.24	42.21		MADE GROUND: Reinforced concrete slab. (5mm rebar.)
		0.50	ES		0.44	42.01		MADE GROUND
		0.90	ES		0.76	41.69		MADE GROUND: Light brown, sandy GRAVEL of subangular to subrounded, fine to coarse brick, concrete, glass and natural lithologies. Occasional subangular cobbles of brick.
					1.50	40.95		MADE GROUND
								MADE GROUND: Firm consistency, greyish brown, sandy, gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of brick and mixed natural lithologies. Occasional wood fragment.
								MADE GROUND
								Orangey brown and brown, clayey, sandy GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including chert.
								LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.50 m

Remarks

1) Terminated in natural ground. 2) No groundwater ingress encountered. 3) Borehole stable. 4) No obvious hydrocarbon odour. 5) Refusal on cobble of natural lithology.

Borehole Log

Borehole No. **TWS05**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.41	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.11	42.30		MADE GROUND: Tarmacadam.
		0.30	ES		0.34	42.07		MADE GROUND
		0.40	ES					MADE GROUND: Greyish brown, sandy GRAVEL. Sand is fine to coarse with gravels comprised of chert. Occasional medium gravel sized brick.
		0.70	ES		0.59	41.82		MADE GROUND
					0.79	41.62		MADE GROUND: Dark reddish brown, clayey, sandy GRAVEL of fine to coarse natural lithologies including chert. Occasional cobble sized brick.
					1.62	40.79		MADE GROUND
					1.98	40.43		MADE GROUND: Greenish brown, sandy, clayey GRAVEL of fine to coarse natural lithologies with some medium grained gravels of brick fragments.
		2.30	ES		2.33	40.08		MADE GROUND
								MADE GROUND: Soft consistency, dark greyish brown to orangey brown, silty, gravelly CLAY. Gravel is fine to coarse of natural origin with flint, chalk, coal and glass. Rare (3cm) pieces of fresh root present.
								MADE GROUND
								MADE GROUND: Stiff consistency, dark brown to orangey brown, silty, gravelly CLAY. Gravel is fine to coarse of natural lithologies with coal and rare pieces of brick. Rare roots (2cm) present.
								MADE GROUND
								Greyish brown to orangey brown, clayey GRAVEL of angular to very angular, fine to coarse natural lithologies including chert and flint.
								LYNCH HILL GRAVEL MEMBER
								End of borehole at 2.33 m

Remarks

1) Terminated in natural strata. 2) Water strike at 2.00 bgl, 3) Borehole stable. 4) Refusal on cobble of natural lithology.

Borehole Log

Borehole No. **TWS06**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.76	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By CJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.69	42.07		MADE GROUND: Dark brown, clayey, sandy GRAVEL of subangular to subrounded, fine to coarse mixed natural lithologies. Rare plastic and brick. A moderate proportion of root material. MADE GROUND End of borehole at 0.69 m

Remarks

1) Concrete obstruction at 0.69m bgl. Hole terminated and relocated.

Borehole Log

Borehole No. **TWS06a**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.33	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES		0.09	42.24		MADE GROUND: Tarmacadam. MADE GROUND
					0.84	41.49		MADE GROUND: Light greyish brown and reddish grey, very sandy GRAVEL of subangular, fine to coarse brick, limestone, sandstone and chert. Occasional subangular cobbles of brick. MADE GROUND
					1.32	41.01		Light brown and orangey brown, clayey, sandy GRAVEL of subangular to rounded, fine to coarse natural lithologies including flint. LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.32 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Borehole stable. 4) Refusal on cobble of natural lithology.

Borehole Log

Borehole No. **TWS07**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.33	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES		0.12	42.21		MADE GROUND: Tarmacadam. MADE GROUND
		0.70	ES		0.56	41.77		MADE GROUND: Greenish brown, silty, sandy GRAVEL of fine to coarse, angular to subrounded brick and natural lithologies including flint. MADE GROUND
					0.93	41.40		*Becoming more sandy with higher proportion of gravels from 0.53m to 0.56m bgl.*
					1.40	40.93		MADE GROUND: Dark brown, slightly sandy gravelly CLAY. Gravel is angular to subangular, fine to coarse of brick, natural lithologies including flint and rare root material. MADE GROUND
								Stiff consistency, yellowish brown, slightly sandy, gravelly CLAY. Gravel is angular to subangular, fine to coarse of natural lithologies including flint. LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.40 m

1 2 3 4 5 6 7 8 9 10

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Borehole stable. 4) Refusal on cobble of natural lithology.

Borehole Log

Borehole No. **TWS08**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.41	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.09	42.32		MADE GROUND: Tarmacadam. MADE GROUND
		0.60	ES					MADE GROUND: Light brown, very sandy GRAVEL of subangular, fine to coarse brick, concrete, ceramic, plastic and rare pieces of metal and wood. Occasional subangular cobbles of brick and natural lithologies.
					1.05	41.36		MADE GROUND
					1.25	41.16		Light brown and orangey brown, sandy, slightly clayey GRAVEL of subangular to rounded, fine to coarse mixed natural lithologies including flint. Occasional subangular to subrounded cobbles of chert. LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.25 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Borehole stable. 4) Refusal on cobble of natural lithology.

Borehole Log

Tier Environmental

Borehole No. **TWS09**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.42	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.10	42.32		MADE GROUND: Tarmacadam. MADE GROUND
		0.60	ES		0.49	41.93		MADE GROUND: Greyish brown, clayey, sandy GRAVEL of subangular to subrounded, fine to coarse brick and natural lithologies including flint. MADE GROUND
					0.99	41.43		MADE GROUND: Orangey brown, clayey, sandy GRAVEL of angular to subangular, fine to coarse natural lithologies with a moderate proportion of subangular cobbles of flint. MADE GROUND
					1.20	41.22		Greyish brown, very clayey, sandy GRAVEL of angular to rounded, fine to coarse natural lithologies including flint. LYNCH HILL GRAVEL MEMBER *Becoming dark orangey brown from 1.17m bgl.* End of borehole at 1.20 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Window sample refusal in base of hand dug pit.

AGS

Borehole Log

Borehole No. **TWS10**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.56	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.06	42.50		MADE GROUND: Brick.
		0.30	ES		0.15	42.41		MADE GROUND
					0.47	42.09		MADE GROUND: Orangey brown, coarse SAND.
								MADE GROUND
								MADE GROUND: Greyish brown, sandy GRAVEL of angular to subangular, fine to coarse brick and natural lithologies.
								MADE GROUND
					1.28	41.28		Dark orangey brown, clayey, very sandy GRAVEL of fine to coarse, subangular to subrounded mixed natural lithologies including flint.
								LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.28 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Window sample refusal in dense gravel.

Borehole Log

Borehole No. **TWS11**

Sheet 1 of 1

Project Name: Harefield Road, Uxbridge	Project No. TE1044	Co-ords: -	Hole Type WS
Location: Uxbridge		Level: 42.49	Scale 1:50
Client: Watkin Jones & Son		Dates: 19/10/2017 -	Logged By NG

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.10	42.39		MADE GROUND: Tarmacadam.
		0.50	ES		0.22	42.27		MADE GROUND
					0.64	41.85		MADE GROUND: Greyish brown, slightly sandy, clayey GRAVEL of subangular to subrounded, fine to coarse natural lithologies and rare pieces of brick.
					1.30	41.19		MADE GROUND
								MADE GROUND: Dark orangey brown, clayey, sandy GRAVEL of angular to subangular, fine to coarse mixed natural lithologies and rare pieces of brick.
								MADE GROUND
								Becoming orangey brown from 0.45m with occasional subangular cobbles of flint.
								Greyish brown, clayey, very sandy GRAVEL of subangular to subrounded, fine to coarse flint and other natural lithologies. Occasional cobbles of subrounded flint.
								LYNCH HILL GRAVEL MEMBER
								End of borehole at 1.30 m

Remarks

1) Terminated in natural strata. 2) No groundwater ingress encountered. 3) Window sample refusal in dense gravel.

APPENDIX D – PHOTOGRAPHS TAKEN DURING SITE WALKOVER AND INVESTIGATION

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH01
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		BOX 1



From: 15.00m bgl

To: 18.00m bgl



From: 18.00m bgl

To: 21.00m bgl

Photographed By Callum Jones		Date	11/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH01
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		BOX 3/4



From: 21.00m bgl

To: 24.00m bgl



From: 24.00m bgl

To: 27.00m bgl

Photographed By Callum Jones	Tier Consult	Date	12/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH02
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		BOX 1



From: 15.00m bgl

To: 18.00m bgl



From: 18.00m bgl

To: 21.00m bgl

Photographed By Callum Jones		Date	16/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH02
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		BOX 1



From: 15.00m bgl

To: 18.00m bgl



From: 18.00m bgl

To: 21.00m bgl

Photographed By Callum Jones		Date	16/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH02
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		



From: 21.00m bgl

To: 24.00m bgl



From: 27.00m bgl

To: 30.00m bgl

Photographed By Callum Jones		Date	17/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH03
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		BOX 1



From: 15.00m bgl

To: 18.00m bgl



From: 18.00m bgl

To: 21.00m bgl

Photographed By Callum Jones		Date	18/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH3
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		



From: 21.00m bgl

To: 24.00 bgl



From: 24.00m bgl

To: 27.00 bgl

Photographed By Callum Jones		Date	19/10/2017

Project Name	Harefield Road, Uxbridge	Photographic Record	Borehole ID
Project No.	TE1044		TBH03
Engineer	Callum Jones		Plate No.
Client	Watkin Jones		



From: 27.00m bgl

To: 30.00m bgl

From:

To:

Photographed By Callum Jones		Date	19/10/2017

APPENDIX E – DEFINITION OF SOURCE PROTECTION ZONES AND GROUNDWATER VULNERABILITY ASSESSMENTS

Source Protection Zones

Source Protection Zones (SPZs) are defined by the Environment Agency (for England and Wales), SEPA (Scotland) and the Environment and Heritage Service (Northern Ireland) for groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area. The size and shape of a zone depends upon subsurface conditions, how the groundwater is removed, and other environmental factors.

SPZs are classified into four categories:

- **Zone 1 (Inner protection zone).** Any pollution that can travel to the abstraction point within 50 days from any point within the zone is classified as being inside Zone 1. This applies at and below the groundwater table. This zone also has a minimum 50 m protection radius around the abstraction point. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.

- **Zone 2 (Outer protection zone).** The outer zone covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area, whichever area is the largest. This travel time is the minimum period over which the Environment Agency considers that pollutants need to be diluted, reduced in strength or delayed by the time they reach the abstraction point.

- **Zone 3 (Total catchment).** This is the total area needed to support removal of water from the abstraction point, and to support any discharge from this.

- **Zone of special interest.** This may occasionally be defined as a special case. This is usually where local conditions mean that industrial sites and other potential sources of contamination could affect the groundwater source, even though they are outside the normal catchment area.

Groundwater Vulnerability Assessments

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

The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different type of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.

- Bedrock -solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Table 1. Aquifer Classification ("Geological Classification").

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

APPENDIX F – 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 G – ASSESSMENT CRITERIA APPLIED FOR GROUND GAS

Monitoring for the following is generally performed as part of ground gas assessment:

- Methane (CH_4): an odourless, flammable gas. Mixtures of methane with air containing between 5 and 15% v/v methane are explosive.
- Carbon dioxide (CO_2): an asphyxiant at elevated concentrations. Denser than air, it can accumulate in excavations, and within low points inside buildings
- Oxygen (O_2): important in the assessment of the potential formation of explosive mixtures with methane. Monitoring normally measures both methane and oxygen concentrations in ground gas to derive an indication of the risk of explosive mixture formation, expressed as a percentage of the Lower Explosive Limit (LEL). Low concentrations of oxygen in ground gas can also exacerbate the risk of CO_2 asphyxiation.
- Hydrogen sulphide (H_2S): odorous and toxic, capable of forming flammable mixtures with air.
- Volatile Organic Compounds (VOCs): present as chemical contaminants of soil and sometimes also biologically produced in low concentrations.

Assessment of methane (CH_4) and carbon dioxide (CO_2)

Methane and CO_2 can arise from natural geological sources, mine workings, rotting organic matter (peat, landfilled materials, etc.) and/or contaminant biodegradation. Assessment of ground gas composition and flows is therefore an essential part of site assessment. The need to adequately address potential risks from ground gas on development sites is therefore required under the planning regime.

In order to appropriately assess the site risks, the Construction Industry Research and Information Association (CIRIA) and others have issued several guidance documents on landfill and ground gas that are intended to provide advice on how to investigate and deal with gas contaminated ground with respect to development. These are:

- Report 149: ‘Protecting Development from Methane’ (CIRIA, 1995a)
- Report 150: ‘Methane Investigation Strategies’ (CIRIA, 1995b)
- Report 151: ‘Interpreting Measurement of Gas in the Ground’ (CIRIA, 1995c)
- Report 152: ‘Risk Assessment for Methane and Other Gases from the Ground’ (CIRIA, 1995d)

More recent guidance has been published to update the documents detailed above to collaborate and promote industry ‘good practice’. These are:

- CIRIA Report 665: ‘Assessing risks posed by hazardous ground gases to buildings (CIRIA, 2008)
- NHBC: ‘Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present’ (NHBC, 2007)
- •BS8485: Code of Practice for the characterisation and remediation from ground gas in affected developments (BSI Group, 2007)

The earlier CIRIA 149 approach is now considered to be too conservative. A more realistic measure of the risk posed by methane and CO_2 in ground gas can be established by determining an appropriate Gas Screening Value (GSV), using the methods described in the NHBC and CIRIA 659 documents. These values are based upon earlier work undertaken by Wilson and Card (1999).

GSVs are calculated by multiplying the borehole flow rate (l/hr) by the percentage (% v/v) concentration in the gas stream of the specific component, i.e.:

GSV = (Concentration / 100) x Flow rate.

A risk-based methodology for deriving GSVs is defined for two situations (designated A and B), which are adequate for the great majority of site cases:

- Situation A: All development types except low rise housing with gardens
- Situation B: Low rise housing with gardens.

Under Situation A, classification of the scope of protection required is determined from the site GSV, summarised in Table 1. For Situation B, GSVs derived are used in a 'Traffic Light' classification (summarised in Table 2) which determines the required level and scope of protection measures. Tables 1 and 2 are summaries only: the details provided in the body text, footnotes and appendices of the above-referenced documents should be read in conjunction with the results to determine the appropriate level of protection.

For conservatism, Tier Environmental uses the maximum concentration and gas flow rate of methane detected in any borehole during all of the monitoring visits in deriving recommendations on appropriate protection measures. This represents the worst-case risk of forming an explosive mixtures. For CO_2, steady state concentrations and flow data are applied, as these determine the development of an asphyxiating mixture. All values are selected whether or not they occurred in the same borehole or during the same monitoring event.

Exceedences of the maximum concentrations used in a Tier 1 Gas Risk Assessment can be tolerated, when the conceptual model indicates that it is safe to do so. However, GSV values must never be exceeded - where site-specific circumstances permit the derivation of alternative GSVs according to the defined conceptual model, then the appropriate GSV values should be applied.

Table 1. GSV Categories Defined for Situation A (Summarised from CIRIA Report 665).

Risk classification	GSV (CH_4 or CO_2; l/hr)	Additional factors	Characteristic situation
Very low	<0.07	Typically methane <=1% and/or CO_2 <=5%, otherwise consider increase to Low Risk.	1
Low	<0.7	Typically borehole ground gas flow rate <=70 l/hr; otherwise consider increase to Moderate Risk.	2
Moderate	<3.5	---	3
Moderate to high	<15	QRA required to evaluate scope of remediation measures.	4
High	<70	---	5
Very high	>70	---	6

Table **2.** GSV Categories Defined for Situation B (Summarised from NHBC, 2007).

Methane		CO_2		"Traffic light" classification
Typical max. conc. (% v/v)	**GSV (l/hr)**	**Typical max. conc. (% v/v)**	**GSV (l/hr)**	
				Green
1	0.13	5	0.78	
5	0.63	10	1.60	Amber 1
20	1.60	30	3.10	Amber 2
				Red

Assessment of hydrogen sulphide (H_2S)

H_2S is toxic and highly odorous ("rotten eggs") gas. It is often a minor component within mine gases, in ground gas within or overlying strata rich in pyrites or other sulphide-rich ores, and in most natural gas fields.

H_2S can be generated biologically in significant concentrations by the decomposition by sulphate-reducing bacteria of natural or anthropogenic organic matter under oxygen-free conditions. Its potential generation will be greater in environments containing elevated sulphate concentrations (including sea water). H_2S is therefore common within the gas arising from estuarine and marine sediments, pond sediment, stagnant water bodies, bogs and marshlands and landfilled waste, for example.

It must be noted that H_2S normally occurs together with other potentially hazardous ground gases. The measures adopted for protection against these will prove equally protective against H_2S.

There are no standards by which H_2S concentrations in ground gas can be assessed directly. Therefore, the significance of measured H_2S concentrations in ground gas must be evaluated on a case-by-case basis, taking into account the measured concentrations of other components and the specific conceptual site and exposure models. To assist in this process, the following standards and guidance may be applied.

General protection of land users

There are no UK air quality standards for general exposure to H_2S. The World Health Organisation has derived ambient air quality standards (WHO, 2000) for this gas, which may be used to inform risk assessment and decision-making:

- The 24 hour average exposure guideline value for ambient air: 0.15 mg/m^3 (0.1 ppmv, approx.; this was derived by the application of a 100x safety factor to the LOAEL for long-term exposure).
- This is significantly above the odour threshold, which is typically around 0.01 mg/m^3. To avoid substantial nuisance odour complaints, WHO (2000) recommends that the 30 minute average H_2S concentration in ambient air should not exceed: 0.007 mg/m^3 (0.005 ppmv, approx.).

Occupational exposures

For occupational exposure, the HSE (2005) limits for H_2S are applicable:

- 8 hour time weighted average occupational exposure limit: 5 ppmv (7 mg/m^3).
- Short-term exposure limit (15 minute reference period): 10 ppmv (14 mg/m^3).

Assessment of VOC data

The assessment of VOC concentrations is not covered by above-referenced reports. These data can be used to inform the human health risk assessment for site occupants but should not be relied upon to assess human health risk due to uncertainties in the ground gas flow regime, variability in the (generally low) contaminant concentrations measured and inaccuracies in the concentrations measured by PID instruments.

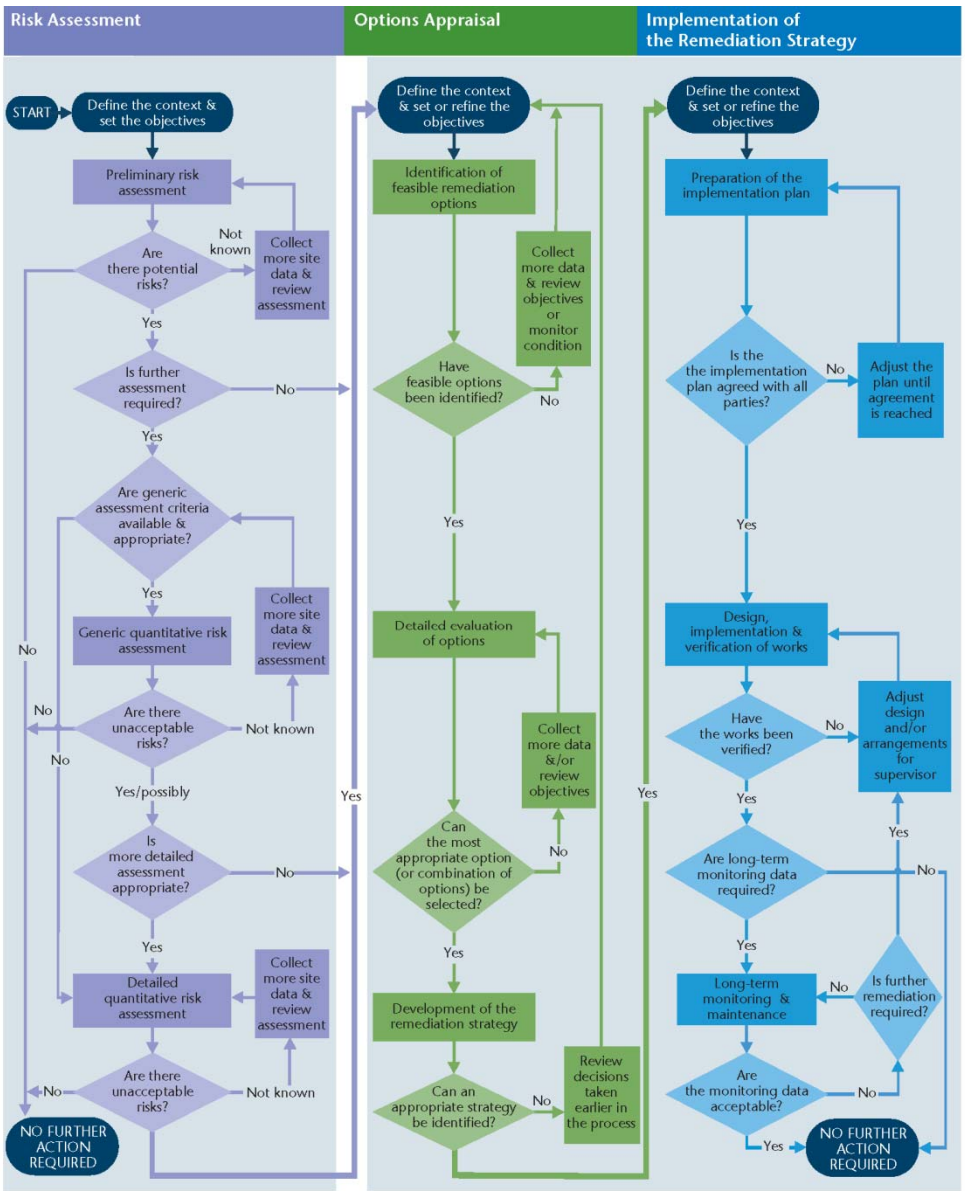
Data on the VOC concentration in ground gas can also help inform potential occupational exposure risks to construction and similar workers. For this purpose, the measured values can be compared to the relevant occupational exposure limit (OEL) for the contaminant(s) of concern, as given in HSE (2005). In cases of doubt as to the identity of the organic contaminants within the ground gas or when these are present as a complex mixture, then the 8 hour time-weighted average (TWA) exposure limit for benzene (1 ppmv) will be applied for screening purposes. This is a reasonably conservative approach since the OEL for benzene is lower than that for the great majority of organic contaminants commonly encountered in soil and groundwater at contaminated sites

APPENDIX H – HUMAN HEALTH 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”.

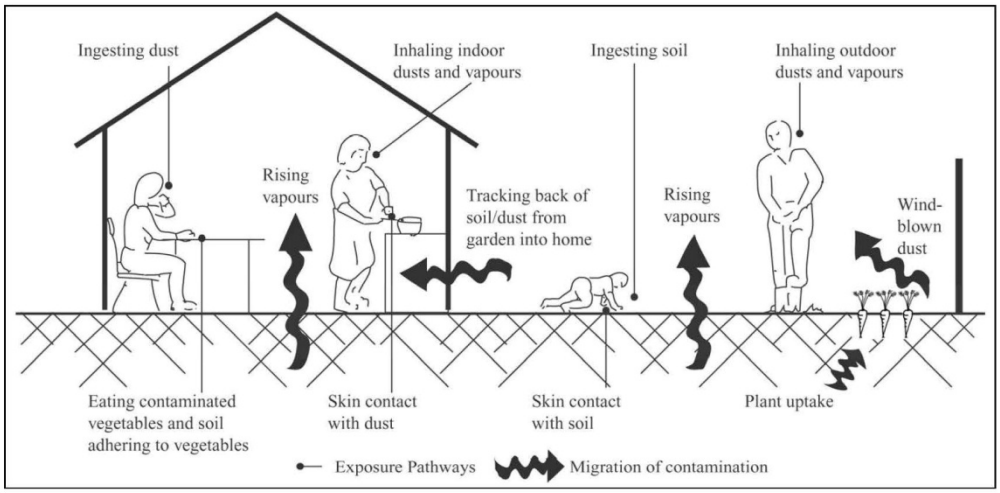
Some form of Detailed Quantitative Risk Assessment (DQRA) will be essential for those cases where appropriate GAC values cannot be established for the contaminant linkages under consideration.

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**
  - Outdoor soil;
  - Indoor dust;
  - Home grown produce;
  - Soil attached to home grown produce.
- **Dermal Contact**
  - Outdoor soil;
  - Indoor dust.
- **Inhalation**
  - Outdoor dust;
  - Indoor dust;
  - Outdoor vapour;
  - 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 dependant 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 pathway 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 pathway 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 polychlriniated 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:

  - Family visits and picnics;
  - Children's play area;
  - Sporting activities such as football on an informal basis (i.e no a dedicated sports pitch); and
  - 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 Suitable 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 Suitable 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 (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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%	
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)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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%**	
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)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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%	
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(283)	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)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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%**	
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,tetrachloroethane	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)

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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%	
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)

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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%**	
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)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
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%	
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 I – CONTROLLED WATERS RISK ASSESSMENT

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Regulatory Context

Government policy is based upon a "suitable for use approach," which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

"any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) Pollution of controlled waters is being, or is likely to be, caused."

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

"the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter"

Controlled Waters are defined Section 104 of the Water Resources Act 1991. They include in summary: Relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured.

The Environment Agency has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land. This is reinforced in The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process, rather than Local Authority or Environment Agency directly, except in cases of very high pollution risk or where harm is occurring. In the planning process, guidance is provided by National Planning Policy Framework (NPPF) of March 2012. The NPPF requires that a site which has been developed shall not be capable of being determined "contaminated land" under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be agreed with the planners.

Environment Agency Guidance

The Environment Agency's stance on groundwater resources is:

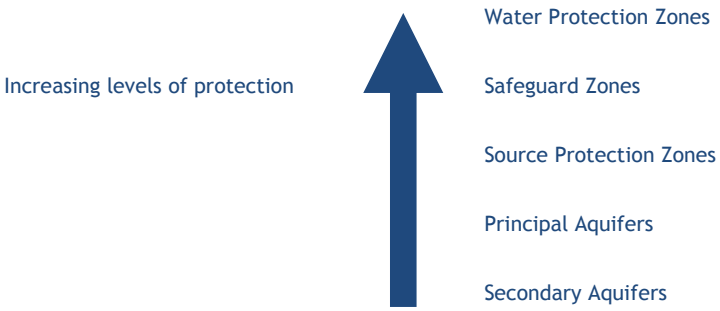
"to protect and manage groundwater resources for present and future generations in ways that are appropriate for the risks we identify" (Groundwater Protection: Policy and Practice GP3, 2012).

At present, the legislation and guidance pertaining to the protection of controlled waters in the UK is complex; however, the core objectives seek to enforce the position given above.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document introduced areas of focus for developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was revised in 1998, since which there have been substantial changes in legislation, driven by key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Gaps in the 1998 PPPG that emerged as the result of further legislative changes were addressed in the Environment Agency Policy document *Groundwater Protection: Policy and Practice (GP3), Version 1* of November 2012. The three main parts of GP3 were:

- Groundwater principals;
- Position statements and legislation; and
- Technical information.

The Environment Agency has a tiered risk based approach to drinking water protection as summarised below:



Controlled Waters Risk Assessment

A number of tools are available (as detailed in GP3) in order for a developer of a potentially contaminated site to fulfil their obligations under the legislation. A site assessment would be required in order to identify any potential risks to controlled waters and to derive suitable clean up criteria, if required, to ensure the protection of controlled waters.

There are three main stages to any risk assessment of controlled waters:

1) Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting, controlled waters context etc)

2) Generic Risk Assessment (EA Remedial Targets Methodology Tier 1 / Comparison of groundwater data with relevant standards)

3) Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, EA Remedial Targets Methodology Tiers 2 & 3)

Risk Screening

Here, the Conceptual Site Model (CSM) is a critical tool to assessing any potentially contaminated site. The information from a robust CSM can be used to establish any pathways or receptors that do not require further assessment at an early stage. For example, it may be possible to confirm the absence of a particular sensitive controlled water receptor (such as a surface water feature) within the vicinity of the Site thereby breaking the associated source-pathway-receptor pollutant linkage. Information from subsequent tiers of risk assessment, such as following intrusive investigations, are used to update the CSM accordingly.

Generic Risk Assessment - England and Wales

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with those screening criteria. Values of screening criteria with which chemical test results can be compared are published in the following:

- EQS Directive 2008/105/EC
- Priority Substances Directive 2013/39/EU
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- UK Drinking Water Standards (UK DWS)
- World Health Organisation (WHO Guidelines) for Drinking Water Quality
- Council Directive 98/83/EC on the quality of water intended for human consumption (Drinking water directive)

Generic Risk Assessment is generally undertaken via comparison of reported leachate and/or groundwater concentrations against selected assessment criteria for the potential contaminants of concern identified for the Site from a preliminary desk based assessment.

The selected Generic Assessment Criteria (GAC) derived from a Water Quality Standard (WQS) for any specific substance may not necessarily be a simple number and can often be found to be expressed as:

- Annual mean concentration;
- Maximum allowable concentration;
- 95th percentile concentration for *n* samples;
- Total concentration;
- Dissolved concentration (applicable to filtered samples)

The values may sometimes be expressed for individual substances (e.g. arsenic or for groups of substances e.g. total xylenes or sums of certain PAHs).

Environmental Quality Standards (EQS) have been used where available for Priority Substances and Priority Hazardous Substances set at a European level:

- Priority Substances Directive 2013/39/EU;
- Amending 2008/105 and 2000/118/EC

In addition, EQS values derived for Specific Pollutants have been used as presented in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

For assessing risks to potable water abstraction supplies, UK Drinking Water Standards presented in the Water Supply (Water Quality) Regulations 2000 (SI/2000/3184) (as amended) have been applied.

In selecting a GAC for a particular Site, Tier Environmental considers the following factors:

- Current use/function of the groundwater (e.g. drinking water, irrigation water, industrial use, base-flow to rivers and streams);
- Plausible, proposed or planned future uses of the water and nearby waters;
- Sensitivity of the critical receptor (e.g. human health, aquatic life); and,
- Requirements to trigger action under the legal context

In accordance with Part 2A:

"in deciding whether pollution of controlled waters is occurring, the assessor will have regard to all of the water quality standards that are relevant to the specific site and make a judgment against the most stringent of those relevant standards".

Please note that there is no quantitative criterion for total petroleum hydrocarbons (TPH), or speciated TPH fractions. Historically, standards provided for petroleum hydrocarbons ranges from 10µg/l (Private Water Supply Regulations 1991, removed from the 2009 regulations) to 50µg/l-1000µg/l (Surface Waters (Abstraction for Drinking Water) Regulations 1989) which related to the degree of treatment of water prior to use as drinking water. Over time, the legislative standards have been rescinded and no alternative standard provided, although the Environment Agency planned to release speciated TPH criteria (Fretwell et al., 2009). In the

absence of suitable criteria, Tier Environmental adopts a value of 10 µg/l for more sensitive locations (e.g. Principal Aquifer, drinking water abstraction), and a value of 50µg/l for locations considered less sensitive (e.g. low permeability aquifers) or where a site is located in close proximity to a surface watercourse.

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;
- To carry out more investigation, sampling and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be informed by the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The robust CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or compliance point. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Aquifer Designations

The Environment Agency have classified different types of aquifer from which groundwater can be extracted. The aquifer designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different type of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock -solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

APPENDIX J – ENGINEER'S FIELD TESTING

Samples for field testing were selected by a representative of Tier Environmental during the site investigation works in accordance with the sampling specification presented elsewhere in this report.

Field testing for geotechnical parameters

In situ Standard Penetration Tests (SPTs) were also carried out throughout the full depth of the cable percussive boreholes using either a split spoon sampler or a 60° solid cone. These tests assess the relative density of granular soils encountered and indicate the undrained shear strength of cohesive soils or the strength of rock. The results of these tests are shown as 'N' values and can be found adjacent to the appropriate sample level on the exploratory hole records in Appendix C.

Hand shear vane testing was also undertaken, where required, to establish the undrained shear strength of cohesive soils within trial pits. Testing was performed, when safe to do so, at shallow depth (<1.0 m) within the trial pit or upon intact samples collected within the digger bucket. Where possible a set of at least 3 No. tests was performed at each depth.

In order for stratum descriptions to comply with BS EN ISO 14688 and 14689, the Engineer performs the following assessment of soil properties in the field.

- Determination of consistency (BS EN ISO 14688 Part 1 Section 5.14);
- Assessment of dry strength (BS EN ISO 14688 Part 1 Section 5.6);
- Shear strength (BS EN ISO 14688 Part 2 Section 5.3);
- Plasticity (BS EN ISO 14688 Part 1 Section 5.8);
- Assessment of particle shape (BS EN ISO 14688 Part 1 Section 5.2).

APPENDIX K – CHEMICAL AND GEOTECHNICAL 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 geotechnical and related testing

Bulk samples were placed within robust heavy duty plastic bags and sealed, together with small disturbed samples, within airtight 1 litre plastic containers.

100 mm diameter 'undisturbed' samples ("U100 samples") were obtained where possible from cable percussive and large diameter window sample boreholes within cohesive materials.

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. *Must be fully filled.*	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] *The former must be fully filled.*	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. *Must be fully filled.*	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] *The former must be fully filled, the latter should be filled if possible.*	14 days
All other organics	500-1000 ml brown or green glass bottle with screw cap. *Fill if possible.*	7 days
Inorganics	500-1000 ml translucent or opaque screw cap plastic *or* brown or green glass bottles. *Fill if possible.*	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 it's 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.

In 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.

APPENDIX L – GEOTECHNICAL TEST RESULTS

LABORATORY REPORT

4043

Contract Number: PSL17/5213

Report Date: 20 November 2017

Client's Reference: TE1044

Client Name: Tier Consult
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Warrington Road
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For the attention of: C Jones

Contract Title: Harefield Road, Uxbridge

Date Received: 25/10/2017
Date Commenced: 25/10/2017
Date Completed: 20/11/2017

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
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