

Sent by email

16th June 2022

Ref: C0362-LR02

Dear Tim,

Contamination Delineation: Reservoir Road, Surfleet, Spalding

Chevin Geoenviro Associates Ltd were commissioned by Tim Forman to carry out trial pitting, sampling and logging of soils on the proposed residential development site near Flaxmill House, Surfleet, Spalding (527298,329030). The aim was to delineate the contaminated soils recorded at TP02 and TP04 during the previous site investigation.

Previous Site Works Summary

A phase 1 desk study for the site was compiled by Chevin Geoenviro Associates (CGA) in December 2019 which found that there had been a flax mill on the site in the 19th century, which was removed by 1903. Maps from 1947-50 also showed two small buildings in the south of the site which were no longer present by 1975-1977.

The phase 1 risk assessment concluded that there was a Moderate to Low level of risk to site users from potential made ground on the site. There was also an estimated Very Low risk from the made ground to controlled waters, and an estimated Low risk from ground gases associated with historical made ground or potential peat deposits. The desk study also concluded that there was a moderate risk from natural ground subsidence from compressible ground and running sands.

A phase 2 intrusive site investigation was carried out by CGA on the 6th October 2020, which involved excavation of six trial pits designated TP01 to TP06 and sampling of shallow soils.

During the investigation made ground topsoil was encountered at every trial pit location and consisted of brown slightly gravelly silt, occasionally with gravel sized fragments of mixed lithologies, brick or ceramic. Further made ground was encountered at TP04, TP05 and TP06 to maximum depths of 0.90m. The made ground at TP04 was observed to contain gravel sized fragments of coal and tar covered aggregate. Beneath the made ground, superficial deposits consisting of slightly clayey sandy silts were encountered.

Following a comparison of the laboratory testing with the C4SL and S4UL for a residential with home grown produce land use scenario, the phase 2 risk assessment concluded that the topsoil at TP02 and made ground at TP04 contained elevated concentrations PAH compounds (using benzo(a)pyrene as a surrogate marker). In TP04 the origin of the contamination was stated to be fragments of coal tar, whereas no origin could be determined in TP02. Modal organic matter contents were around 2.5%. Further sampling recommended to delineate the affected area of soils.

Scope of Works

The supplementary site investigation works were carried out on the 10th May 2022. The scope of the site works was to use a JCB 3CX excavator to carry out additional excavations around the location of trial pits TP02 and TP04 to identify the extent of the contaminated made ground. Logs and environmental samples were to be taken to identify uncontaminated soils.

Site Works

Five trial pits numbered TP201 to TP205 were excavated around TP02 on a rough 2.50m grid, to depths of approximately 0.40m. All excavations encountered sandy silt topsoil with gravel sized fragments of limestone and chert, consistent with the topsoil encountered over the rest of the site. No fragments of tar or ash were encountered, however five samples of topsoil were collected from various depths and tested for PAH compounds only.

Twelve trial pits numbered TP101 to TP112 were excavated around TP04, also on a roughly 2.50m grid, to depths of up to 0.70mbgl. Excavations closer to TP04, which included TP101, TP103, TP106, TP107 and TP110 encountered the made ground containing coal and tar covered fragments, which were also identified in the made ground topsoil between ground level and 0.30mbgl. The surrounding trial pits encountered made ground topsoil as described above and superficial deposits only, delineating the made ground to a roughly 5.00m by 2.50m area, and no deeper than 0.60m. Topsoil at TP106 and TP107, as well as in the eastern edge of TP110 were found to contain gravel sized fragments of brick and coal, similar to the made ground at TP04.

Five samples from the perimeter of the delineated made ground; three samples from the topsoil found to contain fragments of coal and brick, and; one sample from the made ground itself, were taken and tested for PAH compounds only. One additional sample of made ground was tested for waste assessment criteria.

Environmental Testing

The results of the environmental testing have been compared to current the C4SL and S4UL screening values for a Residential End Use with Home Grown Produce. The screening values used are attached. The 2.5% organic matter values were used. Although concentrations were generally low or at the limits of detection, the LQM PAH profiling tool showed that the surrogate marker approach, which uses benzo(a)pyrene to assess all PAH compounds, was suitable for use in this assessment.

Statistical analysis of benzo(a)pyrene in twenty topsoil samples from both the phase 2 site investigation and delineation sampling confirmed the elevated concentration of 6.3mg/kg recorded at the location of trial pit TP04 is an outlier with remediation of the area around TP04 being required.

Removal of the outlier shows the remaining data to be normal distributed with a mean concentration of 1.27mg/kg with a >95% confidence level. This shows that the null hypothesis that the true mean concentration of benzo(a)pyrene is less than the screening value of 3.2mg/kg. Therefore, the remaining soils on site have been shown to be suitable for use with no remediation required.

Conclusions

The made ground containing coal and tar covered aggregate was identified in the phase 2 site investigation at the location of TP02 and TP04 as being a sources of contamination requiring remediation of a large area or delineation to reduce the area of remediation. Delineation sampling, testing and statistical analysis has been carried out and shown that the majority of soils on site are suitable for use with the exception of those at the location of TP04. Delineation sampling around TP04 confirmed an area of contaminated soil approximately 5.00m by 2.50m with a maximum depth of 0.60m requires removal from site. The approximate total volume of contaminated made ground is therefore 7.5m³. Testing of the surrounding topsoil has demonstrated that they are suitable for use in garden areas.

Recommendations

Contaminated made ground soils from the area around TP04 are not suitable for use in garden areas, and should be removed prior to development. Waste Assessment Criteria testing results are attached, which will be required by the receiving waste transfer station or landfill. The WAC test results were taken from a similar soil as those to be disposed and show the soil can be classified as Inert waste.

Alternatively these soils could be placed beneath the formation layer of hardstanding.

As the contaminated soil is to be removed as part of the site clearance works validation of remediation via photographic evidence and confirmation from the developer regarding disposal or reuse of the contaminated soil is likely to provide sufficient information for validation purposes. Importation of clean topsoil is very unlikely as the site soils have been shown to be suitable for use and will remain in-situ.

Should unidentified areas of contaminated soils be encountered during construction works the soils should be left in-situ and be examined by a suitably qualified geo-environmental engineer. Small quantities of contaminated material could be excavated and stockpiled prior to examination, providing they are placed on impermeable hardstanding or waterproof sheeting with sufficient sheeting to cover these soils

We hope that this is satisfactory to your requirements.

Yours sincerely,

Tom Roebuck BSc MGeol FGS



Chevin Geoenviro Associates LTD

Tel: 01943 470363

E-mail info@chevin-ltd.co.uk

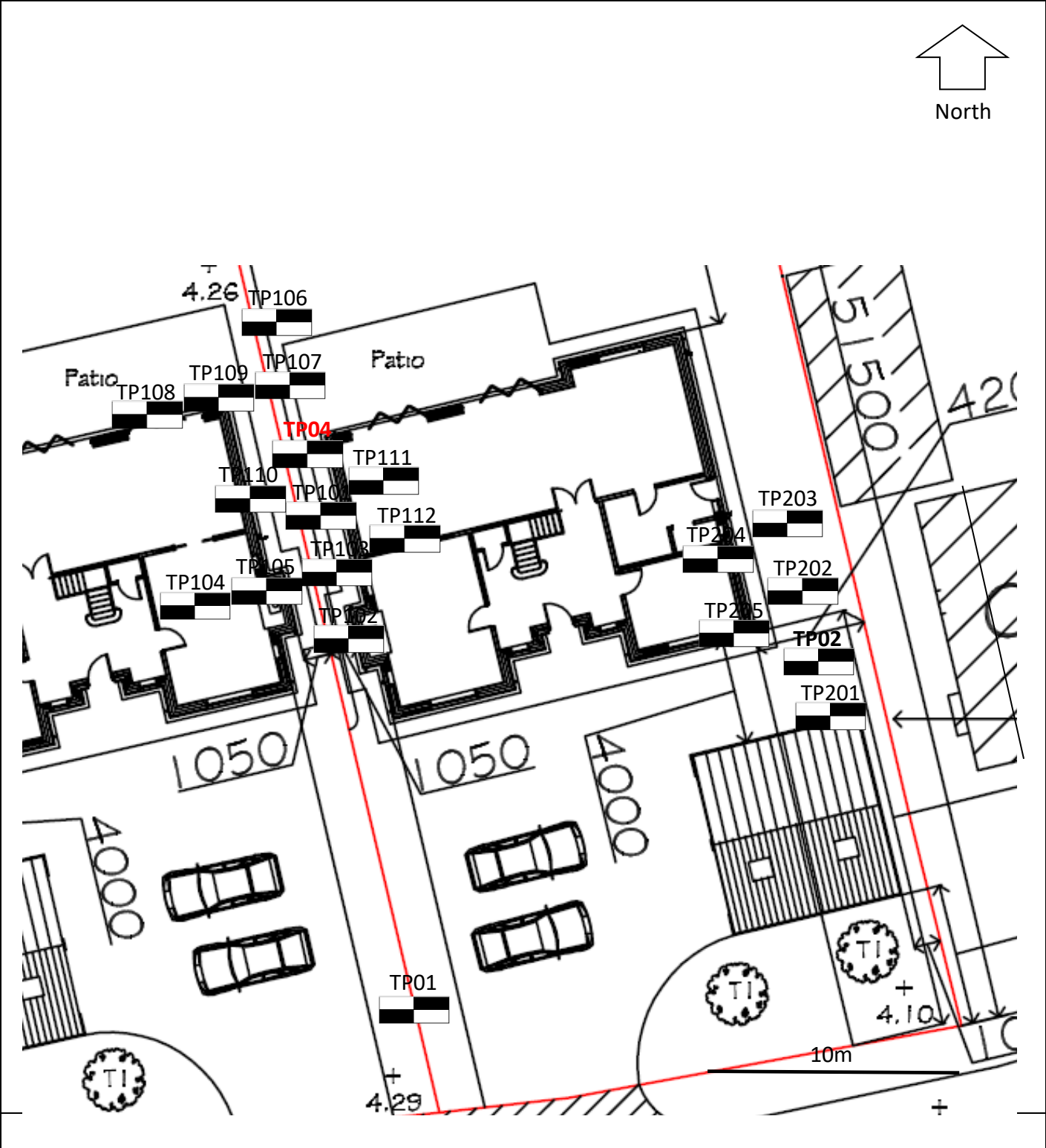
Geo-environmental Consultancy
Ground Technologies & Investigation & Remediation

Project : Reservoir Road, Surfleet, Spalding

Client. Mr. T. Forman

Project No. C0362

Date 13/12/2019



Chevin Geoenviro Associates LTD

Tel: 01943 470363

E-mail info@chevin-ltd.co.uk

Geo-environmental Consultancy
Ground Technologies & Investigation & Remediation

Project: Reservoir Road, Surfleet, Spalding

Client. Mr. T. Forman

Project No. C0362

Date 16/06/22



Photograph No.3: TP201 showing made ground topsoil with no anthropogenic inclusions.



Photograph No.4: View east of the site from the western site boundary.

Chevin Geoenviro Associates LTD

Tel: 01943 470363

E-mail info@chevin-ltd.co.uk

**Geo-environmental Consultancy
Ground Technologies & Investigation & Remediation**

Project: Reservoir Road, Surfleet, Spalding

Client. Mr. T. Forman

Project No. C0362

Date: 09/11/2020

Trial Pit Log

Trialpit No

TP101

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

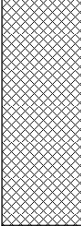
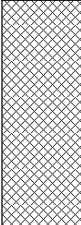
3

Scale
1:10

Client: Tim Forman

Depth
0.70

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies, brick and ceramic.
				0.60			MADE GROUND TOPSOIL: Brown speckled yellow grey slightly sandy gravelly silt. Angular to rounded gravel sized fragments of mixed lithologies, brick, coal and tar covered aggregate. Angular cobble sized fragments of concrete.
				0.70			Soft pale brown slightly clayey sandy SILT. Sand is fine.
							End of pit at 0.70 m

Remarks: No groundwater entries.
Backfilled with arisings on completion.

Stability:

Trial Pit Log

Trialpit No

TP102

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions (m):

3

Scale
1:10

Client: Tim Forman

Depth
0.40

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES					MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.	
				0.30				
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.	
							End of pit at 0.40 m	

1

2

Remarks: No groundwater entries.
Backfilled with arisings on completion.

Stability:



Trial Pit Log

Trialpit No

TP103

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

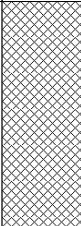
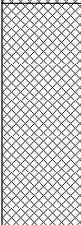
3

Scale
1:10

Client: Tim Forman

Depth
0.70

Logged
V

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies, brick and ceramic.
				0.60			MADE GROUND TOPSOIL: Brown speckled yellow grey slightly sandy gravelly silt. Angular to rounded gravel sized fragments of mixed lithologies, brick, coal and tar covered aggregate. Angular cobble sized fragments of concrete.
				0.70			Soft pale brown slightly clayey sandy SILT. Sand is fine.
							----- End of pit at 0.70 m

1

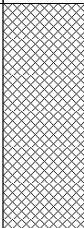
2

Remarks: No groundwater entries.
Backfilled with arisings on completion.

Stability:



Project Name:	Flaxmill House	Project No.	C0362	Co-ords: - Level:	Date 10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	Scale 1:10
Client:	Tim Forman			Depth 0.40	Logged TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies, brick and ceramic.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
							End of pit at 0.40 m
				0.40			

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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Stability:



Trial Pit Log

Trialpit No

TP105

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

3

Scale
1:10

Client: Tim Forman

Depth
0.70

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.	
				0.30			Soft pale brown slightly clayey sandy SILT. Sand is fine.	
				0.70			End of pit at 0.70 m	

1

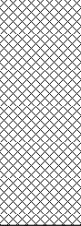
2

Remarks: No groundwater entries.
Backfilled with arisings on completion.

Stability:



Project Name:	Flaxmill House	Project No.	C0362	Co-ords: -	Date	10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	Scale	1:10
Client:	Tim Forman			Depth	0.40	Logged

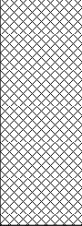
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	0.40		MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies and ceramic. Whole house bricks and cobble sized fragments of concrete.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
						----- End of pit at 0.40 m	

Remarks:	Remnant shallow foundations. No groundwater entries. Backfilled with arisings on completion.
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Stability:



Project Name:	Flaxmill House	Project No.	C0362	Co-ords: - Level:	Date 10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	Scale 1:10
Client:	Tim Forman			Depth 0.40	Logged TR

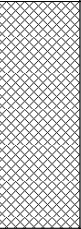
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	0.40		MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies, brick and ceramic.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
						----- End of pit at 0.40 m	

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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Stability:



Project Name:	Flaxmill House	Project No.	C0362	Co-ords: -		Date	10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	3 1	Scale	1:10
Client:	Tim Forman			Depth	0.40	Logged	TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
							End of pit at 0.40 m

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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Stability:



Trial Pit Log

Trialpit No

TP109

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

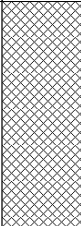
3

Scale
1:10

Client: Tim Forman

Depth
0.40

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND TOPSOIL: Brown slightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.
							----- End of pit at 0.40 m

1

2

Remarks: No groundwater entries.
Backfilled with arisings on completion.

Stability:



Trial Pit Log

Trialpit No

TP110

Sheet 1 of 1

Project Name: Flaxmill House

Project No.
C0362

Co-ords: -
Level:

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

3

Scale
1:10

Client: Tim Forman

Depth
0.40

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES					MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies, brick and ceramic.
				0.30			
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.
							End of pit at 0.40 m

1

2

Remarks: No groundwater entries.
Backfilled with arisings on completion.

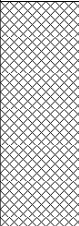
Stability:



Date
10/05/2022

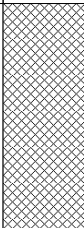
Scale
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Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
							----- End of pit at 0.40 m

Stability:

Project Name:	Flaxmill House	Project No.	C0362	Co-ords: - Level:		Date	10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	3 1	Scale	1:10
Client:	Tim Forman			Depth	0.40		Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
						End of pit at 0.40 m	
				0.40			

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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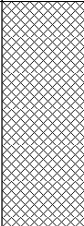
Stability:



Date
10/05/2022

Scale
1:10

Logged
TR

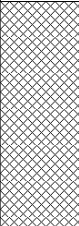
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.30	0.40		MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
						----- End of pit at 0.40 m	

Stability:

Date
10/05/2022

Scale
1:10

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	0.40		MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
							Soft pale brown slightly clayey sandy SILT. Sand is fine.
						----- End of pit at 0.40 m	



Stability:

Project Name:	Flaxmill House
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Project No.
C0362

Co-ords:	-
Level:	

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

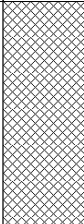
3

Scale
1:10

Client: Tim Forman

Depth
0.40

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.
				----- End of pit at 0.40 m			

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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Stability:



Project Name:	Flaxmill House	Project No.	C0362	Co-ords: - Level:	Date 10/05/2022
Location:	Surfleet, Spalding			Dimensions (m):	Scale 1:10
Client:	Tim Forman			Depth 0.40	Logged TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.
							----- End of pit at 0.40 m

Remarks:	No groundwater entries. Backfilled with arisings on completion.	
Stability:		

Project Name:	Flaxmill House
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Project No.
C0362

Co-ords:	-
Level:	

Date
10/05/2022

Location: Surfleet, Spalding

Dimensions
(m):

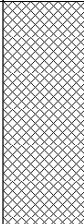
3

Scale
1:10

Client: Tim Forman

Depth
0.40

Logged
TR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES		0.30			MADE GROUND TOPSOIL: Brown sightly gravelly silty topsoil. Angular to rounded gravel sized fragments of mixed lithologies.
				0.40			Soft pale brown slightly clayey sandy SILT. Sand is fine.
				----- End of pit at 0.40 m			

Remarks:	No groundwater entries. Backfilled with arisings on completion.
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Stability:





Certificate of Analysis

Certificate Number 22-09292

Issued: 23-May-22

Client Chevin Geoenviron Associates Ltd
Tarn House 77 High Street
Yeadon
Leeds
LS19 7SP

Our Reference 22-09292

Client Reference CO 362

Order No (not supplied)

Contract Title Flaxmill Ho, Spalding

Description 14 Soil samples, 1 Leachate sample.

Date Received 16-May-22

Date Started 16-May-22

Date Completed 23-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgwood
General Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 22-09292

Client Ref CO 362

Contract Title Flaxmill Ho, Spalding

Lab No	2009522	2009523	2009525	2009526	2009527	2009528	2009529
Sample ID	TP 101	TP 102	TP 104	TP 105	TP 106	TP 107	TP 110
Depth	0.40	0.20	0.10	0.10	0.20	0.20	0.20
Other ID							
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units							
PAHs										
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.2	0.3	0.3
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.2	0.3	0.2
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	1.5	1.2	1.0
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.3	0.3	0.3
Fluoranthene	DETSC 3301	0.1	mg/kg	1.9	0.4	1.4	1.6	3.5	2.7	2.4
Pyrene	DETSC 3301	0.1	mg/kg	1.9	0.5	1.4	1.5	3.2	2.6	2.2
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.3	< 0.1	0.8	0.9	1.7	1.4	1.3
Chrysene	DETSC 3301	0.1	mg/kg	1.2	< 0.1	0.6	0.8	2.1	1.4	1.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	0.6	0.6	1.3	1.2	1.0
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	0.5	0.5	0.9	0.8	0.7
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	1.6	< 0.1	1.3	1.4	1.7	1.5	1.3
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	1.3	< 0.1	0.8	0.9	1.6	1.3	1.0
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	0.3	0.3	0.3	0.2	0.2
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	1.4	< 0.1	0.9	1.3	1.0	0.8	0.7
PAH Total	DETSC 3301	1.6	mg/kg	13	< 1.6	8.6	9.7	20	16	14

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09292

Client Ref CO 362

Contract Title Flaxmill Ho, Spalding

Lab No	2009530	2009532	2009533	2009534	2009536	2009537
Sample ID	TP 111	TP201	TP202	TP203	TP205	TP 10
Depth	0.10	0.10	0.20	0.30	0.20	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.1	0.2	0.2	0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.2	0.4	0.2	0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.5	0.5	0.8	3.9	0.8	0.2
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.2	0.7	0.3	0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	1.3	0.7	1.9	5.2	2.8	0.6
Pyrene	DETSC 3301	0.1	mg/kg	1.3	0.7	2.0	4.9	2.9	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.8	0.5	1.4	2.6	1.9	0.6
Chrysene	DETSC 3301	0.1	mg/kg	1.0	0.4	1.7	3.1	2.1	1.0
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.6	0.4	1.1	2.0	1.3	0.4
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.4	0.2	0.7	1.3	0.9	0.3
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.8	0.5	1.3	2.5	1.5	0.5
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.8	0.7	1.1	1.9	1.2	0.5
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.3	0.5	0.3	0.2
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.4	0.3	0.7	1.3	0.7	0.3
PAH Total	DETSC 3301	1.6	mg/kg	8.7	5.5	14	31	17	5.5

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 22-09292

Client Ref CO 362

Contract Title Flaxmill Ho, Spalding

Sample Id TP 103 0.50

Sample Numbers 2009524 2009538

Date Analysed 23/05/2022

Test Results On Waste			WAC Limit Values		
Determinand and Method Reference	Units	Result	Inert Waste	SNRHW	Hazardous Waste
DETS 2084# Total Organic Carbon	%	2.5	3	5	6
DETS 2003# Loss On Ignition	%	4.5	n/a	n/a	10
DETS 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETS 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETS 3311# TPH (C10 - C40)	mg/kg	16.0	500	n/a	n/a
DETS 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETS 2008# pH	pH Units	8.3	n/a	>6	n/a
DETS 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETS 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			WAC Limit Values		
Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	Limit values for LS10 Leachate		
	10:1	LS10	Inert Waste	SNRHW	Hazardous Waste
DETS 2306 Arsenic as As	4.3	0.043	0.5	2	25
DETS 2306 Barium as Ba	3	< 0.1	20	100	300
DETS 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETS 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETS 2306 Copper as Cu	1.6	< 0.02	2	50	100
DETS 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETS 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETS 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETS 2306 Lead as Pb	0.71	< 0.05	0.5	10	50
DETS 2306 Antimony as Sb	0.31	< 0.05	0.06	0.7	5
DETS 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETS 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETS 2055 Chloride as Cl	460	< 100	800	15,000	25,000
DETS 2055* Fluoride as F	150	1.5	10	150	500
DETS 2055 Sulphate as SO4	1500	< 100	1000	20,000	50,000
DETS 2009* Total Dissolved Solids	45000	450	4000	60,000	100,000
DETS 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETS 2085 Dissolved Organic Carbon	3600	< 50	500	800	1000

Additional Information	
DETS 2008 pH	8.0
DETS 2009 Conductivity uS/cm	64.9
* Temperature*	19.0
Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.101
Stage 1	
Volume of Leachant L2*	0.988
Volume of Eluate VE1*	0.937

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive
Hazardous Waste

Disclaimer: The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.

* DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.

Information in Support of the Analytical Results

Our Ref 22-09292
 Client Ref CO 362
 Contract Flaxmill Ho, Spalding

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2009522	TP 101 0.40 SOIL	10/05/22	GJ 250ml		
2009523	TP 102 0.20 SOIL	10/05/22	GJ 250ml		
2009524	TP 103 0.50 SOIL	10/05/22	GJ 250ml, PT 500ml x2		
2009525	TP 104 0.10 SOIL	10/05/22	GJ 250ml x2		
2009526	TP 105 0.10 SOIL	10/05/22	GJ 250ml		
2009527	TP 106 0.20 SOIL	10/05/22	GJ 250ml		
2009528	TP 107 0.20 SOIL	10/05/22	GJ 250ml		
2009529	TP 110 0.20 SOIL	10/05/22	GJ 250ml		
2009530	TP 111 0.10 SOIL	10/05/22	GJ 250ml		
2009531	TP 112 0.30 SOIL	10/05/22	No containers logged		Cannot evaluate
2009532	TP201 0.10 SOIL	10/05/22	GJ 250ml		
2009533	TP202 0.20 SOIL	10/05/22	GJ 250ml		
2009534	TP203 0.30 SOIL	10/05/22	GJ 250ml		
2009535	TP204 0.10 SOIL	10/05/22	No containers logged		Cannot evaluate
2009536	TP205 0.20 SOIL	10/05/22	GJ 250ml		
2009537	TP 10 0.30 SOIL	10/05/22	GJ 250ml		
2009538	TP 103 0.50 LEACHATE	10/05/22	GJ 250ml, PT 500ml x2		

Key: G-Glass J-Jar P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

LQM PAH profiling Tool (Full Version)

Release: 1.3

Release date: 4th October 2019

Licensee: Chevin Associates Ltd

Licensed Office: Yeadon, Leeds



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This Agreement contains the entire agreement between the parties in relation to the subject matter and supersedes all previous agreements, understandings, negotiations, representations, statements and discussions between the Parties, whether oral or written.

11. Governing law and jurisdiction

This Agreement shall be governed by and construed in accordance with the laws of England and Wales and the parties agree to submit to the exclusive jurisdiction of the courts of England and Wales.

Background:

Polyaromatic Hydrocarbon (PAH) mixtures are commonly encountered in urban and periurban soils. These PAHs can be associated with a diverse range of contaminative risks, recommended the use of benzo[a]pyrene (BaP) as a surrogate marker approach in the assessment of carcinogenic risks posed by PAHs in soils. It was recommended that such assessments should be based on toxicological benchmarks derived from the data for 2 assessment of PAH mixtures in soil. However, PHE (2017) caution that this approach is only applicable if the mixture of (genotoxic) PAHs in the soil is sufficiently similar to that of the coal tar mixtures used as the basis for the toxicological benchmarks used in the assessment. PHE (2017) presented a graphical analysis method that compared the proportions of eight genotoxic PAHs within soil samples (as ratios relative to BaP) with those in the two coal tars tested by Culp et al. (1998). They cited the International Programme on marker; a C4SL (Defra 2014) and a S4UL (Nathanail et al. 2015). However, before these assessment criteria (or any other criteria based on the Culp et al. coal tars) can justifiably be used to assess PAH mixtures in soils, the PAH profile in the soil should be assessed and this spreadsheet facilitates a graphical comparison of PAHs in soil samples with that of the Culp et al coal tars, similar to that presented by the PHE (2017). This can provide a basis for a competent risk assessor to determine whether an assessment based on BaP as a

Instructions:

cells highlighted in grey shading in the "PAH data" sheet; ensure that the correct data is entered into each column. It is not important what unit the data is reported in (i.e. mg/kg, ug/kg, %), as long as all the data is reported in the same unit. It is recommended that concentration of one or more of the genotoxic PAHs (particularly BaP) is below the method limit of detection (i.e. <LoD). **Careful consideration should be given to such samples** plots them on the two charts relative to composition of the the two coal mixtures used by Culp et al. (the plus/minus an order of magnitude limits suggested by PHE (2017) are also shown). The further these ratios diverge from the composition of the Culp *et al.* coal tars, in addition, in the full version only (available at www.hqm.co.uk) the relative proportions of the genotoxic congeners are also presented as ratios in columns X-AD in the "PAH data" sheet. These have been colour coded using a traffic light system, to allow the individual samples that fall at, or close to the order of magnitude limits to be identified. These samples **statement, etc is not obscured or removed. We recommend pasting the charts as a picture/image rather than embedding the workbook or linking the data, as this tends**

References:

Culp C, Caylor B, Shelden W, Carstenn L, & DeLand F. (1998). A comparison of the tumors induced by coal tar and benzo[a]pyrene in a 2-year bioassay. *Carcinogenesis*, 19(1), 117–124. Accessed from:

<http://carcin.oxfordjournals.org/content/19/1/117.full.pdf>

Defra. (2014). *SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*. December 2014.

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<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18341>

PHE. (2017). *Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs)* (London, UK). Accessed from:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/671

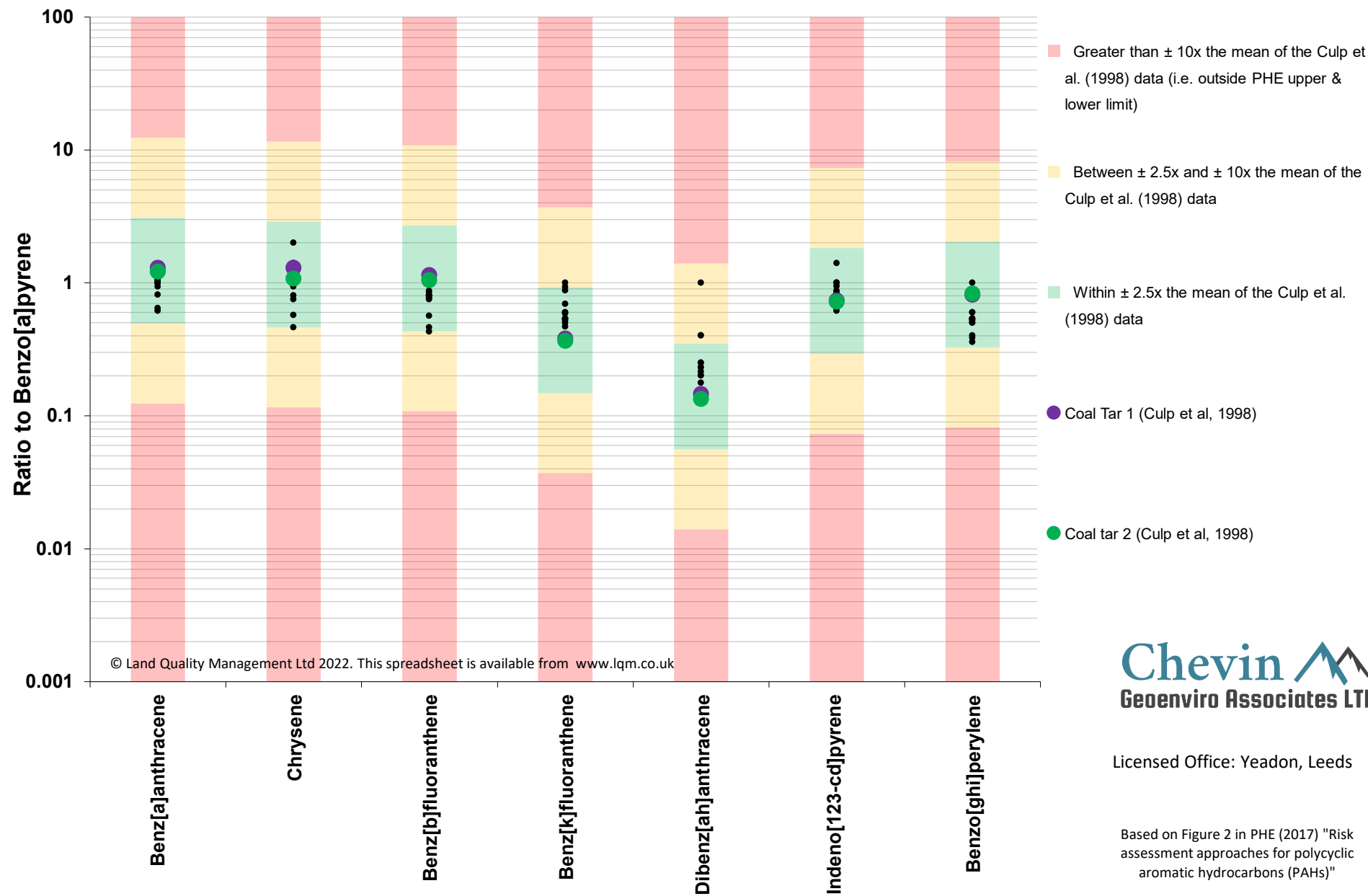
WHO (1988). *Environmental Health Criteria 202: Selected non-heterocyclic polycyclic aromatic hydrocarbons*. World Health Organisation, International Programme On Chemical Safety: Geneva, Switzerland. Accessed from:

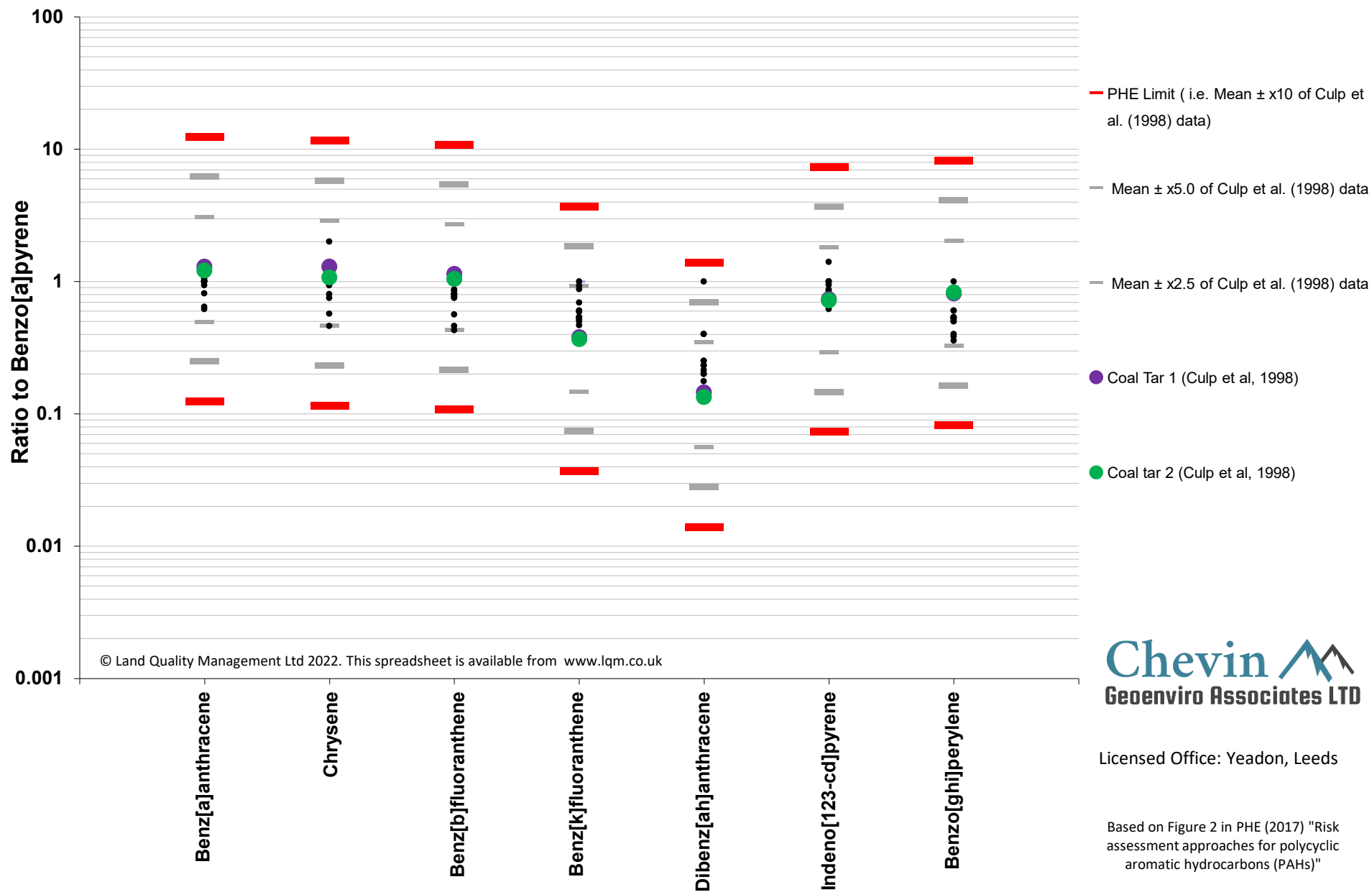
<http://www.inchem.org/documents/ehc/ehc/ehc202.htm>

Nathanail CP, McCaffrey C, Gillett AG, Ogden RC, & Nathanail JF. (2015). *The LQM/CIEH S4ULs for Human Health Risk Assessment*. Land Quality Press, a Division of Land Quality Management Ltd: Nottinghamshire, UK. Available from:

<http://www.lqm.co.uk/publications/s4ul/>

<i>Number</i>	<i>Sample ID</i>	<i>Acenaphthene</i>	<i>Acenaphthylene</i>	<i>Anthracene</i>	<i>Benzo(a)anthracene</i>	<i>Benzo(a)pyrene</i>	<i>Benzo(b)fluoranthene</i>
1	TP 101	0.1	0.1	0.1	1.3	1.6	0.9
2	TP 102	0.1	0.1	0.1	0.1	0.1	0.1
3	TP 104	0.1	0.1	0.1	0.8	1.3	0.6
4	TP 105	0.1	0.1	0.1	0.9	1.4	0.6
5	TP 106	0.1	0.2	0.3	1.7	1.7	1.3
6	TP 107	0.1	0.3	0.3	1.4	1.5	1.2
7	TP 110	0.1	0.3	0.3	1.3	1.3	1
8	TP 111	0.1	0.2	0.1	0.8	0.8	0.6
9	TP 112	0.1	0.1	0.1	0.6	0.5	0.4
10	TP201	0.1	0.2	0.1	0.5	0.5	0.4
11	TP202	0.1	0.1	0.2	1.4	1.3	1.1
12	TP203	0.3	0.2	0.7	2.6	2.5	2
13	TP205	0.1	0.2	0.3	1.9	1.5	1.3
14							
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Client/client ref	C0362
Project ref	C0362
Site ref	Flaxmill House, Spalding
Data description	
Contaminant(s)	BaP
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼
Date	25 May 2022
User details	TR

Statistics Calculator (Version 2)



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

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Go to summary				Project details				Select all filters				Deselect all filters				Paste Values											
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Test Results

Benzo(a)pyrene (BAP)

Client/client ref: C0362

Project ref: C0362

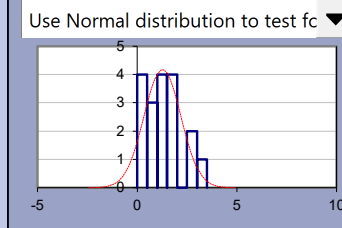
Site ref: Flaxmill House, Spalding

Data description:

Date: 25-May-2022

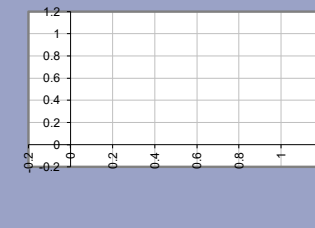
User details: TR

Dataset:	Benzo(a)pyrene (BAP) ▼	
Sample mean (BAP), $\bar{x}$		1.2697
Sample standard deviation, s		0.9239
Sample size, n		18
Critical concentration, Cc (BAP)		3.2



Outliers & non-detects

Outliers present?	No
Significance level	5% ▼
Outliers excluded	0
Non-detects	2

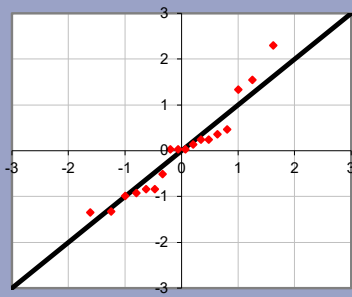


Normality test

Significance level: 5% ▼

Normal distribution

Use: Auto: One-sample t-test ▼

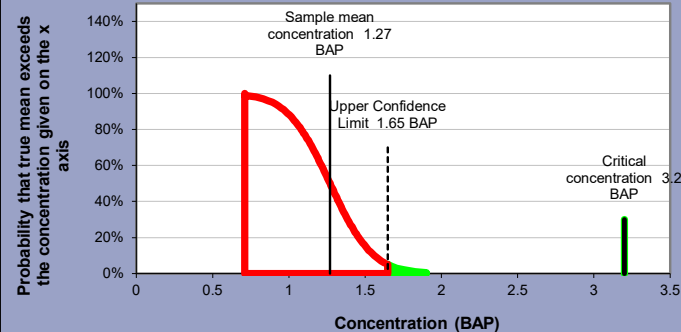


Test scenario:

Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼

Null hypothesis: The true mean concentration is equal to or greater than the critical concentration: $\mu \geq C_c$

Alternative hypothesis: The true mean concentration is less than the critical concentration: $\mu < C_c$



Evidence against Null hypothesis:

100%

Base decision on: evidence level ▼

Evidence level required: 95%

Balance of probability? N/A

Reject Null Hypothesis? Yes

$\mu < C_c$ (re this dataset)

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