



Contamination Investigation Report

LOCATION	The Barn, Claires Barn Farm, Twycross CV9 3PG
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FOR	D Hughes c/o Elegance Architecture
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Prepared by



Jason Pratt BSc(Hons)
Geoenvironmental Engineer

Checked by



Stuart Howe BSc (Hons) FGS
Senior Geotechnical Engineer

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Units 3a and 4 Terry Dicken Industrial Estate
 Ellerbeck Way
 Stokesley
 North Yorkshire
 TS9 7AE
 Tel. 01642 713779
 Fax 01642713923
 Email enquiries@geoinvestigate.co.uk

1. Introduction

In accordance with your instruction, Geoinvestigate Limited has carried out an intrusive site investigation at The Barn, Claires Barn Farm, Twycross CV9 3PG. The site currently comprises a barn within a wider farm site.

The purpose of this Phase 2 investigation was to establish the true nature of the ground conditions at the site with regard to the potential for contamination.

No Phase 1 assessment is provided by this report, nor are a geotechnical assessment or a ground gas monitoring exercise. An earlier phase 1 desk study investigation was provided by Castledine Environmental in March 2023 (report ref. 3434D P1 Hughes - Atherstone).

It is proposed to redevelop the existing structure for residential use with a parcel of land set aside for associated soft landscaping, gardens and hardstanding access/parking. The boundary of the current study area and the proposed developmental layout are presented on the site plan included within Appendix 1 of this report.

2. Scope of Phase 2 Investigation

2.1 Scope of Works

Given the above, the following investigation was carried out to assess the potential risks to the proposed development:

- Three (3) boreholes (BH1 to BH3) were undertaken at the site to a depth of 3.00m below ground level (bgl) with associated soil sampling and logging by a geo-environmental engineer. The boreholes were commenced using windowless sampling techniques with a Dando Terrier 2002 mini drilling rig.
- Two (2) hand excavated trial pits (TPA to TPB) to provide additional information on near-surface ground conditions and collect additional samples from areas of proposed soft landscaping and/or gardens.
- An additional six (6) hand excavated trial pits (TPC – TPH) on returning to site for a second day of field work to provide additional samples for contamination analysis.
- Contamination analyses of eleven (11) samples of near-surface topsoil and made ground recovered from depths between 0.20m and 0.50m bgl to investigate the potential presence and concentrations of various potential contaminants (including metals/metalloids, asbestos, polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs)). Additionally, due to the agricultural history of the land, limited OCP (organochlorine pesticide) and microbiology testing (including e-coli, salmonella etc) were also completed, as was leachate testing to check for mobility of contaminants. Chemical analysis is based on the attending engineer's descriptions of the ground conditions. Five (5) samples were initially analysed with additional testing for selected contaminants carried out on six (6) further samples following the second day of field works.

- Water Soluble Sulphate and pH Testing on selected samples to provide information on appropriate concrete design.
- Provision of a factual and interpretative report including site plan, borehole and trial pit logs, soil analysis results, and advice on the contamination situation at the site.

The trial pit and borehole positions are shown on the plan provided in Appendix 1.

The excavations were sampled and logged at site by a geoenvironmental engineer and the ground conditions encountered are described on the borehole and trial pit logs also provided in Appendix 1.

The results of the contamination testing are included in Appendix 2, which include the results of the water-soluble sulphate and pH testing.

2.2 Sampling Rationale

The borehole positions were chosen to give an indication of the ground conditions generally throughout the site. The soils encountered in the trial pits and boreholes are considered to be broadly representative of soils throughout the site. The hand excavated trial pit positions were chosen to specifically target external areas or potential garden space at the site.

3. Phase 2 Investigation Findings

3.1 Encountered Ground Conditions

3.1.1 Windowless Sample Boreholes

The ground conditions were relatively uniform across the site and comprised topsoil underlain by natural strata comprising gravelly silty clay then weak weathered mudstone to termination at 3.00m

The natural ground comprised an upper layer of firm slightly silty, gravelly clay containing sandstone fragments to depths between 1.00m and 2.00m bgl. Beneath the upper clay was weak, weathered mudstone to termination at 3.00m

Hand shear vane tests returned values between 60kN/m² and 115kN/m² from between 0.50m and 2.00m bgl in the upper clay, indicating generally firm conditions. A lower value is recorded for the weak mudstone (38kN/m²), but this is likely due to this material being more friable and less cohesive as opposed to the material itself being significantly weaker/softer.

No ground water was recorded during the works.

3.1.2 Hand Excavated Trial Pits

TPA and TPB encountered somewhat similar conditions to the boreholes. TPA encountered turf and topsoil of soft slightly gravelly, sandy clay with gravel of sandstone and mudstone to 0.20m then firm to stiff gravelly sandy clay to termination at 1.00m

TPB encountered turf and topsoil of soft slightly sandy, gravelly clay with gravel of sandstone and brick to 0.30m followed by made ground of firm slightly sandy gravelly clay with gravel of sandstone, mudstone,

brick, concrete and coal to 0.60m. This was underlain by firm to stiff gravelly sandy clay with gravel of sandstone and mudstone to termination at 1.00m. No made ground was found anywhere else on the site.

TPC – TPH encountered similar conditions to TPA, with turf and topsoil of soft slightly gravelly sandy clay being found to between 0.20m and 0.40m followed by firm to stiff sandy clay to termination at 0.50m.

The trial pits all remained stable and dry on completion.

4. Contamination Testing

The earlier desk study investigation (by Castledine Environmental) suggested that the historical agricultural use of the site and any made ground associated with the construction of the barn might provide the most viable potential sources of contamination to the site.

Potential contaminants could potentially occur throughout the full thickness of the near surface material which were recovered from the boreholes and trial pits to a maximum depth of 0.60m (at TPB). Soils close to surface would be the most relevant regarding human health risk assessment. Analysis of deeper soils was also included but given the undisturbed and low permeability nature of the deposits and the absence of any evidence of potential contamination therein, there was expected to be a very low likelihood of any contamination of these soils. Analysis of leachate from shallow soils was undertaken to ensure no risk to deeper soils or local ground/surface waters exists through potential contaminant leaching and mobilisation.

Other than the presence of occasional brick and concrete fragments, the topsoil and made ground showed no obvious visual or olfactory evidence of potential contamination or contaminative materials. However due to the agricultural nature of the site, a potential for historical contamination was still considered feasible and analysis would be required to determine whether there was in fact any risk.

Based on the findings of the initial site works, five (5) samples of topsoil, made ground and natural subsoil from 0.20m to 0.50m recovered from across the site were tested for a range of substances. These included common contaminants such as metals/metalloids and speciated PAHs, together with analyses for petroleum hydrocarbons (2 samples) and asbestos (3 samples). A single test each for OCP pesticides and microbiology was also undertaken.

The results of the contamination testing are included in Appendix 2 of this report (Chemtech Environmental Ltd. Report 122386 and have been used in the contamination risk assessment, set out in the following sections.

The additional analyses associated with the second day of field works (TPC-TPH) are discussed in Section 5.3 later.

5. Risk Assessment

5.1 Method

Geoinvestigate Ltd. uses a combination of assessment criterion provided by the Environment Agency, DEFRA and by the Chartered Institute of Environmental Health in order to assess the presence of potentially harmful chemicals within soils and water. These include DEFRA category 4 screening levels (C4SLs), Environment Agency Environmental Quality Standards (EQSs), Site Specific Assessment Criteria (SSAC) generated using CLEA software version 1.06 site specific risk assessment modelling, and Land Quality Management / Chartered Institute of Environmental Health (LQM/CIEH) Safe for Use Limits (S4ULs). An appraisal of the soil/leachate analysis results and relevant limits is set out in the Contamination Risk Assessment that follows.

As the site is to be developed as a residential dwelling, it falls within the residential end-use category. As it is possible that persons living on the site may cultivate vegetables / fruit for consumption, consideration to this end is also necessary.

No site-specific assessment criteria (SSAC) have been created for the site as no unusual circumstances (i.e., occupation periods etc.) are considered to be present/likely at the site that would render the generic residential assessment criteria unsuitable.

It is the policy of Geoinvestigate Ltd. to use C4SLs in preference where duplicate target values exist due to their “more pragmatic (whilst still strongly precautionary)” nature*.

*Quotation taken from “SP1010. Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document”. Defra, March 2014

The results of the contamination testing that has been carried out have been compared to the soil quality values from the above sources. Where they fall below these limit values, they have been deemed safe for a residential end use. Where results have been found to be above the intervention values, an assessment of the available pathways and receptors has been carried out to determine whether further investigation or remediation might have been necessary. (Note that some further investigation has already been undertaken based on the results of these first analyses – see Section 5.3 later).

5.2 Contamination Risk to Identified Receptors

5.2.1 Contamination Risk to Human Health

Made ground was encountered to a maximum depth of 0.60m in a single excavation (TPB), this was underlain by a cohesive clay and subsequently weak weathered mudstone. No soils encountered at the site exhibited any noteworthy visual or olfactory evidence of possible contamination.

As discussed earlier in the report, levels of determinands have been compared to the soil assessment criteria for residential end-use, as published by the Environment Agency, DEFRA and LQM/CIEH.

The results of the analyses of five (5) samples of soil recovered from the site from depths of either 0.20m or 0.50m returned concentrations of a range of substances falling for the most part below respective assessment criteria adopted from the sources named above with some exceptions (discussed later). A summary of the returned soil concentrations together with the adopted assessment criteria is presented in Table 1 on the following page.

A mean Total Organic Carbon Content (TOC) of 3.4% and mean Soil Organic Matter Content (SOM) of 5.82% (estimated from the TOC) were returned from the soil analyses. Therefore, the LQM/CIEH GAC for PAHs and Hydrocarbons were chosen using the Soil Organic Matter (SOM) option of 2.5%, which is considered the most representative (and conservative) value for the samples returned.

Table 1: Chemical Determinands in Soils

	Range of Returned concentrations (mg/kg)	S4UL (LQM/CIEH)* (mg/kg)	C4SL (DEFRA)* (mg/kg)
Asbestos	None detected (all 3 samples)	Any presence unacceptable	
Arsenic	6.8 – 11.1	37	37
Boron	1.0 – 1.5	290	
Cadmium	<0.2 – 0.5	11	26
Chromium VI	<1 (all 5)	6	21
Chromium III	33.5 – 60.2	910	
Copper	9.6 – 23.1	2,400	
Lead	20.9 – 40.4		200
Mercury (elemental)	1.7 – 4.0	1.2	
Nickel	28.5 – 63.1	180	
Selenium	0.6 – 3.1	250	
Zinc	72.7 – 142.1	3,700	
pH	7.6 – 8.3	See Report Section 7.3 "Concrete Design"	
Water Soluble SO ₄	11.3 – 54.3		
Phenol	<0.5 (all 5)	280	
Total PAH	<0.34 – 0.54		
PAH Naphthalene	<0.02 (all 5)	5.6	
PAH Acenaphthylene	<0.02 (all 5)	420	
PAH Acenaphthene	<0.02 (all 5)	510	
PAH Fluorene	<0.02 (all 5)	400	
PAH Phenanthrene	<0.02 – 0.03	220	
PAH Anthracene	<0.02 (all 5)	5400	
PAH Fluoranthene	<0.02 – 0.08	560	
PAH Pyrene	<0.02 – 0.08	1200	
PAH Benzo[a]anthracene	<0.02 – 0.07	11	
PAH Chrysene	<0.03 – 0.06	22	
PAH Benzo(b)fluoranthene	<0.02 – 0.07	3.3	
PAH Benzo(k)fluoranthene	<0.03 – 0.03	93	
PAH Benzo(a)pyrene	<0.02 – 0.05	2.7	5
PAH Indeno(123-cd)pyrene	<0.02 – 0.03	36	
PAH Dibenz(a,h)anthracene	<0.02 (all 5)	0.28	
PAH Benzo(ghi)perylene	<0.02 – 0.03	340	
TPH Aromatic C5-C7	<0.01 (both)	140	0.87 (benzene)
TPH Aromatic C7-C8	<0.01 (both)	290	
TPH Aromatic C8-C10	<0.01 (both)	83	
TPH Aromatic C10-C12	<10 (both)	180	
TPH Aromatic C12-C16	<10 (both)	330	
TPH Aromatic C16-C21	<1 (both)	540	
TPH Aromatic C21-C35	<1 (both)	1500	
TPH Aromatic C35-C44	<1 (both)	1500	
TPH Aliphatic C5-C6	<0.1 (both)	78	
TPH Aliphatic C6-C8	<0.1 (both)	230	
TPH Aliphatic C8-C10	<0.1 (both)	65	
TPH Aliphatic C10-C12	<6 (both)	330 (118)**	
TPH Aliphatic C12-C16	<6 (both)	2400 (59)**	
TPH Aliphatic C16-C35	<15 (both)	92000 (21)**	
TPH Aliphatic C35-C44	<10 (both)	92000 (21)**	

*For residential use with allowance for cultivation of fruit/veg and at 2.5% organic matter where relevant.

Exceedances of assessment criteria are shown in **BOLD**

As can be seen from the results in Table 1 and the detailed results presented in Chemtech Environmental Ltd. report 122386 (Appendix 3) the returned results are below the adopted target values for most contaminants with one exception. There are elevated Mercury levels in every analysed sample. This is discussed further in Sections 5.3 and 6.1.

Analysis for organochlorine pesticides was also undertaken in one sample of topsoil but returned below detectable limits for all potential contaminants. Some microbiology testing was also undertaken but this is discussed in Section 5.2.3 later.

5.2.2 Contamination Risk to the Controlled Waters

Given the possible sources of historical contamination, leachate was analysed from two (2) samples obtained from BH1 and TPB at 0.50m.

Levels for domestic water supply or the protection of aquatic life levels as published by the Environment Agency are presented as the assessment criteria, but these are not strictly target values. They are not directly applicable to leachates because these standards would represent the total concentration in the receiving water bodies following mixing of leached contaminants. As such the standards are included as an example of good water quality for consideration of how leachable contamination might affect such waters. The results of the testing and the assessment criteria are shown Table 2 below with full results presented in Appendix 3 of this report (Chemtech Environmental Ltd. report 122386).

Table 2: Chemical Determinands in Leachate

	Returned Concentrations (µg/l)	UK Standard for Surface Waters intended for Drinking Water Abstraction* (DW) and/or protection of Aquatic Life in surface waters* (Aq) (µg/l)
<i><u>Inorganic Chemicals</u></i>		
Arsenic	0.69 – 10.06	50 (DW, range: 50-100) (No Aq standard)
Boron	<6 (both)	1000 (DW & Aq)
Cadmium	<0.07 (both)	5 (DW & Aq)
Chromium	0.6 – 0.8	50 (DW) / 5-250 (Aq, range: 5-250)
Copper	4.2 – 9.5	50 (DW) / 5-112 (Aq, range: 5-112)
Lead	<0.2 – 0.3	50 (DW) / 4-250 (Aq, range: 4-250)
Mercury (elemental Hg)	<0.008 (both)	1 (DW & Aq)
Nickel	<0.5 – 1.9	20** (DW) / 50-200 (Aq, range: 50-200)
Selenium	0.15 – 0.37	10 (DW) (No Aq standard)
Zinc	<1 (both)	3000 (DW, range: 3000-5000) / 30-2000 (Aq, range: 30-2000)
pH	7.3 – 7.8	Range 5.5 to 10 (UK drinking water standards)
<i><u>Organic Chemicals</u></i>		
Cyanide	<5 (all 3)	50 (DW) / 5 (Aq)
Phenols	<10 (all 3)	50** (DW) / 300 (Aq)
PAHs (total)	<1.6 – 3.9	0.2 (DW, range: 0.2-1.0) (No Aq standard)
Individual PAH species at detectable levels:		
Acenaphthene	<0.1 – 0.5	No applicable UK standard
Anthracene	<0.1 – 0.1	0.4 (surface water quality, max. allowable)
Benzo(ghi)perylene	0.1 – 0.2	0.002 (surface water quality, annual average)
Dibenzo(a,h)anthracene	0.2 – 0.3	No applicable UK standard
Fluorene	<0.1 – 0.6	No applicable UK standard
Indeno(123-cd)pyrene	0.1-0.2	0.002 (surface water quality, annual average)
Naphthalene	<0.1 – 1.5	10 (Aq, UK inland waters)
Phenanthrene	<0.1 – 0.8	No applicable UK standard

*sourced from Environment Agency database at <http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx>.

If more than one option is available (dependant on other water properties or environmental setting) applicability may be discussed later.

**Standard for water supply as no standard available for surface water abstraction for drinking water.

As can be seen from Table 2 and the detailed results presented in Chemtech Environmental Ltd report 122386 (Appendix 2), levels of potential contaminants in analysed leachates are negligible and would not be expected to pose any risk to local ground/surface waters or deeper underlying soils.

Ponds/reservoirs are located fairly close to the site but underlying soils comprise impermeable clay preventing any meaningful pathway for potential contaminant migration.

5.2.3 Microbiology Contamination Risk

Due to the use of the site for the housing of livestock, analysis was undertaken on one soil sample to determine whether this activity might have resulted in the presence of potential pathogens in near surface soils which could potentially pose risk to human site users.

The result of sewage indicators are shown in Table 3 (below) along with published guidelines and research findings from WHO, drinking water standards, and various research papers and fact sheets.

Table 3: Sewage contamination bacterial and chemical indicators

	Range of returned concentrations (colony-forming unit/g)	Health Protection Agency UK (2009) (Food standards) (cfu/g)	Food Safety Authority of Ireland (cfu/g)	Drinking water standards (colonies / 100ml)	Common raw sewage counts (colonies / 100ml WHO)	Wastewater Treatment Sludge counts (cfu/g dry matter)
<i>Escherichia Coli</i>	<1* - <10	<20 20 - ≤10 ² >10 ²	<20 20 - ≤10 ² >10 ²	Absence of in 100ml	10 ⁶ - 10 ⁷	2.2x10 ⁵
<i>Enterobacteriaceae</i>	<1* - >450	<10 ² 10 ² - ≤10 ⁴ >10 ⁴	<10 ² 10 ² - ≤10 ⁴ >10 ⁴	Absence of in 100ml	3.8 x 10 ⁹	2.8x10 ⁶
<i>Clostridium Perfringens</i>	<1* - <10	<10 10 - ≤10 ⁴ >10 ⁴	<10 10 - ≤10 ⁴ >10 ⁴	Absence of in 100ml	6 x 10 ⁴ – 8x10 ⁴ (Clostridium Perfringens spores)	
<i>Salmonella</i>	<1 - <10	Non-Detected Detected	Non-Detected Detected	Absence of in 5000ml and 1000ml		
pH	7.6 - 8.3			6.5-9.5	Average 7.2	7.5-9

ND = None Detected

*Noted in subsequent testing exercise

(green – Satisfactory)

(amber – borderline – not considered injurious to health)

(red – unsatisfactory – further investigation required / source must be identified)

Analysis of soils using microbiological guidelines are presented in Table 3 above. Results have generally returned values below detectable limits with the exception of the presence of *Enterobacteriaceae*. Exceedance is noted above drink water standards, and due to the way the result is reported (as greater than a maximum value) it is unclear whether the food standards have been exceeded.

Exceedance of the drinking water standard is not expected to be representative of any noteworthy potential risk given that these are soils not waters and are not intended for consumption.

Normally, the values would be reported accurately and not as “greater than” a maximum threshold. The subcontracted laboratory has chosen to report in this way for unknown reasons. However, provided the

exceedance of their threshold is not extreme, this result is also fairly unlikely to be representative of any significant risk to future site users. To fall into the unsatisfactory category, the result would need to be >10,000 cfu/g, considerably higher than the reported maximum threshold. Furthermore, this would be the requirements for food intended for human consumption, which does not apply directly to soils.

Nonetheless, following the initial test result (TPA), a second analysis (on soil from TPG) was carried out following the second day of field works to further examine the potential risk in this regard. As shown in Table 3 and Chemtech report 125335 (Appendix 2), this returned results consistently below detectable limits and further suggests minimal risk in this regard.

5.3 Additional Testing

Following the receipt of the above results it was deemed further testing would be pertinent to confirm the elevated mercury levels across the site.

The presence of elevated mercury in all samples was somewhat perplexing given the apparent absence of any potential sources of mercury contamination at the site and the highest result being returned for undisturbed natural clay subsoil. It was assumed to be a laboratory error but when a retest was requested, it transpired that the samples had been lost or disposed of in the meantime.

Geoinvestigate therefore returned to site on 26/07/23 and opened a further six (6) hand excavated trial pits to 0.50m each to collect samples for further testing of mercury and microbiology. The microbiology results were discussed in the preceding section but Table 4 below summarises the mercury analysis results of the additional works, and also includes the original test results for comparison.

Table 4: Mercury testing results

Initial Testing	BH1 – 0.50m 4.0 mg/kg	BH2 – 0.20m 2.9 mg/kg	BH3 – 0.20m 2.4 mg/kg	TPA – 0.20 2.2 mg/kg	TPB – 0.50 1.7 mg/kg	
Additional Testing	TPC – 0.50m <0.1 mg/kg	TPD – 0.20m <0.1 mg/kg	TPE – 0.20m <0.1 mg/kg	TPF – 0.20m <0.1 mg/kg	TPG – 0.50m <0.1 mg/kg	TPH – 0.20m <0.1 mg/kg

As shown in Table 4, the additional testing found the mercury concentration to be below detectable limits in all six (6) samples.

The likelihood of all five samples being above the chosen target value in one round of testing and all six (comparable) samples being below detectable limits in another is extremely low, and the initial mercury analysis results are therefore inferred to be in error and should be disregarded accordingly.

Therefore, the additional analyses are considered to have shown that no risk exists at the site with respect to potential mercury contamination and no mitigation work will therefore be required.

As discussed in the preceding section, another test for microbiology was undertaken, returning below detectable limits for all analyses including Enterobacteriaceae.

5.4 Review of Results

After the initial sampling works, soil mercury concentrations ranged from 1.7mg/kg to 4.0mg/kg with the chosen target value being 1.2mg/kg. As the samples were taken across the site and in a variety of strata the topsoil, natural underlying clay and made ground (TPB), this would have meant that the site would have been considered wholly contaminated in this regard.

Due to the apparent lack of potential sources for this (possible) contamination, its presence in every sample, and the incidence of the highest mercury content in undisturbed natural clay subsoil, these results were inferred to potentially be incorrect.

As such a re-test of all the samples was requested on 2nd June 2023 at Geoinvestigate's expense, one week after receipt of the original results. However, after some weeks it was discovered on following up the request that the laboratory had lost or accidentally disposed of the remaining samples. This information was passed to Geoinvestigate on 18th July 2023. The test was subcontracted by Chemtech environmental Ltd. due to either a machine failure or very high demand, and the subcontracted laboratory was responsible for the loss. Finally, to resolve the remaining uncertainty, additional sampling and testing was undertaken to fully understand the nature of the contamination at site.

In terms of contamination, based on the information from two rounds of contamination testing the elevated mercury levels noted initially are assumed to be erroneous and the subsequent testing of six (6) samples from TPC – TPH are more likely representative of levels of mercury at site.

The earlier error may have been in the transcription of results, contamination during analyses (less likely), or a machine failure. Nonetheless, the results of the initial analyses are considered highly unlikely to be accurate. The subsequent analysis of comparable samples returned no detectable mercury concentrations which is more typical of a site such as this.

Microbiological Indicator Species

Also noted in one sample from the initial works is the elevated level of Enterobacteriaceae, likely due to the livestock within the fields. Additional testing did return negligible levels however.

Microbial indicators tested as above are generally considered to represent the possibility of faecal contamination within the food and water environment. No standards presently exist for assessing microbiological indicators within soil and so a practical assessment of the returned soil analysis results and potential risk to receptors at the site is presented earlier and expanded on below. Indicator species comprise *Escherichia coli* (*E coli*), *Salmonella*, Enterobacteriaceae and *Clostridium Perfringens*.

Enterobacteriaceae is considered to be a large family of Gram-negative, facultatively anaerobic bacteria. This family includes both harmless symbionts as well as the more familiar and harmful bacteria including *Escherichia coli* and *Salmonella* (others include *Shigella* and *Yersinia pestis*, *Klebsiella*). It is considered highly likely that this family of bacteria is widely present in the natural environment. Subsequently, given the very low levels returned for *Escherichia coli* and *Salmonella*, it is likely that the symbionts of this bacteria family found in the sample of topsoil from TPA are harmless to human receptors (although no detailed analysis was conducted to determine which exact symbionts are present).

Given that the samples tested comprise solid matter (as opposed to waters), and that the material will not be ingested in noteworthy quantities (though some accidental ingestion is possible), nor will ground water at the site, it is considered more than adequate to assess soils using the HPA UK food standards.

Given it is unclear on the exact levels due to the nature of the results from the laboratory, no definite conclusion of the risk posed by the microbiology can be drawn following the initial analyses. However, further testing at TPG returned negligible levels of all microbiology tested. As such a reasonable estimate is that the site lies within the Amber threshold noted in Table 3 and not considered injurious to health.

To fall into the unsatisfactory category for food standards, the result would need to be >10,000 cfu/g, considerably higher than the reported maximum threshold of 450 cfu/g. Furthermore, given that this would be the requirements for food intended for human consumption, which do not apply directly to soils, realistic target values for soil would be higher still.

As such, it is concluded that there is no noteworthy or significant potential contamination risk at the site and the redevelopment should be allowed to proceed without any requirement for remedial works (save for if unexpected contamination was subsequently encountered during groundworks).

6. Conclusions

6.1 Contamination

Analysis of the ground conditions at the site and an assessment of the potential pathways have confirmed that soils at the site are generally uncontaminated and fit for purpose in the proposed residential end use of the site.

Furthermore, no discernible risk can be identified to local ground and surface waters through leaching and contaminant mobility.

As such no remedial works will be required at the site in this regard prior to the commencement of the development.

If unexpected contamination were to be subsequently discovered during groundworks, both Geoinvestigate Ltd. and the local planning authority should be notified and a reassessment of the contamination risk should be undertaken. However, this is currently thought to be an unlikely eventuality.

6.2 Ground Gas

It is noted that the earlier desk study report identified a potential risk of ground gas at the site, primarily associated with possible made ground and the nearby ponds/reservoirs.

Based on the findings of this investigation, this potential risk can be disregarded. The reservoirs might have been considered a potential risk had they been infilled, but this is clearly not the case. Regardless, the impermeable clay and mudstone subsoil and rock would not offer a favourable pathway for ground gas migration.

Additionally, made ground was only present in one location and extended to just 0.60m below ground level. Reference CL:AIRE guidance (document RB17) suggests that no ground gas risk would normally be inferred to be possible/likely where <1m of made ground (general infill) is present over low organic content natural subsoils, nor would ground gas monitoring be required.

As such, there is no plausible ground gas source or pathway at the site and no protective measures will be required in that regard.

Note also that no radon risk is apparent in this area (see <https://www.ukradon.org/information/ukmaps> for reference).

6.3 Concrete Design

The results of chemical analyses of the fill returned Water Soluble Sulphate levels of between 11.3mg/l⁻¹ and 54.3mg/l⁻¹ and pH levels of between 7.6 and 8.3. Additionally, the site is inferred to classify as natural soils with static water.

On this basis concrete in contact with the ground may be designed to ACEC Class DS-1 AC-1s of “BRE Special Digest 1 – Concrete in aggressive ground”.

END OF REPORT

The findings and contents of this (intrusive) Site Investigation Report pertain solely to the study area(s) outlined herein and are based solely on the findings of the excavations undertaken as part of the current exercise unless otherwise stated. The findings and/or recommendations of this report do not take into account any ground conditions that may be present but have hitherto not been encountered and as such further investigation and/or a reconsideration of the findings of this report should be undertaken if such conditions are subsequently encountered or an alternative development plan or land use is subsequently proposed.

This report considers various environmental and/or geological risks posed to the site and/or proposed development and offers advice accordingly as guidance only. The findings of this report will remain valid provided no change of ground or groundwater conditions, either natural or anthropogenic, take place and no warrantee is offered or implied.

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Units 3a and 4 Terry Dicken Industrial Estate
Ellerbeck Way
Stokesley
North Yorkshire
TS9 7AE

Tel. 01642 713779

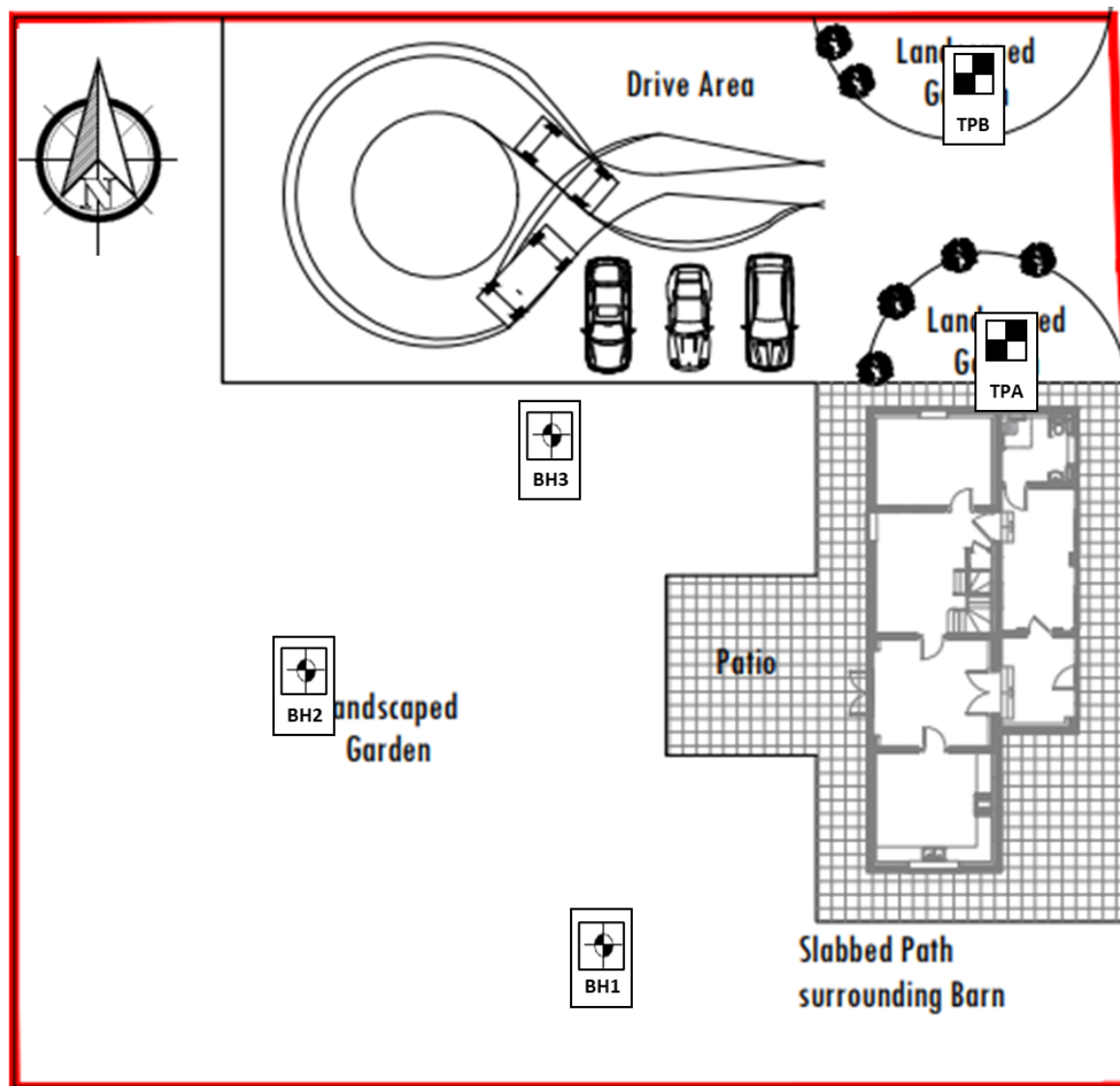
Fax 01642713923

Email enquiries@geoinvestigate.co.uk

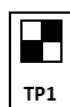
APPENDIX 1
Site Plan
And
Borehole Logs

GEOINVESTIGATE Ltd.

OUR REF: G23127	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE: 25/04/23	LOCATION: Claires Barn, Twycross CV9 3PG	

**Key**

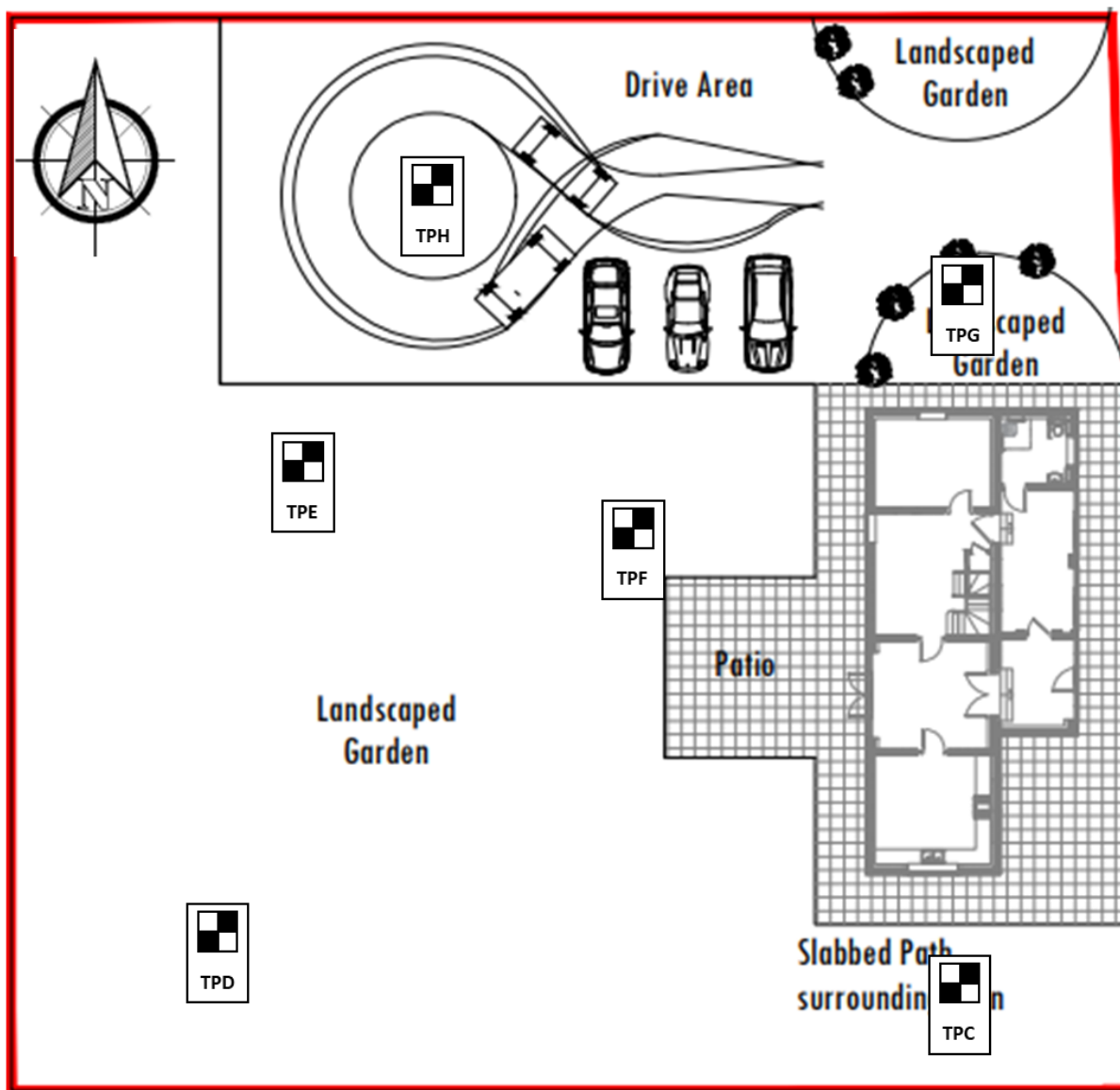
Windowless Sample
Borehole Location



Trial Pit Location

GEOINVESTIGATE Ltd.

OUR REF: G23127	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE: 26/07/23	LOCATION: Claires Barn, Twycross CV9 3PG	

**Key**

Additional Trial Pit
Location

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

BH No.1 Sheet No. 1 of 1**Location:** Claires Barn, Twycross CV9 3PG**DATE:** 25/04/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.40	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay. Gravel is fine to coarse of sandstone, brick and coal	400			O	Cv kN/m ²			0.25
1.00	Firm reddish brown slightly gravelly silty CLAY. Gravel is fine to coarse of sandstone	600			O	70			0.50
						65			0.75
					O				1.00
	Weak reddish brown highly weathered MUDSTONE. Recovered as firm slightly gravelly CLAY				O	38			1.25
									1.50
									1.75
		2000			O				2.00
									2.25
					O				2.50
									2.75
3.00					O				3.00
	Borehole terminated at 3.00m								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 3.00m

Borehole remained open and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

Disturbed sample

Shear vane

Water sample

Standard Penetration Test

Cone Penetration Test

BH1

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

G23127

BH No.2 Sheet No. 1 of 1

Location: Claires Barn, Twycross CV9 3PG

DATE: 25/04/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	TURF and TOPSOIL. Soft dark brown slightly gravelly sandy clay. Gravel is fine to coarse of sandstone and mudstone	300			O	Cv kN/m ² 20			0.25
1.00	Firm reddish brown slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone	700			O	60			0.50
					O	115			0.75
					O	115			1.00
	Stiff reddish brown slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone	1000			O	65			1.25
					O	65			1.50
					O				1.75
2.00					O				2.00
	Weak reddish brown highly weathered MUDSTONE. Recovered as firm slightly gravelly CLAY	1000			O				2.25
					O				2.50
					O				2.75
3.00					O				3.00
	Borehole terminated at 3.00m								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 3.00m

Borehole remained open and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

BH2

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

BH No.3 Sheet No. 1 of 1**Location:** Claires Barn, Twycross CV9 3PG**DATE:** 25/04/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.40	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay. Gravel is fine to coarse of sandstone, brick and coal	400			O	Cv kN/m ²			0.25
0.60	Firm reddish brown sandy gravelly CLAY. Gravel is fine to coarse of mudstone	200			O	60			0.50
	Firm to stiff reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse of mudstone and sandstone				O	92			0.75
									1.00
									1.25
	Sandy inclusion from 1.50m - 1.80m	1400			O	80			1.50
									1.75
2.00					O	60			2.00
	Weak reddish brown highly weathered MUDSTONE. Recovered as firm slightly gravelly CLAY								2.25
					O				2.50
		1000							2.75
3.00					O				3.00
	Borehole terminated at 3.00m								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 3.00m

Borehole remained open and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

Disturbed sample

Shear vane

Water sample

Standard Penetration Test

Cone Penetration Test

BH3

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPA**Sheet No. 1 of 1****Location:** Claires Barn, Twycross CV9 3PG**DATE:** 25/04/23

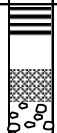
Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.20	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay.	200				Cv kN/m ²			0.25
	Gravel is fine to coarse of sandstone and mudstone				O				0.50
	Firm to stiff very gravelly slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone.	800			O				0.75
1.00					O				1.00
	Trial Pit terminated at 1.00m								

Remarks:

No casing

Hand excavated to 1.00m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

TPA

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPC**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.40	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay. Gravel is fine to coarse of sandstone, brick and coal	400			O	Cv kN/m ²			0.25
0.50	Firm reddish brown slightly gravelly silty CLAY. Gravel is fine to coarse of sandstone	100			O				0.50
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample**Cv** Shear vane**W** Water sample**S** Standard Penetration Test**C** Cone Penetration Test**TPC**

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPD**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

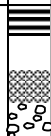
Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	TURF and TOPSOIL. Soft dark brown slightly gravelly sandy clay. Gravel is fine to coarse of sandstone and mudstone	300			O	Cv kN/m ²			0.25
0.50	Firm reddish brown slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone	200			O				0.50
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

TPD

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPE**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

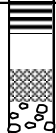
Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	TURF and TOPSOIL. Soft dark brown slightly gravelly sandy clay. Gravel is fine to coarse of sandstone and mudstone	300			O	Cv kN/m ²			0.25
0.50	Firm reddish brown slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone	200			O				0.50
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample**Cv** Shear vane**W** Water sample**S** Standard Penetration Test**C** Cone Penetration Test**TPE**

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPF**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.40	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay. Gravel is fine to coarse of sandstone, brick and coal	400			O	Cv kN/m ²			0.25
0.50	Firm reddish brown slightly gravelly silty CLAY. Gravel is fine to coarse of sandstone	100			O				0.50
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key: Slotted Pipe Plain Pipe Bentonite Gravel Filter**O** Disturbed sample**Cv** Shear vane**W** Water sample**S** Standard Penetration Test**C** Cone Penetration Test**TPF**

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPG**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

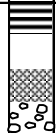
Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.20	TURF and TOPSOIL. Soft dark brown slightly gravelly, slightly sandy clay.	200				O	Cv kN/m ²		0.25
0.50	Gravel is fine to coarse of sandstone and mudstone	300				O			0.50
	Firm to stiff very gravelly slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone.								
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

TPG

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.**

G23127

TPH**Sheet No. 1 of 1****Location:** Claires Barn Farm, Twycross CV9 3PG**DATE:** 26/07/23

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	TURF and TOPSOIL. Soft dark brown slightly gravelly sandy clay. Gravel is fine to coarse of sandstone and mudstone	300			O	Cv kN/m ²			0.25
0.50	Firm reddish brown slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse of sandstone and mudstone	200			O				0.50
	Trial Pit terminated at 0.50m								

Remarks:

No casing

Hand excavated to 0.50m

Trial pit remained stable and dry on completion

Key:

Slotted Pipe



Plain Pipe



Bentonite



Gravel Filter

O Disturbed sample**Cv** Shear vane**W** Water sample**S** Standard Penetration Test**C** Cone Penetration Test**TPH**

APPENDIX 2

Chemtech Analytical Test Reports



ANALYTICAL TEST REPORT

Contract no: 122386

Contract name: The Barn, Claires Barn Farm, Twycross, CV9 3PG

Client reference: G23127

Clients name: Geo Investigate

Clients address: Units 3a & 4 Terry Dicken Industrial Estate
Ellerbeck Way, Stokesley
North Yorkshire
TS9 7AE

Samples received: 05 May 2023

Analysis started: 05 May 2023

Analysis completed: 18 May 2023

Report issued: 18 May 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
\$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing
NAD	No Asbestos Detected

Approved by:

Abbie Neasham-Bourn
Senior Reporting Administrator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
122386-1	BH1	0.50	Sandy Clay with Roots	-	-	14.3
122386-2	BH2	0.20	Sandy Clayey Loam with Gravel & Roots	-	-	20.9
122386-3	BH3	0.20	Sandy Clayey Loam with Gravel & Roots	-	-	22.2
122386-4	TPA	0.20	Sandy Clayey Loam with Gravel & Roots	-	-	30.4
122386-5	TPB	0.50	Sandy Loamy Clay with Gravel	-	-	16.3

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			122386-1 BH1 0.50 25/04/2023	122386-2 BH2 0.20 25/04/2023	122386-3 BH3 0.20 25/04/2023	122386-4 TPA 0.20 25/04/2023	122386-5 TPB 0.50 25/04/2023
Test	Method	Units					
Arsenic (total)	CE127 ^M	mg/kg As	8.9	8.1	9.2	6.8	11
Boron (water soluble)	CE063 ^U	mg/kg B	1.1	1.0	1.5	1.5	1.5
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	0.3	0.3	<0.2	0.5
Chromium (total)	CE127 ^M	mg/kg Cr	60	33	44	44	49
Chromium (III)	CE208	mg/kg CrIII	60	33	44	44	49
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	11	9.6	16	19	23
Lead (total)	CE127 ^M	mg/kg Pb	21	23	31	40	36
Mercury (total)	CE127 ^M	mg/kg Hg	4.0	2.9	2.4	2.2	1.7
Nickel (total)	CE127 ^M	mg/kg Ni	63	29	29	33	31
Selenium (total)	CE127 ^M	mg/kg Se	3.1	1.2	0.6	0.8	<0.3
Zinc (total)	CE127 ^M	mg/kg Zn	118	73	98	142	120
pH	CE004 ^M	units	8.3	7.7	7.7	7.6	8.1
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	54	42	46	11	44
Sulphide	CE016	mg/kg S ²⁻	98	35	31	39	31
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1
Thiocyanate	CE145 ^M	mg/kg SCN	<1	2.2	2.0	1.9	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	0.6	3.5	3.7	6.8	2.3
Estimate of OMC (calculated from TOC)	CE197	% w/w	1.1	6.0	6.4	11.8	3.9
PAH							
Acenaphthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	<0.02	0.07	<0.02	0.07
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	<0.02	0.04	<0.02	0.05
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	0.05	<0.02	0.07
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.03	<0.03	<0.03	<0.03	0.03
Chrysene	CE087 ^M	mg/kg	<0.03	<0.03	0.05	<0.03	0.06
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	CE087 ^M	mg/kg	<0.02	0.02	0.06	<0.02	0.08
Fluorene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03
Naphthalene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03
Pyrene	CE087 ^M	mg/kg	<0.02	0.02	0.06	<0.02	0.08
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	<0.34	<0.34	<0.34	0.54
TPH							
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	<0.01	-	<0.01	-

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			122386-1 BH1 0.50 25/04/2023	122386-2 BH2 0.20 25/04/2023	122386-3 BH3 0.20 25/04/2023	122386-4 TPA 0.20 25/04/2023	122386-5 TPB 0.50 25/04/2023
Test	Method	Units					
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	<0.01	-	<0.01	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	<0.01	-	<0.01	-
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	-	<10	-	<10	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	-	<10	-	<10	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	-	<1	-	<1	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	-	<1	-	<1	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	-	<1	-	<1	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	<0.1	-	<0.1	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	<0.1	-	<0.1	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	<0.1	-	<0.1	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	-	<6	-	<6	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	-	<6	-	<6	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	-	<15	-	<15	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg	-	<10	-	<10	-
Subcontracted analysis							
Asbestos (qualitative)	\$	-	-	NAD	-	NAD	NAD
E.Coli	\$	cfu/g	-	-	-	<10	-
Enterobacteriaceae	\$	colonies/g	-	-	-	>450	-
Enumeration of Clostridium perfringens	\$	colonies/g	-	-	-	<10	-
Salmonella	\$	-	-	-	-	<10	-
Organochlorine Pesticides							
alpha-HCH	\$	mg/kg	-	-	-	<10	-
beta_HCH	\$	mg/kg	-	-	-	<10	-
gamma-HCH	\$	mg/kg	-	-	-	<10	-
delta-HCH	\$	mg/kg	-	-	-	<10	-
Heptachlor	\$	mg/kg	-	-	-	<10	-
Aldrin	\$	mg/kg	-	-	-	<10	-
Heptachlor expoxide	\$	mg/kg	-	-	-	<10	-
trans-Chlordane	\$	mg/kg	-	-	-	<10	-
alpha cis-Chlordane	\$	mg/kg	-	-	-	<10	-
p,p-DDE	\$	mg/kg	-	-	-	<10	-
Dieldrin	\$	mg/kg	-	-	-	<10	-
Endrin	\$	mg/kg	-	-	-	<10	-
p,p-DDD	\$	mg/kg	-	-	-	<10	-
Endosulfan II	\$	mg/kg	-	-	-	<10	-
Endrin aldehyde	\$	mg/kg	-	-	-	<10	-
p,p-DDT	\$	mg/kg	-	-	-	<10	-
Endosulphan sulphate	\$	mg/kg	-	-	-	<10	-
Methoxychlor	\$	mg/kg	-	-	-	<10	-
Endrin ketone	\$	mg/kg	-	-	-	<10	-

Chemtech Environmental Limited

PREPARED LEACHATES

Lab number Sample id Depth (m)			122386-1L BH1 0.50	122386-5L TPB 0.50
Test	Method	Units		
Arsenic (dissolved)	CE128 ^U	µg/l As	0.69	10.06
Boron (dissolved)	CE128 ^U	µg/l B	<6	<6
Cadmium (dissolved)	CE128 ^U	µg/l Cd	<0.07	<0.07
Chromium (dissolved)	CE128 ^U	µg/l Cr	0.8	0.6
Copper (dissolved)	CE128 ^U	µg/l Cu	4.2	9.5
Lead (dissolved)	CE128 ^U	µg/l Pb	<0.2	0.3
Mercury (dissolved)	CE128 ^U	µg/l Hg	<0.008	<0.008
Nickel (dissolved)	CE128 ^U	µg/l Ni	<0.5	1.9
Selenium (dissolved)	CE128 ^U	µg/l Se	0.15	0.37
Zinc (dissolved)	CE128 ^U	µg/l Zn	<1	<1
pH	CE213 ^U	units	7.3	7.8
Sulphate	CE049 ^U	mg/l SO ₄	2.1	2.6
Sulphur (dissolved)	CE128 ^U	mg/l S	1.2	1.4
Sulphide	CE249	µg/l S ²⁻	<100	<100
Cyanide (free)	CE147	µg/l CN	<5	<5
Cyanide (total)	CE147	µg/l CN	<5	<5
Thiocyanate	CE014	µg/l SCN	<200	<200
Phenols (total)	CE148	µg/l PhOH	<10	<10
PAH				
Acenaphthene	CE051	µg/l	<0.1	0.5
Acenaphthylene	CE051	µg/l	<0.1	<0.1
Anthracene	CE051	µg/l	<0.1	0.1
Benzo(a)anthracene	CE051	µg/l	<0.1	<0.1
Benzo(a)pyrene	CE051	µg/l	<0.1	<0.1
Benzo(b)fluoranthene	CE051	µg/l	<0.1	<0.1
Benzo(ghi)perylene	CE051	µg/l	0.2	0.1
Benzo(k)fluoranthene	CE051	µg/l	<0.1	<0.1
Chrysene	CE051	µg/l	<0.1	<0.1
Dibenz(ah)anthracene	CE051	µg/l	0.3	0.2
Fluoranthene	CE051	µg/l	<0.1	<0.1
Fluorene	CE051	µg/l	<0.1	0.6
Indeno(123cd)pyrene	CE051	µg/l	0.2	0.1
Naphthalene	CE051	µg/l	<0.1	1.5
Phenanthrene	CE051	µg/l	0.1	0.8
Pyrene	CE051	µg/l	<0.1	<0.1
PAH (total of USEPA 16)	CE051	µg/l	<1.6	3.9

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE208	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE016	Sulphide	Distillation, Titration	Dry		10	mg/kg S ²⁻
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	U	0.03	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE250	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID	As received		1	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		15	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		10	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-
\$	E.Coli	Microbiology (details on request)	As received		10	colonies/g
\$	Enterobacteriaceae	Microbiology (details on request)	As received		10	cfu/g
\$	Enumeration of Clostridium perfringens	Microbiology (details on request)	As received		10	colonies/g
\$	Salmonella	Microbiology (details on request)	As received		10	colonies/g
\$	alpha-HCH	GCMS	As received		0.02	mg/kg
\$	beta_HCH	GCMS	As received		0.02	mg/kg
\$	gamma-HCH	GCMS	As received		0.02	mg/kg
\$	delta-HCH	GCMS	As received		0.02	mg/kg
\$	Heptachlor	GCMS	As received		0.02	mg/kg
\$	Aldrin	GCMS	As received		0.02	mg/kg
\$	Heptachlor epoxide	GCMS	As received		0.02	mg/kg
\$	trans-Chlordane	GCMS	As received		0.02	mg/kg
\$	alpha cis-Chlordane	GCMS	As received		0.02	mg/kg
\$	p,p-DDE	GCMS	As received		0.02	mg/kg
\$	Dieldrin	GCMS	As received		0.02	mg/kg
\$	Endrin	GCMS	As received		0.02	mg/kg
\$	p,p-DDD	GCMS	As received		0.02	mg/kg
\$	Endosulfan II	GCMS	As received		0.02	mg/kg
\$	Endrin aldehyde	GCMS	As received		0.02	mg/kg
\$	p,p-DDT	GCMS	As received		0.02	mg/kg
\$	Endosulphan sulphate	GCMS	As received		0.02	mg/kg
\$	Methoxychlor	GCMS	As received		0.02	mg/kg
\$	Endrin ketone	GCMS	As received		1.02	mg/kg

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METHOD DETAILS

METHOD	PREPARED LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE002	Leachate preparation (EA)	L:S 10:1		-	-
CE128	Arsenic (dissolved)	ICP-MS	U	0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS	U	8	µg/l B
CE128	Cadmium (dissolved)	ICP-MS	U	0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS	U	0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS	U	0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS	U	0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS	U	0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS	U	0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS	U	1	µg/l Zn
CE213	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	1.7	mg/l SO ₄
CE128	Sulphur (dissolved)	ICP-MS	U	0.2	mg/l S
CE249	Sulphide	Distillation, Titration		100	µg/l S ₂ -
CE147	Cyanide (free)	Continuous Flow Colorimetry		5	µg/l CN
CE147	Cyanide (total)	Continuous Flow Colorimetry		5	µg/l CN
CE014	Thiocyanate	Colorimetry		200	µg/l SCN
CE148	Phenols (total)	Continuous Flow Colorimetry		10	µg/l PhOH
CE051	Acenaphthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Acenaphthylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(b)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(ghi)perylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(k)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Chrysene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Dibenz(ah)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluorene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Indeno(123cd)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Naphthalene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Phenanthrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	PAH (total of USEPA 16)	Solvent extraction, GC-MS		1.6	µg/l

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DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
122386-1	BH1	0.50	N	
122386-2	BH2	0.20	N	
122386-3	BH3	0.20	N	
122386-4	TPA	0.20	N	
122386-5	TPB	0.50	N	

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ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

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

Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.



ANALYTICAL TEST REPORT

Contract no: 125335

Contract name: The Barn, Claires Barn Farm, Twycross, CV9 3PG

Client reference: G23127b

Clients name: Geo Investigate

Clients address: Units 3a & 4 Terry Dicken Industrial Estate
Ellerbeck Way, Stokesley
North Yorkshire
TS9 7AE

Samples received: 31 July 2023

Analysis started: 31 July 2023

Analysis completed: 14 August 2023

Report issued: 14 August 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
\$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by:

E. McCulloch

Ellis McCulloch
Senior Reporting Administrator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
125335-1	TPC	0.50	Sandy Clay with Gravel	-	-	10.1
125335-2	TPD	0.20	Loamy Clay with Gravel & Roots	-	-	18.9
125335-3	TPE	0.20	Loamy Clay with Gravel & Roots	-	-	14.8
125335-4	TPF	0.20	Loamy Clay with Gravel & Roots	-	-	21.2
125335-5	TPG	0.50	Sandy Clay with Gravel & Roots	-	-	13.4
125335-6	TPH	0.20	Sandy Clay with Gravel & Roots	-	-	11.1

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SOILS

Lab number			125335-1	125335-2	125335-3	125335-4	125335-5	125335-6
Sample id			TPC	TPD	TPE	TPF	TPG	TPH
Depth (m)			0.50	0.20	0.20	0.20	0.50	0.20
Date sampled			26/07/2023	26/07/2023	26/07/2023	26/07/2023	26/07/2023	26/07/2023
Test	Method	Units						
Mercury (total)	CE127 ^M	mg/kg Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Subcontracted analysis								
E.Coli	\$	cfu/g	-	-	-	-	<1	-
Enterobacteriaceae	\$	colonies/g	-	-	-	-	<1	-
Clostridium Perfringens	\$	colonies/g	-	-	-	-	<1	-
Salmonella	\$	-	-	-	-	-	<1	-

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
\$	E.Coli	Microbiology (details on request)	As received		10	cfu/g
\$	Enterobacteriaceae	Microbiology (details on request)	As received		-	colonies/g
\$	Clostridium Perfringens	Microbiology (details on request)	As received		50	colonies/g
\$	Salmonella	Microbiology (details on request)	As received		-	-

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DEVIATING SAMPLE INFORMATION

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NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
125335-1	TPC	0.50	N	
125335-2	TPD	0.20	N	
125335-3	TPE	0.20	N	
125335-4	TPF	0.20	N	
125335-5	TPG	0.50	N	
125335-6	TPH	0.20	N	

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