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PHASE 2

GEO-ENVIRONMENTAL REPORT

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< GEOTECHNICAL >

job number	4800/24/E/7331	date	31.01.2025
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site address	The Priory, Cleckheaton, West Yorkshire, BD19 6HR
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Report on a Phase 2 Geo-environmental Investigation

Location:	The Priory Whitechapel Road, Cleckheaton, West Yorkshire, BD19 6HR	
For:	Highstone Building Services	
Report No.	C4800/24/E/7330	Report date: January 2025

For and on behalf of **Rogers Geotechnical Services Ltd**

	
Scott Alexander BSc FGS Senior Geo-environmental Engineer	Rob Palmer MSc FGS ACIEH Engineering Director

Report Summary¹

Item	Comments	Section
Development	Construction of a new residential block of flats.	1.
Geology	Superficial geology – None recorded. Solid geology – Pennine Lower Coal Measures Formation	5.
Strata Conditions	Variable thickness of made ground. Variably very soft to stiff completely Siltstone, Sandstone and Mudstone. Coal seam with iron pyrite present below 2.50m.	6.
Groundwater	Groundwater strikes recorded at 3m in ws03 and WS04.	6.2
Foundation Design	Drilled piled foundation solution. Ground improvement by excavation and mass fill or vibro stone columns.	10.1
Effect of Sulphates	DC-1 concrete up to 2.50m. DC-5 concrete below 2.50m or where coal seam is penetrated.	10.5
Contamination	Arsenic and lead recorded in made ground in two locations. Remediation required.	11.

¹ This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land at The Priory, Whitechapel Road, Cleckheaton is to be developed by the demolition of the existing pub structure and construction of new residential apartments with external soft landscaping and car parking. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C4800/24/E/7330 in January 2025. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 9th December 2024 and included the following:

- Two windowless sample boreholes.
 - There was no access to drill locations near WS01.
 - WS02 was commenced via hand-dug pit due to presence of potential underground utilities. This was terminated when bedrock was encountered at 0.75m
- Standard penetration tests within one borehole.
- One hand excavated trial pit.
- Three gas monitoring standpipes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and reduced in diameter from 87mm for the first 1m through 77mm, 67mm, and 57mm for subsequent 1m increments. The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils were described in general accordance with BS5930: 2015 +A1: 2020 and full descriptions are given on the windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered.

4.2 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample boreholes. The SPT was conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole record. During this work an automatic trip hammer of 63.5kg falling through 750mm was employed to drive either a cone or split barrel sampler assembly into the ground and the recovered barrel samples were retained in air tight plastic containers.

4.3 Trial Pits (Hand-held Equipment)

Trial pits were excavated using hand-held digging equipment in order to reveal the nature of the near surface soils. The soils were logged on site in general accordance with BS5930: 2015+A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 2. Samples were taken from the trial pits for both geotechnical and chemical testing. The chemical test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the appropriate laboratory.

4.4 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 0.75m and 3m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. In the boreholes, the monitoring standpipe consisted of a perforated pipe from 3m below ground level to 1.00m below surface, with a non-perforated pipe to ground level. In the hand pit the standpipe comprised perforated pipe from 0.75m to 0.50m below surface level, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal at the base and above, and the installation was capped with a stop box cover in a concrete surround.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site			
Strata Type	Strata Name ²	Previous Name ³	Description ³
Superficial Geology	None Recorded	-	-
Solid Geology	Pennine Lower Coal Measures Formation	-	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

The geological maps indicate the Trub Coal seam outcrops across the south of the site.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile			
Depth m below ground level to underside of layer	Strata Type	Positions Encountered	Groundwater Strikes m below ground level
0.10 to 0.30	MADE GROUND (Road Surface and subbase)	ALL	None
0.50 to 1.50	MADE GROUND (Granular)	ALL	None
0.95 to 1.65	MADE GROUND (Cohesive)	WS03 and WS04	None
0.90	Weak Yellow SANDSTONE	HP	None
2.47 to 2.86	Extremely weak SANDSTONE and SILTSTONE	WS03, WS04	None
2.56 to 3.10	COAL (Trub) (0.11m and 0.24m thickness)	WS03, WS04	None
2.75	SEATEARTH	WS04	None
+3.45 to +4.45	Extremely weak SILTSTONE and MUDSTONE	WS03, and WS04	3.00m in both boreholes

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

6.1 General Strata

Made ground was proven in the boreholes to maximum depth of 1.65m below existing ground level (begl) and comprised variably granular and cohesive deposits. This was underlain by bedrock

² Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [online resource from www.bgs.ac.uk]

³ Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [online resource from www.bgs.ac.uk]

comprising sandstone and siltstone which had completely weathered to a soft clay or medium dense sand. Underlying these deposits, a thin coal seam was proven in WS03 and WS04 at a depth of 2.86m, with a thickness of 0.24m, and 2.47m, with a thickness of 0.11m, begl respectively. The coal in WS04 was underlain by a very soft organic clay proven to 2.75m begl thought to represent a seatearth below the coal. This was not encountered in WS03, likely owing to the thicker coal seam and higher quality coal observed. The coal and seatearth was underlain by extremely weak completely weathered mudstone recovered as clay proven to borehole termination at 4.45m below ground level.

The deposits encountered within the ground investigation, fall broadly in-line with the anticipated geology from the published geological records of weathered soils of the Pennine Lower Coal Measures.

6.2 Groundwater

Groundwater was recorded at a depth of 3.00m begl in both boreholes. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in the boreholes are summarised in the following table:

Table 3: Summary of Standard Penetration Tests				
Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
MADE GROUND	1.00	9 - 14	-	SPT's indicate a loose to medium dense in-stu condition
Soft CLAY	2.00	-	3 - 21	SPT's indicate soils are in a very soft to stiff in-situ condition
Weathered SILTSTONE and MUDSTONE	3.00 4.00	-	15 - 21 20 - 34	SPT's indicate soils are in a firm to stiff in-situ condition

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 10th January and the 14th January 2024. The gas monitoring period is currently ongoing and six visits are scheduled to be completed over a three-month period due to the observed ground gas sources. The results of the gas monitoring undertaken to date are tabulated below and full results are presented in Appendix 3.

Table 4: Gas Monitoring

Location	Date	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
HP (WS02)	10.01.2025	0.1	1.1	20.6	0.0	1020↑	DRY	0.68
	14.01.2025	0.1	0.1	21.3	0.0.1	1033↔	DRY	
WS03	Tap and pipe frozen							3.86
	14.01.2025	0.0	0.2	21.1	0.0	1033↔	1.60	
WS04	10.01.2025	0.0	0.2	21.6	0.0	1020↑	DRY	3.30
	14.01.2025	0.0	1.4	18.6	0.0	1033↔	DRY	

↑ - rising pressure ↓ - falling pressure ↔ -steady pressure

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 25th October 2024

8. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- Determination of water content BS EN ISO 17892-1:2014
- Determination of liquid and plastic limits BS EN ISO 17892-12:2018
- Loss on ignition BS 1377-3:2018+A1:2021: Pt3: 6
- Determination of total sulphur BS 1377-3:2018+A1:2021: Pt3: 7.10
- Soluble sulphate content BS 1377-3:2018+A1:2021: Pt3: 7.3
- pH value BS 1377-3:2018+A1:2021: Pt3: 12
- Total Sulphate as SO₄ BS 1377-3:2018+A1:2021: Pt3: 7.3

The test results are presented in Appendix 4 and are summarised below:

Table 5: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Water content determinations	4	18% to 56%		Variable with depth. Above, below and at liquid limits.
Index properties (1 Point)	4	LL PL PI	41 to 74% 25 to 42% 16 to 32%	Clay of intermediate plasticity. Silt of high to very high plasticity. Consistency index 0.6 to 1.4 NHBC Class – Medium.
Total Sulphur	2	TS	1600 and 2300 mg/kg	Pyrite present in Coal.
Soluble sulphate & pH	3	SO ₄ pH	16.2mg/l to 49.9mg/l 6.7 to 8.6	Made ground and natural ground. Brownfield conditions with groundwater.

In cohesive soil the approximate cohesion, c_u , and coefficient of consolidation, m_v , may be obtained from the equivalent SPT 'N' value using the following expressions (Stroud 1975).

$$c_u = f_1 N$$

$$m_v = \frac{1}{f_2 N}$$

where: c = cohesion (kN/m²).
 m_v = Coefficient of consolidation (m²/MN).
 f_1 & f_2 = factors based on plasticity index.
 N = SPT 'N₃₀₀' value.

For the cohesive soils revealed at this site the highest (worst case) plasticity index⁴ of 32% could be employed, which suggests an f_1 value of 4.3 and an f_2 value of 0.43.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 6: Summary of Geotechnical Properties			
Property	Range of values		Comments
Volume change potential (NHBC)	Medium		Weathered SANDSTONE and SILTSTONE to clay and silt.
Shear strength parameters (at 2m below ground level)	C _u CLAY C _u SST γ CLAY γ SST	15kN/m ² 85kN/m ³ 20kN/m ³ 18kN/m ³	Stroud (1974) where $c_u = f_1 N$ Extreme variability of instu strength of near surface deposits due to differential rates of weathering.
Consolidation characteristics	m_v	0.78m ² /MN	Stroud (1974) where $m_v = 1/f_2 N$. Most conservative value.
Concrete classification	DC-1 up to 2.5m DC-5 greater than 2.5m		Brownfield ground location (mobile water)

9. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr^{VI}, Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN⁻ and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO₄²⁻.
- Asbestos.

This testing was undertaken by i2 Analytical Ltd and the results of all of the chemical testing are presented in Appendix 4 of this report.

⁴ See paragraph 6.2 'Index Property Tests'

10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of a new residential apartment block and detached summerhouse, with associated hard-standing and soft landscaped areas. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

From the ground investigation the deposits encountered across the site are highly variable and present in a variety of in-situ conditions. Towards the north-end of the proposed structure local to WS02, suspected sandstone bedrock was met at 0.75m; it should be appreciated that this was only observed in a hand-dug trial pit, rather than a borehole.

However, in WS03 and WS04, made ground was encountered to between 1.50m and 1.65m begl in a variably loose to medium dense in-situ condition. In WS03 weathered sandstone was recovered as firm to stiff friable clay, however in WS04 this was recovered as soft to very soft clay underlain by an extremely weathered siltstone. This very soft clay is highlighted in the geotechnical testing where a moisture content of 56% has been proven along with a consistency index of 0.6. For reference the consistency of a firm clay is typically between 0.9 and 1.1. It is considered that this lower consistency index indicates significant localised softening of the clay due to groundwater ingress. Below these deposits a coal seam was proven at depths of 2.86m begl, with a thickness of 0.24m, and at 2.47m begl, with a thickness of 0.11m. This coal seam was observed to have significant quantities of iron pyrite. The underlying completely weathered sandstone, siltstone, and mudstone was present in a generally firm to stiff in-situ condition.

10.1 Discussion of Potential Foundations

Due to the variable nature including varying depths of made ground and varying in-situ strengths of the deposits encountered, the following sections will discuss all potential foundation solutions and determine their suitability based on the ground conditions encountered. It should be appreciated that the area where the summerhouse is to be situated has not been investigated. Therefore, subsequent investigations are required to advise on foundations for that particular part of the development.

10.1.1 Traditional Shallow Foundations

Made ground was proven in WS03 and WS04 to a maximum depth of 1.65m begl. The hand-dug trial pit (HP) encountered sandstone bedrock from 0.50m begl which couldn't be advanced further than 0.75m begl. In addition to this, the initial natural deposits encountered within WS03 were in a firm to stiff in-situ condition whereas in WS04 were proven in a soft to very soft in-situ condition.

Based on the ground conditions encountered, with significant variation in strata conditions across a relatively small distance, it cannot be recommended that traditional shallow foundations be utilised due to the discrepancies between depths of suitable bearing strata and potential risks from excessive differential and settlements across the footprint of the proposed building, which could occur under moderately light surface loading.

10.1.2 Piled Foundations

In view of the above, piled foundations could be considered at this site. However, the ground conditions encountered may also present their own set of challenges for this foundation solution.

Due to the shallow nature of bedrock located adjacent to HP (WS02) it is likely to be difficult to utilise a driven pile, press-in pile or auger pile as it is anticipated that immediate refusal will be met. Drilled piles could be employed to penetrate through the bedrock and to a suitable founding depth, albeit this would prove expensive. Whilst driven piles could be utilised where made ground and weak and variable near surface deposits have been proven locally to a depth of approximately 2m, consideration should also be given to the potential lack of adequate lateral support to the piles. As such, extending the toe of the pile may be required penetrating deeper into the bedrock, or pile diameters may need to be increased and include significant reinforcement.

This introduces another issue whereby the coal seam encountered was observed to contain significant quantities of iron pyrite. Iron pyrite is an iron sulphide compound, which is unstable at shallow earth pressures and reacts aggressively with water, carbonate compounds, and iron compounds. Samples of the coal seam were undertaken to determine the risks from the sulphur contained to buried concrete and services. The results from the samples were returned as 1600mg/kg and 2300mg/kg. When converted to a Total Potential Sulphates to classify the risk as per the guidance given in *BRE: Special Digest 1:2005*⁵ this provides an equivalent Total Potential Sulphate (TPS) of 4.8% and 6.9% respectively. For reference the TPS threshold for DS-1 concrete is 0.24%. The minimum value recorded is twenty-times the maximum threshold value for DS-1 grade concrete and is two-times the lower bound threshold of the highest-grade concrete DS-5. Consequently, the ground is extremely aggressive at this horizon to buried structures due to the sulphur compounds present, which may degrade, corrode and structurally weaken any building materials which penetrate through this layer without adequate protections.

10.1.3 Ground Improvement

It is considered that some ground improvement could be undertaken on this site opposed to a piled foundation to improve the underlying ground conditions and reduce the risks from differential and total settlements. This could be through one of two methods:

- Excavation of loose/weak made ground and replacement with compacted granular fill in an engineered manner.
- Installation of vibro-stone columns to competent strata.

A mass fill solution could be adopted to remove the variable made ground to a depth of say 2m and replace with suitably compacted stone in an engineered manner for placement of shallow foundations to reduce risks from differential settlements. Given the variability in rockhead profile and weathering properties this should also incorporate a 'feathered' layer where a wedge of material be placed lapping onto the existing bedrock to minimise differential settlements between the engineered mass fill and the existing bedrock. This could prove to be a significant groundworks operation, with a significant volume of fill to be removed and subsequently replaced with suitable imported materials.

Vibro-stone columns could be employed at the site. Briefly the method includes the insertion of a gravel column through the weak near surface soils by inserting a vibrating poker into the ground and filling the void created with coarse gravel. These columns are positioned at designed spacing on the

⁵ BRES1:2005 Total Potential Sulphate (TPS) = (Total Sulphur (TS)/1000) * 3.

line of the footings, which are subsequently constructed using reinforced concrete. There are a number of techniques available thus in order to fully assess the efficacy of this approach the advice of specialist contractors should be sought. A full explanation of this method of construction is provided in the *NHBC Standards, Part 4, Foundations, Chapter 4.6 Vibratory ground improvement techniques*. The vibro-compacted gravel would be relatively chemically inert as opposed to concrete and steel piled foundations which may reduce risks from corrosion or heave from the pyrite bearing strata, and the depths of improvement could be varied depending on final depths required.

In both cases a reinforced ground beam or raft foundation spanning the improved ground could be employed to mitigate the risks from differential settlements. It may be possible to use pad footings if stone columns are installed, but this requirement would need to be discussed with a specialist contractor.

10.1.4 General Considerations for Foundations

Given the complex nature of the site it is considered that a combination of piled, or ground improvement solution and reinforced raft or ground beam foundations could be used. The installation of certain foundation types may need to take into consideration any nearby structures. Further guidance should be sought from the relevant foundation specialists and should be designed to an engineered standard. Any final designs may be required to be approved and agreed with any relevant overseeing authorities prior to construction starting.

The client should also remain aware that some of the cohesive soils at the site were revealed to have a medium volume change potential. Large mature coniferous trees have been observed in the desk study to be present around the boundary of the site. Therefore, any chosen foundation solution shall cater for shrinkage or swelling of the cohesive soils should they be installed within the zone of any existing trees or shrubs. For design purposes, in particular the derivation of heave forces on the underside of concrete foundations or ground slabs, the zone of desiccation may be considered as equivalent to the minimum foundation depth recommended for a shallow footing in the *NHBC Standards, Chapter 4.2 – Building Near Trees*

10.2 General Comments for Excavations

The stability of excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary unless the foundations are constructed using trench-fill techniques. In this method the foundation trenches should be excavated, inspected and backfilled with concrete as a continuous operation. Under no circumstances should operatives be allowed to enter unsupported excavations.

Should the excavations be required to stand open, it is considered that a blinding layer of lean-mixed concrete be placed over the sub-grade. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

Should a mass fill solution be selected the client should be aware that “wet ground” was observed from 2.60m and a groundwater strike was recorded at 3m. This strike was relatively consistent in both WS03 and WS04 therefore a more robust dewatering system may be required

Where shallow seepage of groundwater is encountered it is considered that it could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

10.3 Ground-floors

In light of the made ground and weak near surface soils, which were revealed to depths of up to 2m, it is not recommended that ground bearing ground floor slabs be employed. In this instance it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth. However, the final design for ground floors will be dependent upon the foundation design selected and should be included in any foundation designs by specialists, should a suitable ground improvement regime be selected then ground bearing slabs or a raft foundation acting as a ground bearing slab may also be adopted.

Further to the above, due to the volume change potential at the site, should the floor be placed within the zone of influence of any existing, or proposed, trees and shrubs, an allowance for soil volume change should be included. Further guidance is available in the NHBC standards, however, soil volume change can typically be catered for by providing a suitable void or utilize proprietary materials beneath the floor slab.

10.4 Hard-standing Areas

It is considered that any hard-standing at the site could be constructed employing traditional pavement design. A design California Bearing Ratio (CBR) of 2% could be employed in the pavement design⁶. However, where competent rock is exposed at or close to the surface this should provide a CBR in excess of 20% and thicknesses of capping and subbase can be reduced accordingly. It is recommended that proof rolling of the sub-grade be undertaken to establish the suitability of the soils, to expose any soft or weak ground and to ensure the sub-grade is well compacted prior to construction. Any areas of soft or weak ground should be remediated by increasing the sub-base thickness. Alternatively, weak material could be locally removed and replaced with a compacted granular capping layer. If construction were to be undertaken during the winter or after periods of prolonged rainfall, it may be prudent to employ a geotextile and/or a geogrid between the sub-base and sub-grade.

10.5 Effect of Sulphates

In view of the nature of the underlying near surface soils it is considered that the design sulphate class be assessed with reference to Table C2⁷, which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements where this does not intersect with the underlying coal seam with significant iron pyrite content. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1. Where deeper foundations are utilised this will need to be improved to high grade sulphate resistance.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1⁸, which can be found in Part D, *Specifying concrete for general cast-in-situ use*, of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

⁶ Table 11.1, *Reproduction of TRRL Report LR1132 (1984)*, Smith (2006), Smith's Elements of Soil Mechanics, 8th ed.

⁷ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

⁸ Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the erection of an apartment block with hard-standing and soft landscaped areas. Initial plans suggests that both communal and private garden areas will be present. Consequently, the site may be classified as residential with plant uptake.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 3.2% and 4.7%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website⁹ and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 5. These results indicate the following:

Table 7: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
WS03	0.60	Metals and non-metals: Lead, Arsenic PAHs: benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene
WS04	0.20	Metals and non-metals: Lead PAHs: benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene.
WS04	0.70	PAHs: benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene.
HP	0.15	Metals and non-metals: Arsenic PAHs: benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene.

Concentrations of cadmium, chromium^{VI}, selenium, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C10; aromatic C5 to C12) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values other than those listed in the table above. In addition, no asbestos was detected within the soil samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion¹⁰. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

⁹ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

¹⁰ Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Residential with home grown produce land use, 23.06.17.

Table 8: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with Plant Uptake)
WS03	0.60	None
WS04	0.20	None
WS04	0.70	None
HP	0.15	None

On the basis of the above information, the results of the investigation have concluded that the site is contaminated with respect to lead and arsenic. As a result remediation will be required to ensure the site is suitable for the proposed end use.

11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 0.1% and 1.1%, in association with oxygen levels of between 20.6% and 21.2%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, negligible flow rates have been proven to date therefore a flow rate of 0.1 litres per hour will be assumed and will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 1020mb and 1033mb.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 1.1% (0.011) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0011 l/hr for carbon dioxide.

In accordance with Table 2 of BS8485: 2015, *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*, the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures*, of CIRIA report C665.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)¹¹. Accepting that the proposed development is of moderate sensitivity and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of 2 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b*.

In this case, a total of 2 monitoring visits have been undertaken to date. Given the sites location, extent of made ground and potential ground gas sources identified a further 4 visits are due to be

¹¹ Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings*, p60.

undertaken over the following 2 months to fully classify the site, and recommendations upon gas protection measures will be provided once the monitoring period has concluded and will be issued in an addendum letter report.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency¹² advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.¹³ This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'¹⁴

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 9. Sources of contamination include the following:

On-site – Made Ground (Lead and Arsenic).

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

N/A -	A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.
Low -	A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.
Moderate -	The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary
High -	The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 9.

¹² R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.

¹³ The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

¹⁴ See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 9: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: Lead and Arsenic]

Conceptual Site Model			Site Specific Risk Assessment	
Pathways	Receptor	Linkage Present?	Risk Rating	Notes
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contamination found to be present at the site and contact with soil likely during works.	High	Some contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. However, as the site is anticipated to be secured during the development phase, contamination is not anticipated to affect neighbours.
	End User	Yes – contamination found to be present at the site and site to be developed into an apartment block with landscaped areas.	High	
	Neighbours	Yes – contamination found to be present at the site and a populated residential and commercial area surrounds the site.	Low	
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from contaminated soils. Some dust may be produced during construction phase.	Moderate	Some contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. Some measures to prevent generation of dust during construction activity.
	End User	Yes – Dust generation likely to be low. No evidence of vapour producing contaminants.	Low	
	Neighbours	Yes – contamination found to be present at the site and residential and commercial properties located within 250m radius of the site. Risk of possible migration of dust offsite during the works.	Low	
Ingestion of fruit/vegetables and/or waters	Operative	No – no edible plants or contained water sources in the area of the proposed new works.	N/A	Some contamination is present underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. The contamination at the site is considered to be of limited mobility, therefore the likelihood of contamination affecting neighbouring gardens is considered low risk.
	End User	Yes – contamination found to be present at the site and site to be developed into an apartment block with landscaped areas.	Moderate	
	Neighbours	Yes – contamination found to be present at the site and residential area adjoins the site.	Low	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – low concentrations of methane and carbon dioxide have been found to be present at the site to date (assuming <i>Characteristic Situation Level 1</i>).	Low to Moderate	Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. If ground gas conditions remain the same, no special precautionary measures are deemed to be required.
	End User		Low to Moderate	

	Neighbours	No – whilst concentrations of ground gas have been found to be present at the site (assuming <i>Characteristic Situation Level 1</i>), no structures directly adjoin the site, therefore gases migrating from the site would vent to atmosphere before reaching neighbouring structures.	N/A	
Spillage/loss/run off direct to receiving water	Controlled Waters	No – receiving waters are not present within 250m.	Low	Some contamination is present underlying the site. Remediation will be required to either remove the contamination or break pathways. Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – Secondary A aquifer is present beneath the site. Made ground combination of cohesive and granular. Contamination by metals is not anticipated to be significantly mobile.	Moderate	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. However, the site is underlain by cohesive soils of low permeability. Contamination by metals is not anticipated to be significantly mobile.	Low	
Direct contact with contaminated soils	Plants	Yes – Contamination present at the site which may affect plants.	High	Some contamination is present underlying the site. Remediation will be required to either remove the contamination or break pathways.
Uptake via root system			High	
Direct contact with contaminated soils	Building Materials	Yes – Testing indicates that the aggressive chemical environment for concrete classification is AC-1. Where the coal seam is encountered or penetrated this should increase to highest level of protection.	Low (plastic services)	Please see section 11.3.3 for information on good building practice.
Direct contact with contaminated groundwater			High (buried concrete)	
Exposure to Radon	Operative	Yes – Site is in a radon affected area.	Low	Between 1% and 3% of properties are above the action level. No radon protection measures required.
	End User			
UXO Risk	Operative	No – it is considered that the activities of the end users are unlikely to affect any UXO devices that may be present below the site.	Low	No further action required.
	End User			

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.3.1 Remediation Objectives

Based on the site-specific risk assessment the object of the remediation is likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust and vapours.
- To protect the end user from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect neighbours from the inhalation and ingestion dust during the construction process.
- To protect operatives, end users and neighbours from the ingestion of contaminated fruit and vegetables.
- To protect plants from direct contact with contamination and prevent uptake via root system.
- To ensure that contamination cannot reach controlled waters via permeable strata.
- To ensure that contamination cannot enter the former services occupying the site which may return to controlled waters.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwaters.
- To protect buried structural concrete from being degraded or corroded due to the presence of aggressive ground conditions.

11.3.2 Development Requirements

Whilst the precise nature of this development has not been finalised it is understood that it is to be developed by the construction of a new apartment block with hard-standing and soft landscaped areas. In view of the above a site-specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

11.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore, the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with contaminated soils and the potential hazards associated.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Site operatives should be encouraged to only consume food and drink in the appointed areas due to the risks from lead and arsenic in shallow soils.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- In order for contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1 for shallow foundations. Should foundations be required to penetrate through the iron pyrite bearing strata professional guidance should be sought for suitable protection measures due to the extremely high levels of sulphur encountered in this unit.

Landscaped Areas

In view of the potential contamination on site, it is considered that landscaped areas will require some remediation. This could include the provision of a clean cover system including a capping layer of say 500mm of inert material, which will put the contaminated ground out of the end users' dig range. At the base of this layer, a granular capillary break of say 100mm of free draining granular soil should be placed in order to prevent mobile contamination rising upward. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

Gas Protection Measures

Based on the gas monitoring undertaken to date, it is considered there exists a low risk from hazardous ground gases. A final review will be undertaken following the completion of the monitoring period and results provided in an addendum report. The client shall remain aware that the Conceptual Site Model shall remain alive until the completion of this monitoring period.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3882 (2015)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG¹⁵ documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 10: Validation Sampling and Testing		
Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m ³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH.

¹⁵ YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1 Appendix 1a, June 2021

		Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).
Greenfield/ Manufactured Soils	Minimum 3 Dependent on source and receptor, between 1 per 50m ³ and 1 per 250m ³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).
Brownfield/ Screened Soils	Minimum 6 Dependent on source and receptor, between 1 per 50m ³ and 1 per 100m ³	Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE)..

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 11: Fill Screening Values

Contaminant	Screening Value (Residential with Plant Uptake) (mg/kg)		Reference
	1% SOM	6% SOM	
As	37	37	Atrisk ^{SOIL} SSVs
Cd	22.1	22.1	Atrisk ^{SOIL} SSVs
Cr(VI)	3.62	3.63	Atrisk ^{SOIL} SSVs
Cu	4730	4790	Atrisk ^{SOIL} SSVs
Hg	8.81	15.8	Atrisk ^{SOIL} SSVs
Ni	136	136	Atrisk ^{SOIL} SSVs
Pb	200	200	Atrisk ^{SOIL} SSVs
V	136	138	Atrisk ^{SOIL} SSVs
Zn	20000	20300	Atrisk ^{SOIL} SSVs

Please see summary sheet within Appendix 5 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

11.5 Verification Report

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

It will be necessary for this report to include the following:

- The extents of any areas where made ground has been wholly removed.
- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery tickets where appropriate and the conditions by which the clean material has been stored and handled on site.
- Photographic and logged evidence the clean material has been handled on site and placed in a sufficient thickness over areas where made ground remains. This may be either at the time of placement or after placement by means of hand excavated trialpits. Photographs should include visual site references or reference boards to prove the location and date taken. A measurement reference should be visible in the photographs to substantiate the thickness of material placed. Please note that it may also be necessary to undertake a topographical survey and the requirement for which should be checked with any statutory authorities.

The report detailed above should be produced by a suitably qualified engineer. The number of verification areas for the development should be confirmed with any statutory authorities for the site.

12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Completion and reporting of recommended additional gas monitoring.
- Complete additional site investigation, preferably once all areas are available. Trial pits recommended to assess excavation stability and determine strata profile in area of the summer house and to investigate rock profile across the site.
- Discussions with foundations specialists for the most appropriate foundation solutions.
- Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Discussion with concrete specialists to determine the required protection of buried concrete due to aggressive ground conditions.
- Production of remediation statement.
- Produce a validation report to demonstrate that the geo-environmental risks discussed in this report have been mitigated.
- Detailed design of the sub-structure.

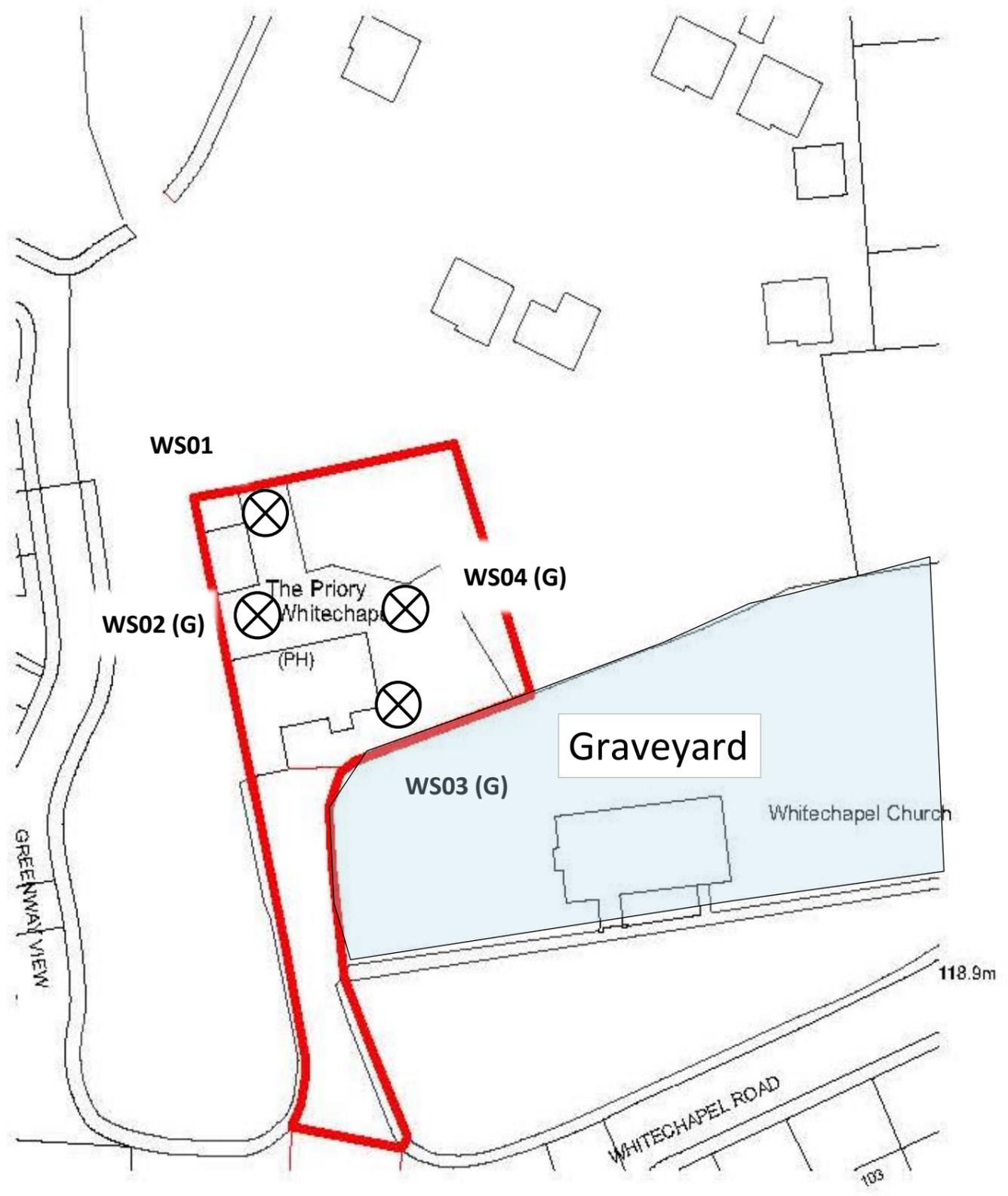
Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

- British Geological Survey (NERC) (2025), BGS, Keyworth.
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- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
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Appendix 1

Site Plan



Notes:
Investigation positions approximated from site operative's notes.



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Client:
Highstone Building Services

Job Number:
C4800/24/E/7331

Project Details:
The Priory, Whitechapel Road, Cleckheaton, BD19 6HR

Scale: Not to scale - reference only

Appendix 2

Borehole & Trial Pit Records



Borehole Log

Borehole No.

WS03

Sheet 1 of 2

Project Name: The Priory, Cleckheaton	Project No. C4800/24/E/7331	Co-ords:	Hole Type WLS
Location: Whitechapel Road, Cleckheaton	Level:		Scale 1:13
Client: Highstone Building Services	Dates: 09/12/2024		Logged By SA

Well	Water Strikes	Samples and In Situ Testing					Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Dia. (mm)	TCR (%)	Results				
						0.10			MADE GROUND. (Macadam chippings).	
									MADE GROUND. (Black subangular fine to medium GRAVEL of ash and macadam chippings).	
		0.60 - 1.00	ES				0.60		MADE GROUND. (Red and grey sandy angular to sub rounded fine to coarse GRAVEL of brick, concrete, ash, and macadam).	
		1.00	SPT			N=14 (3,3/3,3,4,4)	1.00		MADE GROUND. (Mixed soft brown CLAY and brownish grey fine to coarse SAND with angular coarse GRAVEL of brick, and concrete).	1
		1.60 - 1.70	D				1.50		Extremely weak yellowish brown highly to completely weathered SANDSTONE. Locally completely weathered to clay. [PENNINE LOWER COAL MEASURES FORMATION]	
		2.00	SPT			N=21 (1,1/3,6,6,6)	2.00		Extremely weak brownish grey and greyish brown extremely to completely weathered SILTSTONE. Generally crumbles to fissile tabular fine to medium gravel when handled, locally completely weathered to clay. [PENNINE LOWER COAL MEASURES FORMATION]	2
	2.30 - 2.40	D				2.20				
Continued on Next Sheet										

Remarks
 1. CAT and genny survey. 2. Groundwater at 3m.





Borehole Log

Borehole No.
WS03
Sheet 2 of 2
Hole Type
WLS
Scale
1:13
Logged By
SA

Project Name: The Priory, Cleckheaton
Project No. C4800/24/E/7331
Co-ords:
Location: Whitechapel Road, Cleckheaton
Level:
Client: Highstone Building Services
Dates: 09/12/2024

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Dia. (mm)	TCR (%)				
G	▼	2.90 - 3.00	ES			2.86		Black intact COAL with common pyrite nodules. [TRUB COAL, PENNINE LOWER COAL MEASURES FORMATION]	
		3.00	SPT			N=21 (1,1/3,6,6,6)			
		3.00				3.10		Extremely weak dark bluish grey completely weathered SILTSTONE recovered as slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to medium of siltstone lithorelicts. [PENNINE LOWER COAL MEASURES]	
						3.55		Extremely weak light brownish grey extremely weathered fine SANDSTONE recovered as angular fine to medium tabular GRAVEL. Occasional fragments of ironstone. [PENNINE LOWER COAL MEASURES FORMATION]	
		4.00	SPT			N=20 (2,2/3,4,6,7)	3.95	Extremely weak light grey extremely weathered to completely weathered SILTSTONE recovered as slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium of siltstone lithorelicts. [PENNINE LOWER COAL MEASURES FORMATION]	
						4.45	Extremely weak grey and dark grey completely weathered MUDSTONE recovered as firm slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine of mudstone lithorelicts. [PENNINE LOWER COAL MEASURES FORMATION]		
							End of Borehole at 4.45m		

Remarks
1. CAT and genny survey. 2. Groundwater at 3m.





Borehole Log

Borehole No.

WS04

Sheet 1 of 2

Project Name: The Priory, Cleckheaton	Project No. C4800/24/E/7331	Co-ords:	Hole Type WLS
Location: Whitechapel Road, Cleckheaton	Level:		Scale 1:13
Client: Highstone Building Services	Dates: 09/12/2024		Logged By SA

Well	Water Strikes	Samples and In Situ Testing					Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Dia. (mm)	TCR (%)	Results				
		0.20 - 0.40	ES				0.15		MADE GROUND. (Macadam chippings).	
		0.70 - 0.90	ES				0.25		MADE GROUND. (Light grey sandy sub angular to sub rounded fine to coarse GRAVEL of sandstone).	
							0.45		MADE GROUND. (Red and grey sandy angular to sub rounded fine to coarse GRAVEL of brick, concrete, ash, and macadam).	
							0.65		MADE GROUND. (Brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is angular to sub rounded fine to coarse of brick, concrete, and sandstone. Common plant roots). [INFERRED RELICT TOPSOIL]	
			1.00	SPT					0.95	MADE GROUND. (Soft to firm mixed brown, light brown and yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone, brick and white stone. Common plant rootlets).
			1.70 - 1.90	D					1.45	MADE GROUND. (Brown clayey slightly gravelly fine to coarse SAND of soil. Gravel is angular to rounded fine to medium of sandstone, brick, and concrete. Occasional plant matter and rootlets).
		1.65							MADE GROUND. (Light yellowish brown and white sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium of sandstone. Common plant roots and plant matter.) [INFERRED REWORKED SANDSTONE]	
		1.80							Soft light yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to medium of sandstone lithorelicts. [RESIDUAL SOILS PENNINE LOWER COAL MEASURES FORMATION]	
			2.00	SPT					2.00	N=3 (1,1/1,0,1,1)
			2.30 - 2.40	D					2.25	Extremely weak brownish grey and greyish brown completely weathered SILSTONE recovered as soft to firm slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is tabular fine to medium siltstone lithorelicts.
		2.50 - 2.55	D				2.47	[RESIDUAL SOILS PENNINE LOWER COAL MEASURES FORMATION]		
							2.56			

Remarks
 1. CAT and genny survey. 2. Ground wet from 2.60m groundwater at 3m.



Continued on Next Sheet



Borehole Log

Borehole No.

WS04

Sheet 2 of 2

Project Name: The Priory, Cleckheaton	Project No. C4800/24/E/7331	Co-ords:	Hole Type WLS
Location: Whitechapel Road, Cleckheaton	Level:		Scale 1:13
Client: Highstone Building Services	Dates: 09/12/2024		Logged By SA

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Dia. (mm)	TCR (%)						Results
		3.00	SPT			N=15 (2,2/3,3,4,5)	2.75 2.80		Black intact coal with peaty lignite band. [TRUB COAL, PENNINE LOWER COAL MEASURES FORMATION]	3	
		3.00							Very soft brownish grey slightly sandy organic CLAY. Sand is fine to medium. [SEATEARH, PENNINE LOWER COAL MEASURES]		
								3.45		Extremely weak grey highly weathered MUDSTONE recovered as fine to medium tabular GRAVEL. [PENNINE LOWER COAL MEASURES FORMATION]	
										Extremely weak grey and dark grey completely weathered MUDSTONE recovered as firm slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine of mudstone lithorelicts. [PENNINE LOWER COAL MEASURES FORMATION]	
		4.00	SPT			N=34 (4,5/7,8,8,11)			Inferred completely weathered MUDSTONE.	4	
							4.45		End of Borehole at 4.45m	5	

Remarks
 1. CAT and genny survey. 2. Ground wet from 2.60m groundwater at 3m.





Trial Pit Log

Trialpit No

HP

Sheet 1 of 1

Project Name: The Prior, Cleckheaton

Project No. C4800/24/E/7331

Co-ords: -
Level:Date
09/12/2024

Location: Whitechapel Road, Cleckheaton

Dimensions (m):

Scale
1:13

Client: Highstone Building Services

Depth
0.75Logged
SA

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.15 - 0.30 0.15 - 0.30	D ES		0.15			MADE GROUND. (Macadam chippings).
	0.30 - 0.50	D		0.30			MADE GROUND. (Light grey sandy sub angular to sub rounded fine to coarse GRAVEL of sandstone).
	0.50 - 0.75 0.50 - 0.75	D ES		0.50			MADE GROUND. (Red and grey sandy angular to sub rounded fine to coarse GRAVEL of brick, concrete, ash, and macadam).
				0.75			Light yellowish brown SANDSTONE recovered as GRAVEL.
							End of pit at 0.75 m

1

2

Remarks: 1. CAT and Genny Survey. 2. Hand dug trial pit abandoned on encountering sandstone bedrock.

Stability:



Appendix 3

Gas Monitoring Records

Post Fieldworks Discrete Well Monitoring Site Record



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Rogers Geotechnical Services Ltd , Offices 1 & 2
Barnciffe Business Park, Shelley, Huddersfield,
HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Job No:	C/4800/24/E/7331	Client:	Highstone Building Services	Visit:	1	Of	6
Site:	ThePrioryWhitechapelRdCleckBD19 6HR	Date:	10.01.2025				

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments	
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak					
2	0	0.1	1.1	1.1	0	0	0	0	20.6	20.6			0	0	Dry		0.68		
3																		Unable to open. Frozen with ice.	
4	0	0	0.2	0.2	0	0	0	0	21.6	21.2			0	0	Dry		1.22		

Max.	0	0.1	1.1	1.1	0	0	0	0	21.6	21.2	0	0	0	0	0			
Min.	0	0	0.2	0.2	0	0	0	0	20.6	20.6	0	0	0	0	0			

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Snow, ice.
Precipitation	0
Wind	0
Temperature	-2
Barometric Pressure	1020
Pressure Trend	Rising

Monitor Technical Specifications								Monitoring Period Summary (All Visits)				
Gas Monitor Used:	GA5000									Peak	Steady	
Serial No:	G503524									Max CH ₄	0	0
Monitor Gas Range	CH ₄	5>60	CO ₂	5<40	O ₂	21.2			Max CO ₂	1	1	
Gas Flow Range	0-10 l/hr									Max CO		
Date of Calibration	25.10.2024									Max H ₂ S		
PID Monitor (if used)										Max O ₂	22	21
PID Monitor Serial No.										Min O ₂	21	21
Calibration Date.										Flow rate		

Operative Details.	M.Tuck
---------------------------	--------

	Min	Max
Barometric Pressure	1004	1005

Appendix 4

Laboratory Testing

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LABORATORY REPORT

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job number	date
site address	
date scheduled	date issued
issued by	

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8948

Schedule of UKAS Accredited Laboratory Tests



1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN ISO 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2 : 3.2	Pt 1 : 2014 Pt 12 : 2018 : 5.3 / 5.5	A	
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3		A	
ii. Plastic limit	Pt 2 : 5.3		A	
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5		A	
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2		A	
ii. Large pycnometer	Pt 2 : 8.3			U
iii. Small pycnometer	Pt 2 : 8.4	Pt 3 : 2015 : 5.1		U
1.4 Density Tests				
i. Linear measurement	Pt 2 : 7.2	Pt 2 : 2014 : 5.1	A	
ii. Immersion in water	Pt 2 : 7.3	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2 : 7.4	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9 : 2.1, 2.2			U
v. Core cutter	Pt 9 : 2.4			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2 : 9.2	Pt 4 : 2016 : 5.2	A	
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2	A	
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4	A	
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS				
ii. Mass loss on ignition	Pt 3 : 4			U
3. COMPACTION RELATED TESTS				
3.1 Dry density/moisture relationship				
i. 2.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
ii. 4.5kg rammer – 1 litre mould	Pt 4 : 3		A	
- CBR mould	Pt 4 : 3		A	
3.2 Moisture Condition Value				
i. Single point test	Pt 4 : 5.4			U
ii. MCV/moisture content relationship	Pt 4 : 5.5			U
3.3 California Bearing Ratio				
i. Undisturbed sample	Pt 5 : 7		A	
ii. Recompacted sample	Pt 5 : 7		A	
iii. Soaked, inc measurement of swell	Pt 5 : 7		A	
4. COMPRESSIBILITY OF SOIL				
ii. Swelling pressure test	Pt 5 : 3		A	
ii. Swelling pressure test	Pt 5 : 3			U
5. SHEAR STRENGTH OF SOIL				
i. Hand shear vane	Makers instructions			U
ii. Shear box (100mm square sample)	BS 1377 : Pt 7 : 4			U
iii. Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9		A	
6. PERMEABILITY				
i. Falling head	K. H. Head Vol 2			U
ii. Constant head	BS 1377 : Pt 6 : 6			U
iii Triaxial cell	BS 1377 : Pt 6 : 6			U
7. ROCK TESTS				
7.1 Classification Tests				
i. Natural moisture content	-			U
ii. Saturated moisture content	-			U
iii. Natural density	-			U
iv. Porosity	-			U
7.2 Strength Tests				
i. Point load index	ISRM '85			U
ii. Uniaxial compression test	ISRM '81			U

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Disclaimer

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GEOTECHNICAL TESTING RESULTS



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 Near Bank, Shelley,
 Huddersfield,
 HD8 8LU

Classification of Index Properties

C4800/24/E/7331

Project Name: The Prior,

BS EN ISO: 17892: Parts 1, 12

Fig. Sheet.
2 1

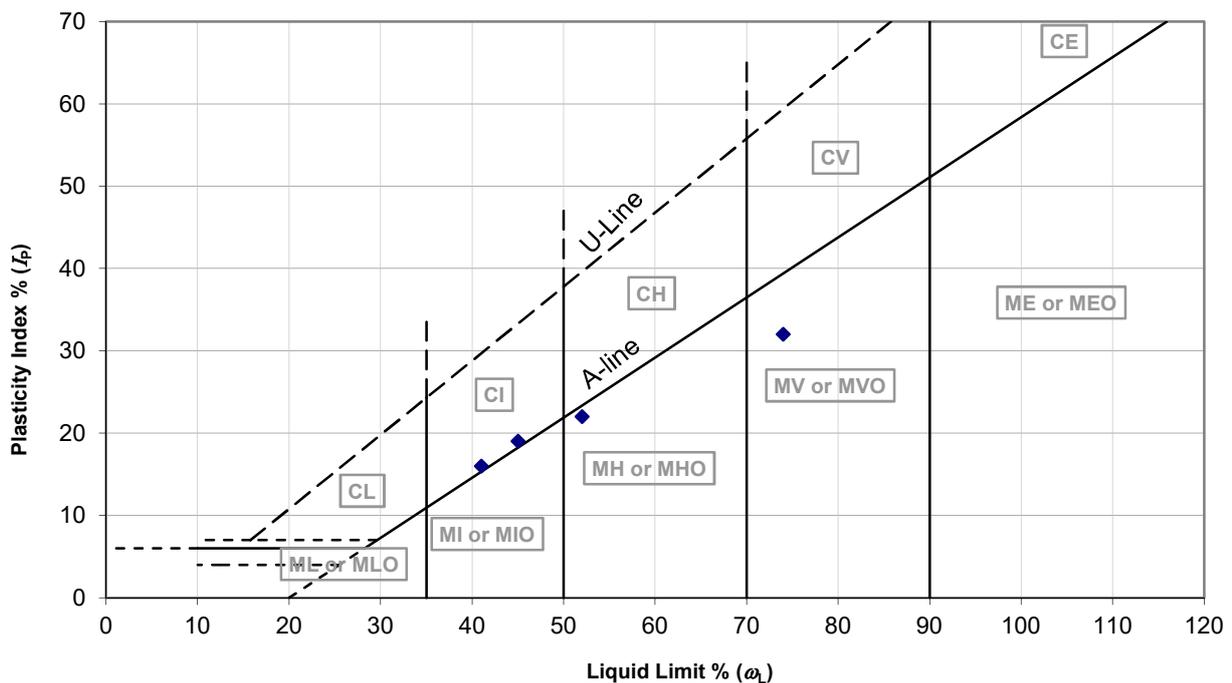
Location: Cleckheaton

Input By: Harry

Client: Highstone Building Services

Check By: Harry

Location	Depth (m)	Water Content (ω) (%)	Liquid Limit (ω_L) (%)	Plastic Limit (ω_P) (%)	Plasticity Index (I_P) (%)	Retained by 0.425mm (%)	Modified (ω) (%)	Modified (I_P) (%)	Liquidity/ Consistency		Casagrande Class	N.H.B.C Class (%)
									(I_L) (%)	(I_C) (%)		
WS03	1.60	26	45	26	19	27	36	14	0.0	1.0	C I	LOW
WS03	2.30	18	41	25	16	1	18	16	-0.4	1.4	C I	LOW
WS04	1.70	56	74	42	32	0	56	32	0.4	0.6	M V	MEDIUM
WS04	2.30	30	52	30	22	2	31	22	0.0	1.0	M H	MEDIUM





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Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 24-060730

Project / Site name:	The Prior, Cleckheaton	Samples received on:	20/12/2024
Your job number:	C4800 24 E 7331	Samples instructed on/ Analysis started on:	20/12/2024
Your order number:		Analysis completed by:	02/01/2025
Report Issue Number:	1	Report issued on:	03/01/2025
Samples Analysed:	8 soil samples		

Signed:

Charlotte Hall
Customer Service Advisor
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-060730
Project / Site name: The Prior, Cleckheaton

Lab Sample Number	415660	415661	415662	415663	415664			
Sample Reference	WS03	WS04	WS04	HP	WS03			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Water Matrix	N/A	N/A	N/A	N/A	N/A			
Depth (m)	0.60-1.00	0.20-0.40	0.70-0.90	0.15-0.30	1.60-1.70			
Date Sampled	18/12/2024	18/12/2024	18/12/2024	18/12/2024	18/12/2024			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Stone Content	%	0.1	NONE	33.9	24.7	< 0.1	19.1	< 0.1
Moisture Content	%	0.01	NONE	9.7	18	18	18	16
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.6	0.6	0.5

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	KWB	KWB	KWB	KWB	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.3	8.6	7.4	7.3	7.5
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	-	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	0.364	0.148	-	0.111	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	450	110	37	83	32
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	226	53.2	18.6	41.7	-
Water Soluble SO ₄ 16hr extraction (2:1)	mg/l	1.25	MCERTS	-	-	-	-	16.2
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	3.2	4.7	2.2	4.2	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
----------------------------	-------	---	--------	-------	-------	---	-------	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.24	0.48	0.12	0.32	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.14	0.13	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	0.12	0.13	< 0.05	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	0.11	0.1	< 0.05	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	1.6	1.4	0.23	0.36	-
Anthracene	mg/kg	0.05	MCERTS	0.55	0.37	0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	5.5	4.2	0.34	0.36	-
Pyrene	mg/kg	0.05	MCERTS	4.9	4.2	0.34	0.37	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.6	2.5	0.24	0.22	-
Chrysene	mg/kg	0.05	MCERTS	2.7	2.5	0.23	0.23	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.9	3.9	0.21	0.34	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.4	1.8	0.11	0.17	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.3	3.7	0.17	0.25	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.7	2	0.08	0.14	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.41	0.44	< 0.05	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.8	2.2	0.08	0.15	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	31	30	2.2	2.9	-
-----------------------------	-------	-----	-----------	----	----	-----	-----	---

Analytical Report Number: 24-060730
Project / Site name: The Prior, Cleckheaton

Lab Sample Number	415660	415661	415662	415663	415664			
Sample Reference	WS03	WS04	WS04	HP	WS03			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Water Matrix	N/A	N/A	N/A	N/A	N/A			
Depth (m)	0.60-1.00	0.20-0.40	0.70-0.90	0.15-0.30	1.60-1.70			
Date Sampled	18/12/2024	18/12/2024	18/12/2024	18/12/2024	18/12/2024			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Heavy Metals / Metalloids

Parameter	Units	Test Limit of detection	Test Accreditation Status	415660	415661	415662	415663	415664
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	43	32	19	49	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13	18	21	23	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	72	39	72	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	350	270	80	120	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	< 0.3	0.4	0.7	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	22	21	25	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	47	44	33	47	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	61	450	69	100	-

Petroleum Hydrocarbons

Parameter	Units	Test Limit of detection	Test Accreditation Status	415660	415661	415662	415663	415664
TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	-	< 0.010	-
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	-	< 0.010	-
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	-	< 0.010	-
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	4.9	2.4	-	3.8	-
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	11	< 8.0	-	< 8.0	-
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	59	60	-	< 8.0	-
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	75	63	-	< 10	-

Parameter	Units	Test Limit of detection	Test Accreditation Status	415660	415661	415662	415663	415664
TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	-	< 0.010	-
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	-	< 0.010	-
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	-	< 0.020	-
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	2.9	2.4	-	3.4	-
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	23	18	-	< 10	-
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	88	61	-	< 10	-
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	110	81	-	< 10	-

VOCs

Parameter	Units	Test Limit of detection	Test Accreditation Status	415660	415661	415662	415663	415664
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	-	< 5.0	-
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	< 5.0	-
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	-	< 8.0	-
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	< 5.0	-

I/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-060730
Project / Site name: The Prior, Cleckheaton

Lab Sample Number	415665	415666	415667
Sample Reference	WS03	WS04	HP
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	2.90-3.00	2.50-2.55	0.50-0.75
Date Sampled	18/12/2024	18/12/2024	18/12/2024
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Stone Content	%	0.1	NONE	< 0.1	< 0.1	31.1
Moisture Content	%	0.01	NONE	18	24	12
Total mass of sample received	kg	0.1	NONE	0.6	0.5	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	-	-	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	6.7	6.9	7.7
Free Cyanide	mg/kg	1	MCERTS	-	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	210	330	-
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	61	100	46
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1)	mg/l	1.25	MCERTS	30.5	49.9	23.1
Total Sulphur	mg/kg	50	MCERTS	1600	2300	-
Organic Matter (automated)	%	0.1	MCERTS	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	-	-	-
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Analytical Report Number: 24-060730
Project / Site name: The Prior, Cleckheaton

Lab Sample Number	415665	415666	415667
Sample Reference	WS03	WS04	HP
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	2.90-3.00	2.50-2.55	0.50-0.75
Date Sampled	18/12/2024	18/12/2024	18/12/2024
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Heavy Metals / Metalloids

Parameter	Units	Test Limit of detection	Test Accreditation Status	415665	415666	415667
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-

Petroleum Hydrocarbons

Parameter	Units	Test Limit of detection	Test Accreditation Status	415665	415666	415667
TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	-	-	-
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	-	-	-
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	-	-	-
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	-	-	-
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	-	-	-
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	-	-	-
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	-	-	-
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	-	-	-

Parameter	Units	Test Limit of detection	Test Accreditation Status	415665	415666	415667
TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	-	-	-
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	-	-	-
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	-	-	-
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	-	-	-
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	-	-	-
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	-	-	-
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	-	-	-
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	-	-	-

VOCs

Parameter	Units	Test Limit of detection	Test Accreditation Status	415665	415666	415667
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-
p & m-Xylene	µg/kg	8	MCERTS	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-060730

Project / Site name: The Prior, Cleckheaton

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
415660	WS03	None Supplied	0.60-1.00	Brown sand with gravel and stones
415661	WS04	None Supplied	0.20-0.40	Brown sand with gravel and stones
415662	WS04	None Supplied	0.70-0.90	Brown clay with gravel and vegetation
415663	HP	None Supplied	0.15-0.30	Brown sand with gravel and stones
415664	WS03	None Supplied	1.60-1.70	Brown clay and sand with gravel
415665	WS03	None Supplied	2.90-3.00	Non Soil. ⁹
415666	WS04	None Supplied	2.50-2.55	Brown clay
415667	HP	None Supplied	0.50-0.75	Brown sandy loam with gravel and stones

Analytical Report Number : 24-060730

Project / Site name: The Prior, Cleckheaton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS

Analytical Report Number : 24-060730

Project / Site name: The Prior, Cleckheaton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

*g - Unaccredited sample matrix.



< ENVIRONMENTAL > < GEOTECHNICAL >

End of Report



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Rogers Geotechnical Services: Soil Screening Values Comparison Sheet



Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet														
Job Number	C4800/24/E/7331			A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be					KEY Exceeds SSV Exceeds 2017, Below 2015 Below limit of detection (LOD)			KEY Exceeds SSV Exceeds 2017, Below 2015 Below limit of detection (LOD)		
Job Name	The Priory, Cleckheaton			Sample Location		WS03	WS04	WS04	HP	WS03	WS03	WS04	HP	
Date	24/01/2025			Depth Top		0.60	0.20	0.70	0.15	1.6	2.9	2.5	0.5	
Client	Highstone Developments			Depth Base		1.00	0.40	0.90	0.3	1.7	3	2.55	0.75	
Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%										
				Atrisk 2015 (No Free Product)	Atrisk 2017									
Cadmium	mg/kg	C	0.20		22.1	< 0.2	< 0.2	< 0.2	< 0.2					
Chromium (Hexavalent)	mg/kg	B/C	1.80	20.5	3.62	< 1.8	< 1.8	< 1.8	< 1.8					
Copper	mg/kg	A+	1.00		4730	110	72	39	72					
Mercury	mg/kg	A/D	0.30		8.81	0.6	< 0.3	0.4	0.7					
Nickel	mg/kg	A+	1.00		136	31	22	21	25					
Lead	mg/kg	C	1.00		200	350	270	80	120					
Zinc	mg/kg	A+	1.00		20000	61	450	69	100					
Vanadium	mg/kg	A+	1.00		136	47	44	33	47					
Arsenic	mg/kg	C	1.0		37	43	32	19	49					
Selenium	mg/kg	A	1.00		375	< 1.0	< 1.0	< 1.0	< 1.0					
Cyanide (Free)	mg/kg	A	1.00		34	< 1.0	< 1.0	< 1.0	< 1.0					
Total Phenols	mg/kg	A	1.00		267	< 1.0	< 1.0	-	< 1.0					
Naphthalene	mg/kg	A+	0.05		0.829	0.24	0.48	0.12	0.32					
Acenaphthylene	mg/kg		0.05			0.14	0.13	< 0.05	< 0.05					
Acenaphthene	mg/kg	A+	0.05	608	157	0.12	0.13	< 0.05	< 0.05					
Fluorene	mg/kg	A+	0.05	0	735	0.11	0.1	< 0.05	< 0.05					
Phenanthrene	mg/kg		0.05			1.6	1.4	0.23	0.36					
Anthracene	mg/kg	A+	0.05	0	10200	0.55	0.37	0.05	< 0.05					
Fluoranthene	mg/kg	A+	0.05		983	5.5	4.2	0.34	0.36					
Pyrene	mg/kg	A+	0.05		668	4.9	4.2	0.34	0.37					
Benzo[a]anthracene	mg/kg	A	0.05	4.52	1.71	2.6	2.5	0.24	0.22					
Chrysene	mg/kg	A	0.05	585	0.44	2.7	2.5	0.23	0.23					
Benzo[b]fluoranthene	mg/kg	A	0.05	7.72	1.22	3.9	3.9	0.21	0.34					
Benzo[k]fluoranthene	mg/kg	A	0.05	84.4	0.686	1.4	1.8	0.11	0.17					
Benzo[a]pyrene	mg/kg	B/C	0.05	4.95	1.51	3.3	3.7	0.17	0.25					
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	7.31	0.0614	1.7	2	0.08	0.14					
Dibenz(a,h)Anthracene	mg/kg	A	0.05	0.838	0.00393	0.41	0.44	< 0.05	< 0.05					
Benzo[g,h,i]perylene	mg/kg	A	0.05	96.2	0.0187	1.8	2.2	0.08	0.15					
Total Of 16 PAH's	mg/kg		2.0			31	30	2.2	2.9					
Aliphatic TPH >C5-C6	mg/kg	A+	0.001	0	42.7	< 0.010	< 0.010		< 0.010					
Aliphatic TPH >C6-C8	mg/kg	A+	0.001	0	99.3	< 0.010	< 0.010		< 0.010					
Aliphatic TPH >C8-C10	mg/kg	A+	0.001	0	13.9	< 0.010	< 0.010		< 0.010					
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	81.7	49.9	< 1.0	< 1.0		< 1.0					
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	385	20.9	4.9	2.4		3.8					
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		210000	11	< 8.0		< 8.0					
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		210000	59	60		< 8.0					
Total Aliphatic Hydrocarbons	mg/kg		10			75	63		< 10					
Aromatic TPH >C5-C7	mg/kg	A+	0.001		0.137	< 0.010	< 0.010		< 0.010					



Rogers Geotechnical Services: Soil Screening Values Comparison Sheet



Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet												
Job Number	C4800/24/E/7331		A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be				KEY			KEY		
Job Name	The Priory, Cleckheaton						Exceeds SSV	Exceeds 2017, Below 2015	Below limit of detection (LOD)	Exceeds SSV	Exceeds 2017, Below 2015	Below limit of detection (LOD)
Date	24/01/2025		Sample Location	WS03	WS04	WS04	HP	WS03	WS03	WS04	HP	
Client	Highstone Developments		Depth Top	0.60	0.20	0.70	0.15	1.6	2.9	2.5	0.5	
			Depth Base	1.00	0.40	0.90	0.3	1.7	3	2.55	0.75	
Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%								
Aromatic TPH >C7-C8	mg/kg	A+	0.001	113	< 0.010	< 0.010		< 0.010				
Aromatic TPH >C8-C10	mg/kg	A+	0.001	20.5	< 0.020	< 0.020		< 0.020				
Aromatic TPH >C10-C12	mg/kg	A+	1.0	70	< 1.0	< 1.0		< 1.0				
Aromatic TPH >C12-C16	mg/kg	A+	2.0	165	155	2.9	2.4	3.4				
Aromatic TPH >C16-C21	mg/kg	A+	10	319	23	18		< 10				
Aromatic TPH >C21-C35	mg/kg	A+	10	1120	88	61		< 10				
Total Aromatic Hydrocarbons	mg/kg		10		110	81		< 10				
pH			N/A		7.3	8.6	7.4	7.3	7.5	6.7	6.9	7.7
Sulphate (2:1 Water Soluble) as SO4	g/l		0.00125		226	53.2	18.6	41.7	16.2	30.5	49.9	23.1
ACM Type			N/A		Not-detected	Not-detected	Not-detected	Not-detected				
Asbestos Identification	%		0.001		KWB	KWB	KWB	KWB				
Moisture	%		0.01		9.7	18	18	18	16	18	24	12
Total Sulphur	mg/kg		50		-	-	-	-	-	1600	2300	-
Sulphate (Total)	mg/kg		50		-	-	-	-	-	210	330	-
Sulphate (Total)	%		0.005		0.364	0.148	-	0.111				
Organic Matter	%		0.10		3.2	4.7	2.2	4.2	-	-	-	-

Appendix 5

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

Tox Data Report No.	Compound	Residential with Homegrown Produce Landuse (mg/kg)				Reference
		SOM: 1%		SOM: 6%		
<i>Metals</i>						
		SOM: 1%		SOM: 6%		
3	Cadmium	22.1		22.1		C
4	Chromium VI	3.62	20.5	3.63	20.5	B/C
	Copper	4730		4790		A+
7	Mercury	8.81		15.80		A/D
8	Nickel	136		136		A+
	Lead	200		200		C
	Zinc	20000		20300		A+
	Vanadium	136		138		A+
<i>Semi and Non Metals</i>						
1	Arsenic	37		37		C
10	Selenium	375		375		A
	Free Cyanide	34		34		A
9	Phenols (total)	267		1200		A
<i>Poly Aromatic Hydrocarbons</i>						
		Free product	No free product	Free product	No free product	
20	Napthalene	0.829		12.2		A+
	Acenaphthene	157	608	2760		A+
	Fluorene	735		2610		A+
	Anthracene	10200		26200		A+
	Fluoranthene	983		2980		A+
	Pyrene	668		2120		A+
	Benzo(a)anthracene	1.71	4.52			A
2	Chrysene	0.44	585			A
2	Benzo(b)fluoranthene	1.22	7.72			A
2	Benzo(k)fluoranthene	0.686	84.4			A
2	Benzo(a)pyrene	1.51	4.95	2.05	4.95	B/C
2	Dibenzo(a,h)anthracene	0.00393	0.838			A*
2	Indeno(1,2,3-cd)pyrene	0.0614	7.31			A
2	Benzo(g,h,i)perylene	0.0187	96.2			A
<i>Petroleum Hydrocarbons</i>						
	Aliphatic C5-C6	42.7		369		A+
	Aliphatic C6-C8	99.3		768	1240	A+
	Aliphatic C8-C10	13.9		204		A+
	Aliphatic C10-C12	49.9	81.7	297	1180	A+
	Aliphatic C12-C16	20.9	385	125	4130	A+
	Aliphatic C16-C21	210000		210100		A+
	Aliphatic C21-C35	210000		210100		A+
	Aromatic C5-C7 (Benzene)	0.137		0.871		A+
	Aromatic C7-C8 (Toluene)	113		780		A+
	Aromatic C8-C10	20.5		232		A+
	Aromatic C10-C12	70		468		A+
	Aromatic C12-C16	155	165	830		A+
	Aromatic C16-C21	319		1040		A+
	Aromatic C21-C35	1120		1710		A+
<i>Others</i>						
Asbestos Not Detected						
A+ = Values update June 2017.						
A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.						
B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report).						
C = Category 4 Screening Levels (C4SLs).						
D = SSV provided is for Methyl Mercury.						