Environmental
Geotechnical
Specialists

RGS

<ENVIRONMENTAL> <GEOTECHNICAL>

PHASE 2

GEO-ENVIRONMENTAL REPORT

job number	C4483/24/E/6941
date	12.02.25
site address	Site of Former Perseverance House St Andrew's Road Huddersfield HD1 6RZ
written by	R. Palmer
checked by	I. Sakoor
issued by	R. Palmer

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

CITATION APPROVED HEALTH & SAFETY SYSTEMS Registered Member

UKAS United Kingdom Accreditation Service

Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

Contents

Appendices	
1.	Site Plan
2.	Borehole Records
3.	Dynamic Probing Records
4.	Trial Pit Photographs
5.	Gas Monitoring Sheets
6.	Laboratory Testing
7.	Fill Screening Values

Report on a Phase 2 Geo-environmental Investigation

Location:	Site of Former Perseverance House St Andrew's Road, Huddersfield HD1 6RZ
For:	Arrow Commercial Centre (Huddersfield) Ltd
Consultants:	Northern Design Partnership
Report No.	C4483/24/E/6941 Report date: February 2025

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

Rob Palmer MSc FGS ACIEH Engineering Director	**Imran Sakoor** BEng FGS Geo-environmental Engineer

Report Summary[1]

Item	Comments	Section
Development	Construction of a new commercial building with associated hard-standing and car parking areas.	1.
Geology	Superficial geology – Alluvium. Solid geology – Pennine Lower Coal Measures Formation.	5.
Strata Conditions	Variable thickness of made ground overlying alluvial deposits.	6.
Groundwater	None encountered during investigation.	6.2
Foundation Design	Deep strip or pad footings. Alternatively piles or ground improvement techniques could be adopted, albeit further investigation would be required.	10.1
Effect of Sulphates	DC-1 concrete.	10.5
Contamination	Contamination falls below screening levels for the intended end use.	11.
Ground Gas	Low levels of ground gas recorded.	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 former Perseverance House is to be developed by the construction of new commercial building with associated hard-standing and store. 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 C4483/24/E/6940 in September 2024. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 27th November 2024 and included the following:

- Three windowless sample boreholes.
- Standard penetration tests.
- One dynamic probe.
- Installation of three gas monitoring standpipes.
- One machine excavated trial pit.

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 and 67mm 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 the 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 Dynamic Probes

One dynamic penetration test was undertaken at DP03 in accordance with the procedure given in BS EN ISO 22476: Part 2: 2005 +A1: 2011, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

4.4 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 1.0m and 2.5m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. 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.

4.5 Trial Pit

In view of the shallow refusal of the boreholes, a trial pit was excavated by the client in order to reveal the nature of the near surface soils using a 13 ton tracked 360° excavator. The soils were examined on site by the windowless sample drillers and their descriptions are given on the trial pit photographs which are presented in Appendix 4.

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
Superficial Geology	Alluvium	-	Soft to firm normally consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.
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.

Alluvial deposits associated with the River Colne are indicated to be present beneath the site. It should be appreciated that the nearest available borehole record[4] on the BGS website indicates 1.83m of ash fill, with sand and clay recorded to 3.28m depth, whereupon sand with sandstone cobble and boulder fragments were present.

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
0.3 – 0.4	CONCRETE	WS01, WS02, WS03	-
+1.04 – 1.1	MADE GROUND (Granular)	WS02, WS03	-
1.5 – 2.0	MADE GROUND (Cohesive)	WS01, WS03	-
1.8 – 2.4	ALLUVIUM (SAND)	WS02, WS03	-
+2.14 – +2.56	ALLUVIUM (GRAVEL)	WS02, WS03	-
+2.1	ALLUVIUM (COBBLES)	TP01	-

'+' 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

[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*]
[4] Sources: British Geological Survey Borehole Record SE11NE25 https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/40831

6.1 General Strata

In general, variably granular and cohesive made ground was revealed to depths of 2.0m, with the exception of WS02 where an obstruction was met at 1.0m depth. It is anticipated that such obstruction, possibly bricks or concrete blocks, could be quite common within the made ground across the site.

Beneath the fill at 2.0m depth, granular alluvial deposits were revealed comprising variably graded sands and gravels. These soils appear to be river bed deposits and are present in a medium dense to dense insitu condition. With reference to the trial pit photographs, cobbles and boulders are also present in the granular layer at 2.0m depth.

6.2 Groundwater

No groundwater strikes were observed during the site investigation. 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 undertaken 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 (Cohesive)	0.4 1.0	-	3 2 to 5	SPT's indicate a soft in-situ condition
MADE GROUND (Granular)	0.3 1.0	17 to 28 50+	-	SPT's indicate granular material is in a medium dense to in-situ condition. Obstruction within the made ground anticipated at 1.0m depth.
ALLUVIUM (SAND)	2.0	40	-	SPT's indicate granular material is in a dense to in-situ condition.
ALLUVIUM (GRAVEL)	2.0	50+	-	SPT's indicate granular material is in a very dense to in-situ condition.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the windowless sample borehole positions. A summary of the results is presented below:

Table 4: Summary of Dynamic Penetration Tests

Position	Blows/100mm			Refusal type (Effective/ Abrupt)[5]	Comments
	0 - 2	3 - 10	10+		
	Depth to which blow count range was observed (m)				
DP03	2.0	4.8	0.6 6.6	Abrupt	Initial high blow counts associated with coarse particles present within the granular made ground at the near surface.

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 14th January and 3rd February 2025. The results of the gas monitoring undertaken to date are tabulated below and full results are presented in Appendix 5:

Table 5: Gas Monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	14.01.25	0.1	0.1	21.2	0.0	1031↔	2.33	2.55
	20.01.25	0.0	0.1	21.3	0.0	1013↓	-	
	27.01.25	0.1	0.1	21.6	0.0	974↔	-	
	03.02.25	0.0	0.1	21.2	0.0	1020↔	-	
WS02	14.01.25	0.1	0.1	21.1	0.0	1031↔	-	0.90
	20.01.25	0.1	0.2	21.3	0.0	1013↓	-	
	27.01.25	0.1	0.1	21.4	0.0	974↔	-	
	03.02.25	0.1	0.1	21.2	0.0	1020↔	-	
WS03	14.01.25	0.0	0.1	21.2	0.0	1031↔	-	1.75
	20.01.25	0.1	0.1	21.4	0.0	1013↓	-	
	27.01.25	0.1	0.1	21.4	0.0	974↔	-	
	03.02.25	0.0	0.1	21.2	0.0	1020↔	-	

↑ - 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.

[5] Abrupt refusal: obstruction or bedrock encountered. Effective refusal: +25 blows/100mm.

8. Laboratory Testing - Geotechnical

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

- Soluble sulphate content — BS 1377-3:2018+A1:2021: Pt3: 7.3
- pH value — BS 1377-3:2018+A1:2021: Pt3: 12

The test results are presented in Appendix 6 and are summarised below:

Table 6: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Soluble sulphate & pH	3	SO_4 pH	46.8 to 257mg/l 7.8 to 10.3	

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 SO_4^{2-}.
- Asbestos.

This testing was undertaken by i2 Analytical Ltd and the results of all of the chemical testing are presented in Appendix 6 of this report.

10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of a two-storey commercial building surrounded predominantly by hard-standing and car parking 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. It should be appreciated that a building was present on site previously and the nature of foundations and sub-structure for that building are not currently known. This may need to be explored further via trial pits as it may be possible to utilise the previous footings and floor if they appear suitable. However, it is anticipated that this will not be the case, therefore any relict footings and floors will likely need to be removed.

10.1 Strip or Pad Foundations

The results of this investigation indicate that variable made ground is present to around 2.0m depth. The made ground is not deemed suitable to represent suitable bearing strata as they are present in

a weak and variable condition such that excessive total and or differential settlement could occur under moderately light loadings.

It is considered that the granular alluvial deposit will provide a suitable bearing stratum, provided that the foundations are placed on soil generally described as being present in at least a medium dense insitu condition. Within this investigation, suitable soils have been revealed from depths of 2.0m.

It is considered that strip or spread foundations constructed within this material could be designed assuming an allowable increase in stress given in the following table:

Table 7: Allowable Increase in Stress

Foundation Type		Strip Footings		Spread/Pad Footings	
Foundation Breadth	B (m)	0.6	0.9	0.6	>1.0
Foundation Depth	D (m)	2.0		2.0	
Allowable Bearing Pressure	(kN/m²)	150	225	160	315

The allowable bearing pressure given above assumes a factor of safety of 3 against general shear failure, with SPT 'N' value of 30 at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately once final trimming has taken place. Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil. In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

Should seepages of groundwater be encountered it is considered that they 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.

The stability of the 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.

10.2 Piled Foundations

As an alternative to the above, a piled foundation could be adopted. In order to formulate a suitable design it is recommended that the advice of specialist piling contractors be sought. It is anticipated that further ground investigation will likely be required to complete a pile design. However, for preliminary design and estimating purposes it is considered that driven piles could prove suitable. It should be noted that RGS have completed ground investigation locally on similar geological deposits and the granular river deposits from 2m to 3m depth have been consistent in composition and density to approximately 10m depth, whereupon the bedrock is typically present. This typical soil profile would appear to have been confirmed by the dynamic probe log which had consistent high blow counts beyond 2.0m depth.

10.3 Ground-floors

In light of the made ground and weak near surface soils, which were revealed to depths of up to 3m, it is not recommended that ground bearing ground floor slabs be employed without prior ground improvement. With the current ground conditions, 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.

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 design[6]. However, 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 soils it is considered that the design sulphate class be assessed with reference to Table C2[7], 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. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[8], 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.

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a two storey commercial building with associated hard-standing areas. Consequently, screening values for a commercial end use have been adopted for contamination analyses.

[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.*

11.1.1 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 0.5% and 3.6%. On this basis, it is considered that the screening values associated with 6% 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 website[9] 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 6. These results indicate the following:

Table 8: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
WS01	0.5	None.
WS02	0.6	PAHs (chrysene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene).
WS04	0.3	PAHs (indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene).

Concentrations of chromium^{VI}, mercury, selenium, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C12; aromatic C5 to C7) 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. In addition, no asbestos was detected within the soils 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 criterion[10]. 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:

Table 9: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
WS01	0.5	None.
WS02	0.6	None.
WS04	0.3	None.

On the basis of the above information, the results of the investigation have concluded that the soils beneath the site are suitable for the intended end use.

[9] http://www.atrisksoil.co.uk/pages/general/subscribers.asp
[10] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Commercial land use, 23.06.17.

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 0.2%, in association with oxygen levels of between 21.1% and 21.4%. 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. It should be appreciated that no flow was detected, therefore in order to complete ground gas analyses a maximum flow rate of 0.1 litres per hour 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 974mb and 1031mb.

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 0.2% (0.002) 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 0.0002 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 low sensitivity and that the generation potential is very low, these tables suggest that 4 readings could be undertaken over a period of 1 month. 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 4 monitoring visits were undertaken over a 1 month time period and for the purpose of this assessment, it is considered that the site can be fully characterised as Characteristic Situation Level 1.

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 Agency[12] advice on the assessment of risks arising from the presence of

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

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 10. Sources of contamination include the following:

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 10.

[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 10: Conceptual Site Model and Site-Specific Risk Assessment				
Conceptual Site Model			**Site Specific Risk Assessment**	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contamination falls below screening levels for intended site use, but contact with soil likely during works.	Low to Moderate	Some contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Site is anticipated to be secured during the development phase, contamination is not anticipated to affect neighbours.
	End User	Yes – contamination falls below screening levels for intended site use.	Low	
	Neighbours	Yes – contamination falls below screening levels for intended site use. Site is present in a commercial/industrial setting.	Low	
Inhalation of Dust/Vapours	Operative	Yes – contamination falls below screening levels for intended site use, but contact with soil likely during works.	Low to Moderate	Some contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Site is anticipated to be secured during the development phase, contamination is not anticipated to affect neighbours.
	End User	Yes – contamination falls below screening levels for intended site use.	Low	
	Neighbours	Yes – contamination falls below screening levels for intended site use. Site is present in a commercial/industrial setting.	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	No further action required.
	End User	No – site will not have any soft landscaped areas for plating of fruits and vegetables.	N/A	
	Neighbours	Yes – contamination falls below screening levels for intended site use. Site is present in a commercial/industrial setting.	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 (assuming *Characteristic Situation Level 1*).	Low	Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. No further action required.
	End User		Low	
	Neighbours	No – site not considered to represent a generative source of ground gas	N/A	No further action required.

Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – known controlled waters within 250m. Contamination falls below screening levels.	Low	Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a secondary A aquifer is present beneath the site. Contamination falls below screening levels.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. Contamination falls below screening levels.	Low	
Direct contact with contaminated soils	Plants	Yes – contamination falls below screening levels.	Low	
Uptake via root system			Low	
Direct contact with contaminated soils	Building Materials	Yes – minor PAH contamination revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1.	Low (plastic services)	Please see section 11.3 for information on good building practice.
Direct contact with contaminated groundwater			Low (buried concrete)	
Exposure to Radon	Operative	Yes – in a radon affected area.	Low	Between 1% and 3% of properties are above the action level. No radon protection measures required.
	End User			

11.3 Remediation Strategy

In view of the site specific risk assessment it is considered that it will not be necessary to undertake any specific remediation at this site. It should be appreciated, however, that careful inspection of the subgrade should be made during the groundworks. Should areas of contamination be detected then further testing may become necessary.

11.3.1 General Approach to Construction

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 fundamental principles of identifying potentially contaminated soils and the hazards of working with such soils not identified by the ground investigation.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives encouraged to use them.
- 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 at all times.
- Where vehicles are transferring soil to landfill site they should be covered to prevent any potential contamination of the surrounding area by dust.
- Any stockpiles of soil should be sheeted over to prevent excessive amounts of airborne 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 any potential 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 development the following items are required to protect the structure from the potential contaminants revealed at this site.

- Beneath, pavements and hard-standings clean inert granular sub-base should be employed.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.

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 YALPAG[15] 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 11: 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 500m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. 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)..

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

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.
- Detailed design of the sub-structure.
- Further ground investigation should be considered, particularly if piled foundations are chosen.
- 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.

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.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test,* B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations,* B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.
- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*
- 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.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings,* CIRIA Report C665.

Appendix 1

Site Plan

northern design partnership

Chartered Architects
The Chapel, Millmoor Road,
Meltham, Holmfirth, HD9 5JU

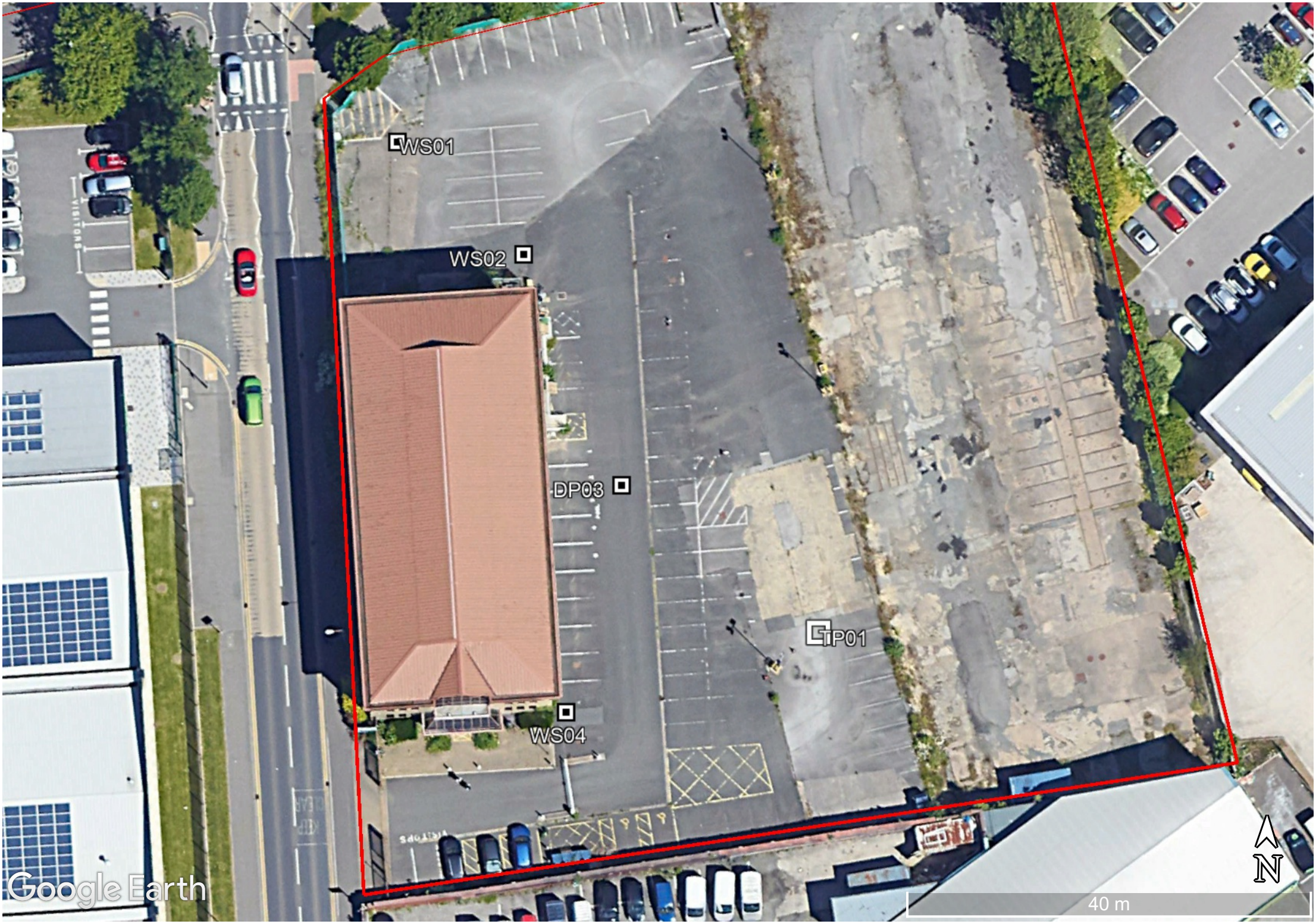
www.northerndesignpartnership.co.uk
Instagram: @northerndesignp
Telephone: (01484) 854848

client	ARROW SELF DRIVE
project	NEW PREMISES ST ANDREWS ROAD HUDDERSFIELD HD1 6RZ
drawing	SITE PLAN

revision	notes	date	drawn
*	*	*	*

scale :	1:200 AT A1	02.24	PB

project no.	drawing no.	revision
2322	01	


WS01
WS02
DP03
TP01
WS04
Google Earth
40 m
N

Appendix 2

Borehole Records

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS01**

Sheet 1 of 1

Project Name: St. Andrew's Road	Project No. C4483/24/E/6941	Co-ords:	Hole Type WLS
Location: Huddersfield HD1 6RZ		Level:	Scale 1:25
Client: Arrow Commercial Centre		Dates: 27/11/2024	Logged By RP

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
							0.00			CONCRETE.
		0.40	SPT	87	100	N=3 (1,2/1,1,1,1,0)	0.40			MADE GROUND (Dark brown and black sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is sub-angular fine to coarse of brick clinker ash slag concrete mudstone and sandstone).
		1.00	SPT	77	100	N=2 (1,1/0,1,0,1)	1.20			MADE GROUND (Very soft and soft brownish grey slightly organic slightly gravelly silty CLAY. Gravel is sub-rounded and sub-angular of mudstone and rare clinker (Re-worked natural)).
		2.00	SPT	67	100	N=40 (1,1/7,7,12,14)	2.00			Medium dense brownish grey silty fine and medium SAND. ALLUVIUM
							2.40			Dense brown and grey very sandy rounded to angular medium and coarse GRAVEL of sandstone and various lithologies. ALLUVIUM
							2.56			End of Borehole at 2.56m

Remarks

Client broke out concrete to 0.4m with excavator.

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS02**

Sheet 1 of 1

Project Name: St. Andrew's Road	Project No. C4483/24/E/6941	Co-ords:	Hole Type WLS
Location: Huddersfield HD1 6RZ		Level:	Scale 1:25
Client: Arrow Commercial Centre		Dates: 27/11/2024	Logged By RP

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
										CONCRETE (Driller's notes).
		0.30	SPT			N=17 (1,2/3,4,7,3)	0.30			MADE GROUND (Cream very sandy sub-angular and angular medium and coarse GRAVEL of sandstone (Sub-base)).
				87	100		0.50			MADE GROUND (Dark brown and red very sandy sub-angular and angular medium and coarse GRAVEL of brick. Low cobble content. Rare ash).
		1.00	SPT			50 (50 for 40mm/50 for 40mm)	1.04			End of Borehole at 1.04m

1 2 3 4 5

Remarks

Client broke out concrete to 0.3 with excavator.

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS04**

Sheet 1 of 1

Project Name: St. Andrew's Road	Project No. C4483/24/E/6941	Co-ords:	Hole Type WLS
Location: Huddersfield HD1 6RZ		Level:	Scale 1:25
Client: Arrow Commercial Centre		Dates: 27/11/2024	Logged By RP

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
							0.00			CONCRETE (Driller's notes).
		0.30	SPT	87	100	N=28 (2,5/5,3,9,11)	0.30			MADE GROUND (Cream very sandy sub-angular and angular medium and coarse GRAVEL of sandstone (Sub-base)).
		1.00	SPT	77	100	N=5 (3,3/1,1,1,2)	0.70			MADE GROUND (Dark brown and red very sandy sub-angular and angular medium and coarse GRAVEL of brick. Low cobble content. Rare ash).
							1.10			MADE GROUND (Very soft and soft brownish grey slightly organic slightly gravelly silty CLAY. Gravel is sub-rounded and sub-angular of mudstone and rare clinker (Re-worked natural)).
							1.50			Medium dense brownish grey silty fine and medium SAND. ALLUVIUM
		2.00	SPT			50 (12 for 75mm/50 for 75mm)	1.80			Dense brown and grey very sandy rounded to angular medium and coarse GRAVEL of sandstone and various lithologies. ALLUVIUM
							2.14			Sandstone COBBLE
										End of Borehole at 2.14m

Remarks

Client broke out concrete to 0.3m with excavator.

AGS

Appendix 3

Dynamic Probing Records

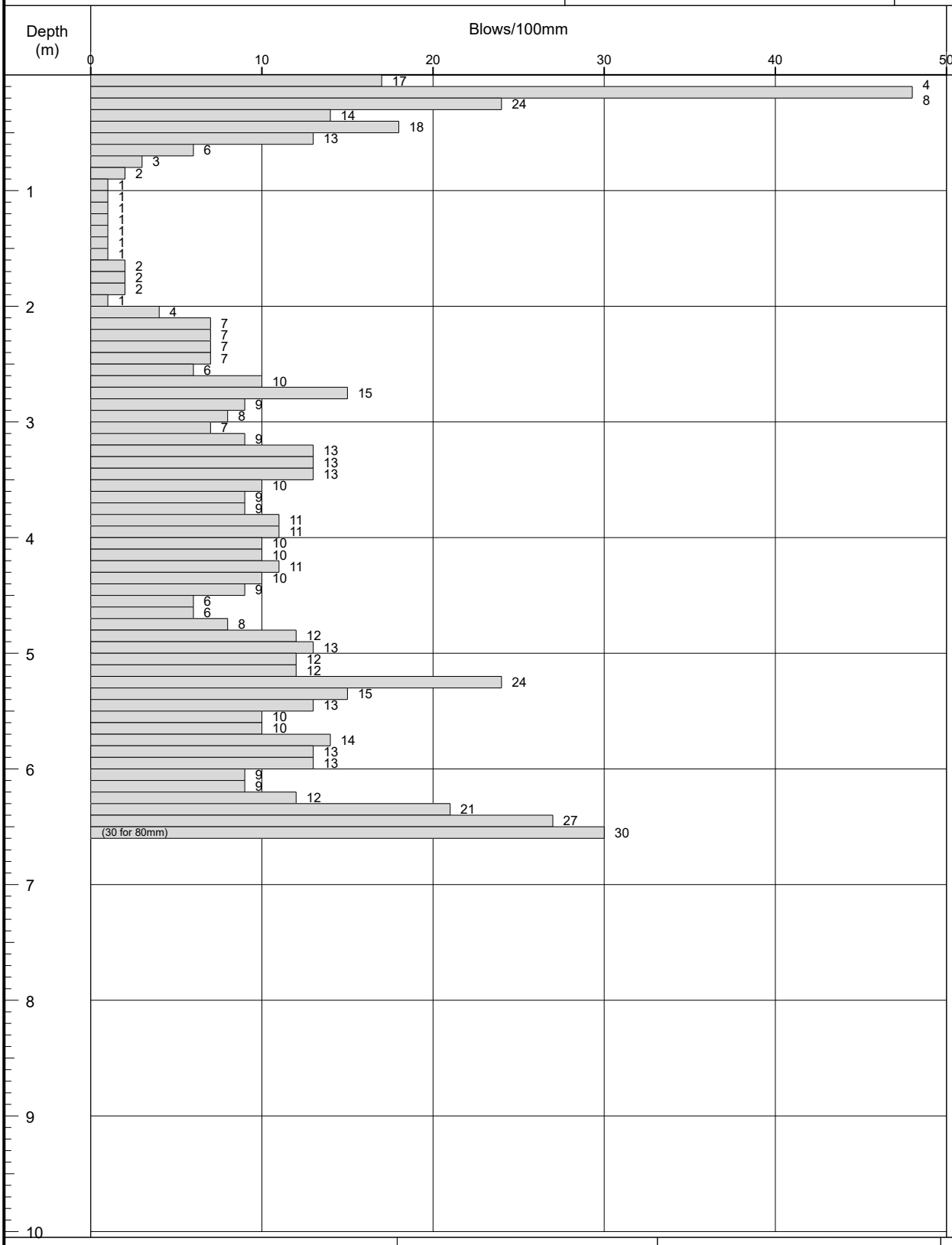
RGS Environmental Geotechnical Specialists

Probe Log

Probe No. **DP03**

Sheet 1 of 1

Project Name: St. Andrew's Road	Project No. C4483/24/E/6941	Co-ords:	Hole Type DCP
Location: Huddersfield HD1 6RZ		Level:	Scale 1:50
Client: Arrow Commercial Centre		Dates: 27/11/2024	Logged By AB



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	6.58m
Probe Type	DPSH-B		

AGS

Appendix 4

Trial Pit Photographs

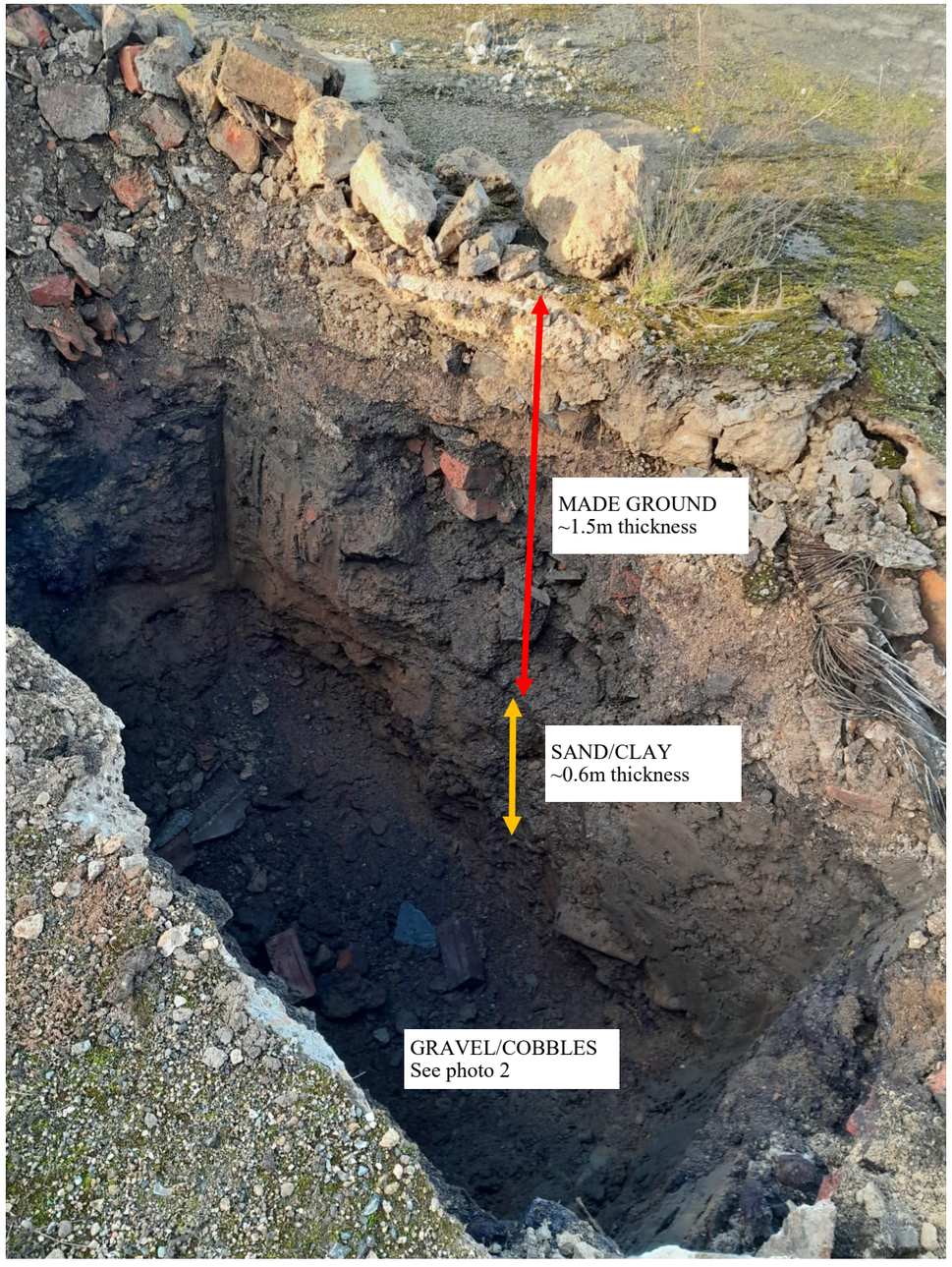


Photo 1: Trial Pit TP01

Photo 2: Strata taken from the base of the trial pit

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield,

Job No:	Site:	Client:
C4483/24/E/6941	St Andrews Rd Huddersfield	Arrow Commercial Centre

Appendix 5

Gas Monitoring Sheets

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4483/24/E/6941	Client:	Arrow Commercial Centre	Visit:	1	Of	4
Site:	FormerPerserv.HouseStAndrewsRdHD1 6RZ	Date:	14.01.2205				

Environmental Geotechnical Specialists

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

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

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				
1	0.1	0.1	0.1	0.1	0	0	0	0	21.2	21.2			0	0	2.33		2.54	
2	0	0.1	0.1	0.1	0	0	0	0	21.1	20.5			0	0	DRY		0.9	
4	0	0	0.1	0.1	0	0	0	0	21.2	21.2			0	0	DRY		1.75	
Max.	0.1	0.1	0.1	0.1	0	0	0	0	21.2	21.2	0	0	0	0	2.33			
Min.	0	0	0.1	0.1	0	0	0	0	21.1	20.5	0	0	0	0	2.33			

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

Meteorological & Site Information	
General Ground Condition	Wet
Precipitation	0
Wind	0
Temperature	9
Barometric Pressure	1031
Pressure Trend	Steady

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0	0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Min	Max
Barometric Pressure	1022	1024

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4483/24/E/6941	Client:	Arrow Commercial Centre	Visit:	2	Of	4
Site:	FormerPerserv.HouseStAndrewsRdHD1 6RZ	Date:	20.01.2025				

Environmental Geotechnical Specialists

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

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

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				
1	0	0	0.1	0.1	0	0	0	0	21.3	21.1			0	0	DRY		2.54	
2	0	0.1	0.2	0.2	0	0	0	0	21.3	21.3			0	0	DRY		0.9	
4	0	0.1	0.1	0.1	0	0	0	0	21.4	21.3			0	0	DRY		1.75	
Max.	0	0.1	0.2	0.2	0	0	0	0	21.4	21.3	0	0	0	0	0			
Min.	0	0	0.1	0.1	0	0	0	0	21.3	21.1	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	Wet
Precipitation	0.0L/M2 in last 6 hours
Wind	2
Temperature	6
Barometric Pressure	1013
Pressure Trend	Falling

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Min	Max
Barometric Pressure	1000	1009

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4483/24/E/6941	Client:	Arrow Commercial Centre	Visit:	3	Of	4
Site:	FormerPerserv.HouseStAndrewsRdHD1 6RZ	Date:	27.01.2025				

Environmental Geotechnical Specialists

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

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

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				
1	0.1	0.1	0.1	0.1	0	0	0	0	21.6	20.9			0	0	DRY		2.54	
2	0.1	0.1	0.1	0.1	0	0	0	0	21.4	20.2			0	0	DRY		0.9	
4	0.1	0.1	0.1	0.1	0	0	0	0	21.4	21.2			0	0	DRY		1.75	
Max																		
Min.																		

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

Meteorological & Site Information	
General Ground Condition	Wet
Precipitation	0.2L/M2 over last 6 hours
Wind	14
Temperature	6
Barometric Pressure	974
Pressure Trend	Steady

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Min	Max
Barometric Pressure	967	968

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4483/24/E/6941	Client:	Arrow Commercial Centre	Visit:	4	Of	4
Site:	FormerPerserv.HouseStAndrewsRdHD1 6RZ	Date:	03.02.2025				

RGS Environmental Geotechnical Specialists

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

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

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				
1	0.1	0.1	0.1	0.1	0	0	0	0	21.4	20.9			0	0	DRY		2.55	
2	0	0.1	0.1	0.1	0	0	0	0	21.2	21.2			0	0	DRY		0.9	
4	0	0	0.1	0.1	0	0	0	0	21.2	21.1			0	0	DRY		1.75	
Max																		
Min.																		

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

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0L/M2 in last 12 hours
Wind	17
Temperature	6
Barometric Pressure	1020
Pressure Trend	Steady

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Min	Max
Barometric Pressure	1011	1012

Operative Details.	M.Tuck

CERTIFICATION OF CALIBRATION

PJLA Calibration
No. 66916

Date Of Calibration: 25-Oct-2024

Certificate Number: G503524_10/36927

Issued by: QED Environmental Systems Inc.

As received Barometric Pressure recorded at: 23.2 °C/73.7 °F

As received gas check readings are only recorded if the instrument is received in a working condition. Where the instrument is received damaged no reading can be taken.

Date of Issue : 26 Oct 2024

Approved By Signatory

Linda Ostrowski

Laboratory Inspection

www.qedenv.com (800) 624-2026 info@qedenv.com

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

CERTIFICATION OF CALIBRATION

PJLA Calibration
No. 66916

Date Of Calibration: 25-Oct-2024

Certificate Number: G503524_10/36927

Issued by: QED Environmental Systems Inc.

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Certification only applies to results shown. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

www.qedenv.com (800) 624-2026 info@qedenv.com

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

Appendix 6

Laboratory Testing

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4483/24/E
Job Name	St Andrews Rd Huddersfield
Date	07.02.25
Client	Arrow Commercial

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2'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 known then a limit of 102 should be used.

KEY

- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Commercial 1%		Sample Location	WS01	WS02	WS04							
				Atrisk 2015 (No Free Product	Atrisk 2017	Depth Top	0.5	0.6	0.3							
						Depth Base										
Cadmium	mg/kg	C	0.2		410		< 0.2	0.5	0.2							
Chromium (Hexavalent)	mg/kg	B/C	1.8	49.1	19.7		< 1.8	< 1.8	< 1.8							
Copper	mg/kg	A+	1.0		106000		63	87	21							
Mercury	mg/kg	A/D	0.3		350		< 0.3	< 0.3	< 0.3							
Nickel	mg/kg	A+	1.0		1770		30	27	16							
Lead	mg/kg	C	1.0		2310		290	73	34							
Zinc	mg/kg	A+	1.0		1100000		150	150	95							
Vanadium	mg/kg	A+	1.0		7490		38	53	18							
Arsenic	mg/kg	C	1.0		635		120	18	5							
Selenium	mg/kg	A	1.0		13000		< 1.0	< 1.0	< 1.0							
Cyanide (Free)	mg/kg	A	1.0		373		< 1.0	< 1.0	< 1.0							
Total Phenols	mg/kg	A	1.0		685		< 1.0	< 1.0	< 1.0							
Naphthalene	mg/kg	A+	0.05	90.1	75		0.15	0.69	< 0.05							
Acenaphthylene	mg/kg		0.05				< 0.05	0.19	< 0.05							
Acenaphthene	mg/kg	A+	0.05	83600	156.8		< 0.05	0.17	< 0.05							
Fluorene	mg/kg	A+	0.05		66500		< 0.05	0.3	< 0.05							
Phenanthrene	mg/kg		0.05				0.21	1.6	0.15							
Anthracene	mg/kg	A+	0.05		535000		< 0.05	0.32	< 0.05							
Fluoranthene	mg/kg	A+	0.05		72200		0.25	1.9	0.28							
Pyrene	mg/kg	A+	0.05		54100		0.26	1.6	0.26							
Benzo[a]anthracene	mg/kg	A	0.05	131	1.71		0.13	0.98	0.15							
Chrysene	mg/kg	A	0.05	14000	0.44		0.21	0.95	0.16							
Benzo[b]fluoranthene	mg/kg	A	0.05	142	1.22		0.18	1.1	0.17							
Benzo[k]fluoranthene	mg/kg	A	0.05	1430	0.686		0.12	0.51	0.09							
Benzo[a]pyrene	mg/kg	B/C	0.05	76.3	26.1		< 0.05	0.88	0.13							
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	142	0.0614		< 0.05	0.48	0.09							
Dibenz(a,h)Anthracene	mg/kg	A	0.05	14.3	0.00393		< 0.05	< 0.05	< 0.05							
Benzo[g,h,i]perylene	mg/kg	A	0.05	1440	0.0187		< 0.05	0.53	0.09							
Total Of 16 PAH's	mg/kg		0.8													
Aliphatic TPH >C5-C6	mg/kg	A+	0.01	4490	327		< 0.010	< 0.010	< 0.010							
Aliphatic TPH >C6-C8	mg/kg	A+	0.01	10400	157		< 0.010	< 0.010	< 0.010							
Aliphatic TPH >C8-C10	mg/kg	A+	0.01	1370	82.4		< 0.010	< 0.010	< 0.010							
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	7900	49.9		< 1.0	< 1.0	< 1.0							
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	34000	20.9		3	2.1	< 2.0							
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		3620000		8.7	< 8.0	< 8.0							
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		3620000		150	60	28							
Aliphatic TPH >C35-C44	mg/kg		10.0													
Total Aliphatic Hydrocarbons	mg/kg		10.0													

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4483/24/E
Job Name	St Andrews Rd Huddersfield
Date	07.02.25
Client	Arrow Commercial

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2'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 known then a limit of 102 should be used.

KEY

- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Sample Location	WS01	WS02	WS04
Depth Top	0.5	0.6	0.3
Depth Base			

Determinand	Units	Ref	LOD	Commercial 1%				
Aromatic TPH >C5-C7	mg/kg	A+	0.01		12.5	< 0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	mg/kg	A+	0.01	27900	834	< 0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	mg/kg	A+	0.02	2210	613	< 0.020	0.022	< 0.020
Aromatic TPH >C10-C12	mg/kg	A+	1.0	12300	369	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	mg/kg	A+	2.0	41300	155	< 2.0	4.3	< 2.0
Aromatic TPH >C16-C21	mg/kg	A+	10.0		28400	< 10	< 10	< 10
Aromatic TPH >C21-C35	mg/kg	A+	10.0		28400	60	14	21
Aromatic TPH >C35-C44	mg/kg		10.0					
Total Aromatic Hydrocarbons	mg/kg		10.0					
Total Petroleum Hydrocarbons	mg/kg		10.0					
pH			N/A			**10.3**	8.3	**7.8**
Sulphate (2:1 Water Soluble) as SO4	mg/l		1.25			**257.00**	**46.80**	50.00
ACM Type			N/A					
Asbestos Identification	%					Not-detected	Not-detected	Not-detected
ACM Detection Stage			N/A					
Moisture	%		0.01			13	19	5.6
Soil Colour			N/A					
Other Material	%		N/A			35.7	65.3	38.7
Soil Texture			N/A					
Sulphate (Total)	%		0.005			0.22	0.202	0.033
Organic Matter	%		0.1			3	**3.6**	**0.5**

Rogers Geotechnical Services Ltd
Offices 1&2 Barncliffe Business Pk
Near Bank, Shelley
Huddersfield
West Yorkshire
HD8 8LU

t: 01484 604354

e: harry.letch@rogersgeotech.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

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

Analytical Report Number : 24-060729

Project / Site name:	St Andrews Road, Huddersfield	**Samples received on:**	20/12/2024
Your job number:	C4483 24 E 6941	**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:	3 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

Excel copies of reports are only valid when accompanied by this PDF certificate.

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: 24-060729
Project / Site name: St Andrews Road, Huddersfield

Lab Sample Number				415657	415658	415659
Sample Reference				WS01	WS02	WS04
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.50	0.60	0.30
Date Sampled				20/12/2024	20/12/2024	20/12/2024
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	35.7	65.3	38.7
Moisture Content	%	0.01	NONE	13	19	5.6
Total mass of sample received	kg	0.1	NONE	0.7	0.6	0.7
Asbestos						
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PKU	PKU	PKU
General Inorganics						
pH (L099)	pH Units	N/A	MCERTS	10.3	8.3	7.8
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO_4	%	0.005	MCERTS	0.22	0.202	0.033
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	510	94	100
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	257	46.8	50
Organic Matter (automated)	%	0.1	MCERTS	3	3.6	0.5
Total Phenols						
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	0.15	0.69	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.19	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.17	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.3	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.21	1.6	0.15
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.32	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.25	1.9	0.28
Pyrene	mg/kg	0.05	MCERTS	0.26	1.6	0.26
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.13	0.98	0.15
Chrysene	mg/kg	0.05	MCERTS	0.21	0.95	0.16
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.18	1.1	0.17
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.12	0.51	0.09
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.88	0.13
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.48	0.09
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.53	0.09
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.51	12.2	1.58

Analytical Report Number: 24-060729
Project / Site name: St Andrews Road, Huddersfield

Lab Sample Number				415657	415658	415659
Sample Reference				WS01	WS02	WS04
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.50	0.60	0.30
Date Sampled				20/12/2024	20/12/2024	20/12/2024
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	120	18	5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.5	0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	20	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	63	87	21
Lead (aqua regia extractable)	mg/kg	1	MCERTS	290	73	34
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	30	27	16
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	38	53	18
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	150	95
Petroleum Hydrocarbons						
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	3	2.1	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	8.7	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	150	60	28
TPHCWG - Aliphatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	170	63	28
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	0.022	< 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	< 2.0	4.3	< 2.0
TPHCWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	60	14	21
TPHCWG - Aromatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	60	19	21
VOCs						
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	11	< 5.0

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

Analytical Report Number : 24-060729
Project / Site name: St Andrews Road, Huddersfield

* 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 *
415657	WS01	None Supplied	0.5	Brown sand with gravel and stones
415658	WS02	None Supplied	0.6	Non Soil. [*g]
415659	WS04	None Supplied	0.3	Brown sand with gravel and stones

Analytical Report Number : 24-060729
Project / Site name: St Andrews Road, Huddersfield

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
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

Analytical Report Number : 24-060729
Project / Site name: St Andrews Road, Huddersfield

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
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
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 30oC.
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.

Appendix 7

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Commercial Landuse

Tox Data Report No.	Compound	Commercial (mg/kg)				Reference
	Metals	1% SOM		6% SOM		
3	Cadmium	410		410		C
4	Chromium VI	19.7	49.1	19.7	49.1	B/C
	Copper	106000		106000		A+
7	Mercury	350.00		405.00		A/D
8	Nickel	1770		1770		A+
	Lead	2310		2310		C
	Zinc	1100000		1100000		A+
	Vanadium	7490		7490		A+
	Semi and Non Metals					
1	Arsenic	635		635		C
10	Selenium	13000		13000		A
	Free Cyanide	373		373		A
9	Phenols (total)	685		3170		A
	Poly Aromatic Hydrocarbons	Free product	No free produc	Free product	No free product	
20	Naphthalene	75	90.1	432	1050	A+
	Acenaphthene	156.8	83600	106000		A+
	Fluorene	66500		72000		A+
	Anthracene	535000		544000		A+
	Fluoranthene	72200		72600		A+
	Pyrene	54100		54400		A+
	Benzo(a)anthracene	1.71	131	10.3	142	A
2	Chrysene	0.44	14000	2.64	14300	A
2	Benzo(b)fluoranthene	1.22	142	7.29	144	A
2	Benzo(k)fluoranthene	0.686	1430	4.12	1440	A
2	Benzo(a)pyrene	26.1	76.3	26.2	76.3	B/C
2	Dibenz(a,h)anthracene	0.00393	14.3	0.0236	14.4	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	142	0.368	144	A*
2	Benzo(g,h,i)perylene	0.0187	1440	0.112	1450	A*
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	327	4490	1100	29400	A+
	Aliphatic C6-C8	157	10400	769	98200	A+
	Aliphatic C8-C10	82.4	1370	476	14800	A+
	Aliphatic C10-C12	49.9	7900	297	69500	A+
	Aliphatic C12-C16	20.9	34000	126	139000	A+
	Aliphatic C16-C21	3620000		3620000		A+
	Aliphatic C21-C35	3620000		3620000		A+
	Aromatic C5-C7 (Benzene)	12.5		98		A+
	Aromatic C7-C8 (Toluene)	834	27900	4360	183000	A+
	Aromatic C8-C10	613	2210	3600	20800	A+
	Aromatic C10-C12	369	12300	2190	53800	A+
	Aromatic C12-C16	155	41300	65400		A+
	Aromatic C16-C21	28400		28400		A+
	Aromatic C21-C35	28400		28400		A+
	Others					
Asbestos						

A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 1% SOIL ORGANIC MATTER

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 1% soil organic matter.

D - Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 7.95 should be used.