REMEDIATION STRATEGY
FOR LAND AT
SNELL STREET
MANCHESTER

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LIST OF ACRONYMS

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DP	Dynamic Probe
DoE	Department of Environment
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HP	Hand Pit
HA	Hand Auger
LPA	Local Planning Authority
LQM	Land Quality Management
mbgl	Metres Below Ground Level
MP	Mackintosh Probe
NPPF	National Planning Policy Framework
NGR	National Grid Reference
OS	Ordnance Survey
SGV	Soil Guideline Value
SSV	Soil Screening Value
WSV	Water Screening Value
SPOSH	Significant Possibility of Significant Harm
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample

1.0 INTRODUCTION

1.1 Instruction

1.1.1 GeoCon Site Investigations Ltd (GeoCon) have been commissioned by Artal UK Ltd (AUK) on behalf of Penrose Manor Ltd (PM) to develop a Remediation Strategy on land at Snell Street, Manchester.

1.1.2 It is understood that development proposals comprise of the redevelopment of the site for nine terraced residential properties.

1.2 Previous Surveys

1.2.1 Previous assessments conducted upon the site comprise the following, which should be read in conjunction with this strategy:

- GeoCon report dated April 2021 referenced M0142 CO (GSI450) PI Report AF A 300321 and entitled 'Phase I Preliminary Risk Assessment'.
- GeoCon report dated June 2021 referenced M0142 JL (GSI1450) PII Report AF A 170521 and entitled 'Phase II Site Investigation'.

1.3 Objectives

1.3.1 The objectives of this remediation strategy are as follows:

- To outline the remedial strategy proposed at the site and the proposed verification strategy for agreement by the Local Planning Authority (LPA).

1.4 Limitations

1.4.1 The assessment and interpretation of the factual data obtained as part of this report has been undertaken in accordance with standard consulting practise and with current national and international guidance.

1.4.2 This report presents the observations made during the geoenvironmental site investigations and the factual data obtained. The conclusions and recommendations in this report are limited to those which can be made based on the findings of the survey and information provided by third parties. GeoCon assumes all third party data to be true and correct. No responsibility can be accepted by GeoCon for inaccuracies in the information provided by any other party.

1.4.3 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practises, and changes in legislation may require the reinterpretation of the report in whole or in part after its original issue. GeoCon reserve the right to alter their conclusions and recommendations in the light of further information that may become available. This report is provided for the sole use of the client and their professional advisers and is confidential to them unless agreed otherwise in writing.

1.4.4 Ground conditions can be variable and change rapidly, especially in areas of Made Ground, however it is assumed that the ground conditions encountered and observed are typical and representative of the site as a whole. Most specifically with regard to this limited investigation, the ground conditions have been determined from a limited number of exploratory holes formed across the site, therefore only a small percentage of the total area of the site has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced. Conclusions drawn from the ground investigation should be read in this context. GeoCon cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.

1.4.5 In addition, subsurface conditions including contaminant concentrations and groundwater levels may vary spatially with time. This factor should be given due consideration in the event that the information contained within this report is used after any significant period of time has elapsed.

2.0 SITE LOCATION AND DESCRIPTION

2.1.1 The site is located at land off Snell Street, Manchester, at approximate National Grid Reference NGR: 385640, 398170 (centre of the site).

2.1.2 A site location plan is presented as Drawing No. GSI 1450/01 in Appendix A.

2.2 Site Reconnaissance

2.2.1 A site reconnaissance was carried out on the 31st March 2021. Details from the site walkover are included in the site description below.

2.3 Site Description

2.3.1 The site is a generally rectangular shaped piece of land with an approximate area of 0.12Ha.

2.3.2 The topography of the site is generally dipping gently to the south.

2.3.3 The site is currently occupied by a masonry warehouse structure with associated hardstanding, comprising of concrete. The site boundary, in particular the eastern boundary, has become overgrown with grass and shrubs.

2.3.4 An approximate distribution of the surface covering is given below in Table 2.1: Site Surface Covering

Table 2.1: Site Surface Covering

Type of Surface Cover	Distribution (%)
Soft Ground (grassed and landscaped areas)	5
Hardstanding	55
Roadways	0
Buildings	40
Water (ponds, streams)	0

2.3.5 The site is bounded by Snell Street to the west, and residential properties to the north, east and south.

2.3.6 Access to the site is via Snell Street to the southwest.

2.4 Surrounding Area

2.4.1 The current surrounding land use to the site is generally residential properties in all directions.

2.4.2 The topography of the surrounding area is generally dipping to the south.

2.5 Future Site Usage

2.5.1 It is currently proposed to construct a series of nine new terraced two storey masonry and pitched roof properties at the site which includes the demolition of the existing structure on site.

2.5.2 A proposed development plan has been provided by AUK, drafted by Calderpeel Architects, dated 5thOctober 2021, referenced 20096 (FE) 001.

2.5.3 This outline development plan has been utilised in the development of this remediation strategy. Any significant deviation from this proposal may require a re-assessment of the environmental risks associated with this site and a revision to this remediation strategy.

3.0 BACKGROUND

3.1 Published Geology

3.1.1 The British Geological Survey Map Sheet 85 Manchester and online mapping shows the site to be underlain by the geological succession outlined below Table 3.1: Published Geology.

Table 3.1: Published Geology

Geology	Description /strata
Artificial	None recorded
Superficial	Till
Bedrock	Manchester Marls Formation and Collyhurst Sandstone Formation

3.1.2 There are no known artificial deposits recorded underlying the site.

3.1.3 The superficial geology recorded underlying the site is shown to be Till. No BGS description is currently available for Till; however, these deposits are generally comprised of sandy gravelly clay with cobbles and varying silt sand and gravel content.

3.1.4 The bedrock geology beneath the site is shown to be the Manchester Marls Formation to the west, underlain by the Collyhurst Sandstone Formation, which outcrops to the east. The Manchester Marls Formation which is generally described as *'Red marl (calcareous mudstone and siltstone) with thin beds of fossiliferous marine limestone and dolomite; locally green; sandy in places especially in top part; local breccias and pebbly beds',* (BGS online lexicon of rock units general description). The Collyhurst Sandstone Formation is generally described as '*a soft red sandstone with abundant beds of "millet seed" sand grains alternating with beds of fine-grained sharp sand with some interbedded grey sandstones locally*'. (BGS online lexicon of rock units general description).

3.2 Ground Investigation

3.2.1 The intrusive investigation was carried out on 12th April 2021.

3.2.2 The specification and scope of works for the ground investigation has been provided by AUK.

3.2.3 The ground investigation has been carried out in accordance with BS5930 and the UK Specification for Ground Investigation Second Edition 2012.

3.2.4 All strata descriptions were undertaken in accordance with BS5930 Amendment 1; EN ISO 14688 -1; EN ISO 14688 -2; and EN ISO 14689.

3.2.5 The actual ground investigation comprised the formation of:

- One day's windowless sampling at four locations.
- Insitu geotechnical and geoenvironmental testing and sampling.
- Full supervision of all works by engineering geologist including sampling and detailed geotechnical descriptions to BS5930, EN ISO 14688-1 EN ISO 14688-2 and EN ISO 14689 of all strata types encountered within the exploratory holes.
- The installation of three No. gas and groundwater monitoring wells.
- Subsequent groundwater monitoring on six occasions over a three month period in accordance with CIRIA 665 commencing approximately one week after the completion of the ground investigation.
- A suite of geotechnical laboratory analysis.
- A suite of chemical laboratory analysis.
- Production of an interpretative report.

3.3 Ground Conditions

General

3.3.1 The actual ground conditions encountered across the site were generally uniform and comprised Made Ground overlying Till deposits.

Made Ground

3.3.2 Made ground was encountered in all exploratory hole locations from ground level to depths of between, 0.50 and 2.30mbgl.The Made Ground generally comprised hardstanding overlying layers of granular and cohesive made ground materials.

Hardstanding

3.3.4 Hardstanding was encountered in WS01, WS03, and WS04 from ground level to depths of between 0.14 and 0.32mbgl, and generally comprised concrete.

Granular Made Ground

3.3.5 Granular made ground materials were encountered in WS01, WS03, and WS04 from ground level or beneath the hardstanding to depths of between 0.65 and 2.40mbgl, and generally comprised sandy gravel or gravelly sand, with fragments of tile, glass, wood, brick, ash, concrete and limestone.

Cohesive Made Ground

3.3.6 Cohesive made ground materials were encountered WS02, and WS03, from ground level or beneath the granular material to depths of between 0.50 and 1.10 mbgl, and generally comprised soft to firm sandy gravelly clay, with fragments of coal, glass, brick, tile, mudstone, and porcelain.

Superficial Deposits (Till)

3.3.7 Soils considered to represent Till deposits were encountered in all exploratory hole locations directly beneath the Made Ground and were proven to depths of between 4.90 and 5.45mbgl.

3.3.8 The Till deposits generally comprised firm becoming stiff, slightly sandy slightly gravelly clay.

Bedrock

3.3.9 Bedrock was not encountered during this ground investigation.

Groundwater

3.3.10 Groundwater was encountered in three of the four exploratory holes formed across the site. Further details are as follows:

- WS02 – strike at 4.50mbgl remaining stable after 20 minutes.
- WS03 – strike at 2.80mbgl remaining stable after 20 minutes.
- WS04 – strike at 2.60mbgl remaining stable after 20 minutes.

Obstructions

3.3.11 No obstructions were encountered during this ground investigation.

Contamination

3.3.12 No visual or olfactory evidence of contamination was encountered or observed during this ground investigation, in particular no obvious visual or olfactory evidence of mobile contamination was observed during the ground investigation.

4.0 CHEMICAL TESTING AND RESULTS

4.1 General

4.1.1 All samples were sent to a UKAS accredited chemical testing laboratory, and MCERTS were used where available. The analytical strategy focussed on a general suite of potential contaminants and the analytical suites are summarised in Table 4.1 Summary of Chemical Testing Suite below.

Table 4.1: Summary of Chemical Testing Suite

Testing	Comment	No. of soil samples analysed	No. of leachate samples analysed
General metals suite including Arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, phenol, selenium, zinc, pH, and water soluble sulphate	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
Speciated PAH	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
TPH CWG	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
Asbestos Screen	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	-

4.1.2 All chemical testing results are presented in Appendix B.

4.2 Chemical Results

4.2.1 All chemical results have initially been compared against screening criteria for a residential end use with plant uptake.

4.2.2 A list of the screening criteria used for soils is presented in Appendix C.

4.2.3 Total Organic Carbon (TOC) was not analysed; therefore, a worst case scenario of 1% SOM has been used where appropriate in the chemical assessment below.

4.2.4 Only detectable concentrations of contaminants reported above the screening criteria are presented below in Table 4.2: Summary of Soil Chemical Testing Results.

Table 4.2: Summary of Soil Chemical Testing Results

Analyte	No. Of samples analysed	Screening value (mg/kg) (where applicable)	Analyte concentration range (mg/kg)	No of Samples exceeding screening value
Summary of soil results				
Arsenic	4	11	7 – 204	2
Lead	4	210	50 - 721	3
Mercury	4	1.2	<0.17 – 4.66	1

4.2.5 Four samples were analysed for asbestos screen. No fibres were detected in any of the samples.

4.3 Groundwater Testing

4.3.1 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.

4.3.2 A list of the screening criteria used for waters is presented in Appendix D.

4.3.3 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.

5.0 ENVIRONMENTAL RISK ASSESSMENT

5.1 General

5.1.1 The refined Environmental Risk Assessment has been evaluated using a probability/consequence matrix, which is provided in Appendix D.

5.2 Risk to Human Health

5.2.1 The majority of the chemical analytes analysed recorded levels below the relevant screening criteria for a residential end with plant uptake usage with the exception of arsenic, lead, and mercury.

5.2.2 Elevated concentrations of the above analytes are listed below in Table 6.1: Chemical Analytes Exceeding Screening Criteria.

Table 5.1: Chemical Analytes Exceeding Screening Criteria

Exploratory Hole Location	Depth Range (mbgl)	Analyte Concentration Result (mg/kg)
Analyte = Arsenic - Screening Criteria = 37mg/kg		
WS01	0.50	101
WS01	1.00	204
Analyte = Lead - Screening Criteria = 210mg/kg		
WS01	0.50	378
WS01	1.00	721
WS03	0.70	218
Analyte = Mercury - Screening Criteria = 1.2mg/kg		
WS03	0.70	4.66

5.2.3 Based on the above, contamination does appear to be present beneath parts of the site within the made ground. The elevated levels of contamination may represent either localised hotspots of contamination or could be representative of the site as a whole. At this stage it is not possible to determine the full extent of the soil contamination.

5.2.4 It is understood that the proposed development comprises residential properties with private gardens and associated hardstanding and infrastructure.

5.2.5 Therefore, a pollutant linkage is considered to be present and the risk to human end users are considered to be **moderate**.

5.2.6 Risks to construction workers are considered to be **low to moderate**. All construction workers should wear appropriate Personal Protective Equipment (PPE) in accordance with their risk assessment, which should be informed by this document and the Phase II investigation report. Provision should be made for water on site to 'damp down' any dust in dry conditions.

5.2.7 In areas where site soils are to be exposed at the surface such as areas of landscaping then these areas will need remedial action.

5.3 Risk to Controlled Waters

Groundwater

5.3.1 The site is underlain by Secondary B Aquifer for the superficial deposits, and Principal Aquifer for the bedrock deposits.

5.3.2 There are no source protection zones within 1000m of the site. There is one groundwater abstraction noted 727m to the southwest with fourteen noted between 1000-2000m from site.

5.3.3 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.

5.3.4 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.

5.3.5 Therefore, based on the above information, the results of the soil and leachate testing, the generally impermeable geology directly underlying the site, and considering that natural attenuation, dilution and dispersion will take place, the risks to groundwater and drinking waters are considered to be **very low**.

Surface Water

5.3.6 The nearest surface water course is the Ashton Canal located 194m to the northwest, and topographically up gradient of the site. The nearest surface river is the River Medlock, located 204m to the east.

5.3.7 There are three pollution incidents, all recorded as category three minor incidents, in 1993-1996 to the canal, with no/ unknown pollutants.

5.3.8 There are two licenced surface water abstraction points within 1000m of the site. The nearest to the site is located approximately 653m to the northeast for Tar Distillers, from the Ashton Canal. The second entry is located 658m to the north for an unrecorded abstraction from the Ashton Canal. There are a further six licensed surface water abstraction points between 1000 and 2000m of the site for cooling, dust suppression and unrecorded uses.

5.3.9 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.

5.3.10 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.

5.3.11 Therefore, based on the above information, the results of the soil and leachate testing, the generally impermeable geology directly underlying the site, and considering that natural attenuation, dilution and dispersion will take place, the risks to surface waters are considered to be **very low**.

5.4 Ground Gas Risk Assessment

General

5.4.1 There is one historical landfill site located 234m to the southeast, dated in 1986 for inert and industrial waste, there are four areas of potential infilling located 201m from site. There is a large area of artificial ground noted in BGS mapping located 55m southwest.

5.4.2 Made ground was also encountered beneath the site and was proven to depths of up to 2.30mbgl.

5.4.3 Ground gas monitoring standpipes have been installed to a maximum depth of 3.00mbgl with response zones placed within the made ground and natural deposits (where the made ground was less than 3.00m thick) beneath the site.

5.4.4 It is considered that hazardous ground gasses if present would migrate vertically upwards through the permeable sands beneath the site into the proposed development.

Results

5.4.5 The monitoring period has been carried between the 30th April 2021 and the 5th July 2021.

5.4.6 The following ground gas risk assessment was carried out in accordance with CIRIA 665, CIRIA 149 and BS 8485.

5.4.7 Methane concentrations ranged between 0.0 and 0.2% v/v; Carbon dioxide concentrations ranged between 0.3 and 4.1% v/v; oxygen concentrations ranged between 18.0 and 21.0% v/v; and flows were recorded between 0.1 and 0.5l/hr during the monitoring period.

5.4.8 In the case of any negative flows, it should be assumed that any negative flows can become positive and therefore the any negative GSV's should be taken as positive.

5.4.9 Based on these recorded values a maximum Gas Screening Values (GSVs) for methane were calculated at 0.0005l/hr; and a maximum GSV for carbon dioxide were calculated at 0.006/hr.

Conclusions and Recommendations

5.4.10 Based on the above information to date, this site has been categorised as falling under Characteristic Situation (CS) 1 – very low risk.

5.4.11 As such no specific remedial action is required with respect to gas protection.

5.4.12 The site would be classed as Green under the NHBC traffic light system.

5.4.13 It is recommended that the above conclusions should be agreed with the local Planning Authority to gain their approval prior to commencing with the construction of the new development.

5.4.14 Following the installation of any gas resistant membranes the local authority may require verification to prove the membrane has been installed correctly.

5.4.15 With regards carbon monoxide: Information provided by the World Health Organisation (WHO) provides air quality guidelines for Europe 2000, which provides time weighted average exposures that have been determined in such a way that the carboxyhaemoglobin (COHb) level of 2.5% is not exceeded. These are as follows:

- 87ppm for 15 minutes
- 52ppm for 30 minutes
- 26ppm for one hour
- 9ppm for eight hours

5.4.16 In addition, recommended WHO European guidelines for indoor air quality is as follow:

- 6ppm for twenty four hours so as not to exceed 2% COHb for chronic exposure.

5.4.17 Carbon Monoxide concentrations were recorded between 1 and 2 ppm.

5.4.18 Based on the above, the risks from Carbon Monoxide are considered to be **very low** .

5.4.19 Therefore, based on the above results, no protection is considered necessary against Carbon Monoxide.

5.4.20 With regards hydrogen sulphide: Information taken directly from the HSE (Health & Safety Executive) Online provides the following:

- 0.0047 ppm is the recognition threshold of human smell, the concentration at which 50% of humans can detect the characteristic odour of hydrogen sulphide.
- 10-20 ppm is the borderline concentration for eye irritation.
- 50-100 ppm leads to eye damage.
- At 150-250 ppm the olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger.
- 320-530 ppm leads to pulmonary edema with the possibility of death.
- 530-1000 ppm causes strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing.

- Concentrations over 1000 ppm cause immediate collapse with loss of breathing, even after inhalation of a single breath.

5.4.21 Hydrogen Sulphide concentrations were recorded as 1 ppm.

5.4.22 Based on the above, the risks from Hydrogen Sulphide are considered to be **very low**.

5.4.23 Therefore, based on the above results, no protection is considered necessary against Hydrogen Sulphide.

5.5 Plants and Native Grasses

5.5.1 Any plants that may be grown at the site in areas of landscaping may potentially be at risk from phytotoxic elements in any artificial soils beneath the site. Guideline screening values are currently available for copper, nickel and zinc which are considered to be the most harmful to plant life.

5.5.2 All three chemical analytes recorded levels below the relevant phytotoxic screening criteria. Given the above and the generally low potential for contamination and the results of the wider soil analysis, the risks to plants and native grasses are considered to be very low. Any remaining residual risks will be mitigated by the remedial measures set out in Section 6.3 above.

5.6 Buried Services and Utilities

5.6.1 Any organic contamination present in the soils or groundwater beneath the site would pose a risk of premature failure to below ground services via chemical reaction. Based on the chemical analysis carried out during this ground investigation, the risks to buried services and pipelines are considered to be low.

5.6.2 It is the responsibility of the utility providers to confirm the risk status and determine what materials should be used in the provision of any newly proposed buried services and utilities based on the results of the chemical analysis with this report. A copy of this report should therefore be provided to the utility contractors.

5.6.3 It is recommended that prior to the placement of any newly proposed buried services, that adequate testing of the soils of which the pipes / cables will be laid in is carried out to determine the suitability of those soils for the utility provider's equipment.

5.7 Conceptual Site Model

5.7.1 Following the results of the site investigation and above assessment, an updated CSM has been produced overleaf as Table 5.2: Conceptual Site Model .

Table 5.2: Conceptual Site Model

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Pollutant Linkage	Probability	Consequence	Risk Classification	Action / Mitigation
Made Ground both on site and within influencing distance of the site Current and former land uses both on site and within influencing distance of the site	Arsenic, Lead and Mercury	Inhalation Dermal Contact	**Human health**: Including current site users.	Potentially active	Low	Mild	**Low**	Remediation will be required to render the site suitable for a residential with plant uptake end use.
	Arsenic, Lead and Mercury	Ingestion Inhalation Dermal Contact	**Human health**: Including future site users.	Potentially active	Likely	Medium	**Moderate**	
	Arsenic, Lead and Mercury	Inhalation	**Human health**: Including neighbouring residents.	Potentially active	Likely	Mild	**Low to moderate**	
	Arsenic, Lead and Mercury	Ingestion Inhalation Dermal Contact	**Human health**: Including constructions workers	Potentially active	Low	Medium	**Low to Moderate**	
Made Ground on site Current and former land uses on site	None identified	Lateral and vertical migration and leaching of contaminants into surface water bodies via permeable strata and features.	Local **water courses** and associated flora and fauna	Inactive	-	-	**Very Low**	No further action.
Made Ground on site Current and former land uses on site	None identified	Lateral and vertical migration and leaching of contaminants into local groundwater	**Underlying Aquifer** (Drinking water and baseflow to rivers)	Inactive	-	-	**Very Low**	No further action.

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Pollutant Linkage	Probability	Consequence	Risk Classification	Action / Mitigation
Made Ground beneath the site Current and former site uses	None identified	Plant uptake	**Plants and vegetation**	Inactive	-	-	**Very Low**	No further action.
Landfill sites Potentially infilled Land (ponds, quarries, reservoirs etc) Made Ground (on and off-site sources)	Hazardous ground gases including CO_2, CH_4 CO, H_2S Vapours	Inhalation	**Human health** animals and plants: Including current site users, future site users, neighbouring residents and constructions workers	Considered potentially active	Unlikely	Minor	**Very low**	No further action.
		Explosion	**Buildings**	Considered potentially active	Unlikely	Minor	**Very low**	

6.0 REMEDIATION OUTLINE

6.1.1 The aim of this Remediation Strategy is to minimize the risk to identified receptors, in this case:

- Construction Workers, and
- Future residents of the proposed development.

6.1.2 Contamination on site is identified as:

- Concentrations above guideline values of Arsenic, Lead and Mercury in WS01 and WS03 recorded at near surface depths in the made ground.

6.1.3 The investigation to date has been point specific, therefore there is potential for further contamination to be present on site in those areas not previously tested.

6.1.4 Based on the contamination profile identified and the proposed end use of the site, in order to meet the needs of this Remediation Strategy the recommendations as set out in Section 7.0 below are considered the appropriate approach.

7.0 REMEDIATION STRATEGY

7.1 Aims

7.1.1 The aims of this remediation strategy are the following:

- Resolve any identified and potential contamination issues in order to protect environmental receptors and render the site suitable for the proposed development with respect to the National Planning Policy Framework (NPPF).
- Render the site as unlikely to be defined as Contaminated Land as defined under Part 2A of the EPA.

7.2 Construction Activities

7.2.1 During the construction works, especially the groundworks, construction workers will be subject to an elevated level of risk.

7.2.2 As such, all personnel on site will comply with guidance provided in the Health and Safety Executive (HSE) document "Protection of Workers and the general public during the redevelopment of potentially Contaminated Land". In summary, the following should be provided by the appointed contractor:

- All staff to be suitably trained and competent.
- Protective clothing, footwear, glasses, suitable dust masks and gloves. (Personnel should be instructed in why and how they are to be used).
- Hand-washing, eye-washing and boot-washing facilities.
- Damp down all exposed soils on site.
- Smoking shall be limited to designated areas.

7.3 Removal of Below Ground Obstructions

7.3.1 Obstructions in the form of relic foundations and infrastructure may be found on site during groundworks.

7.3.2 Where relict structures are found to retain fluid contaminants, they shall be drained and removed from site. The engineer should be notified to ensure that the appropriate action is taken, and records made for final validation.

7.3.3 Deep excavations for the removal of structures etc. will be unstable in the short term and side support may be necessary.

7.3.4 Suitable materials derived from the grubbing-up shall be stored in a location on site, to be agreed with the engineer, prior to crushing. Any unsuitable materials shall be removed to a suitable licensed landfill site as stipulated within the Materials Management Plan.

7.4 Contaminated Soils

7.4.1 It is currently proposed to construct a series of nine new terraced, two storey masonry, with pitched roof properties at the site.

7.4.2 In areas of the site where buildings and hardstanding are proposed the Made Ground can be left insitu as the buildings and hardstanding areas will break the 'pollutant linkage' and remove the pathway for contamination and come in to contact with the end users.

7.4.3 However, remedial measures are required with respect to any intended landscaped areas associated with the new construction.

7.4.4 During removal, it is recommended that a watching brief is present on site to record and validate the removal of materials.

7.4.5 At this stage as a minimum, the made ground materials should be removed from site in accordance with BRE Cover systems for land regeneration 2004. This document recommends that based on the soil testing results, up to 600 mm of made ground below proposed formation level should be removed from site and replaced with clean inert materials comprising of clean inert imported topsoil material in line with BS 3882: 2015 Specification for topsoil.

7.4.6 As insufficient test points have been analysed it is recommended that the maximum guidance depth of 600mm be removed. Some of these materials may require removal anyway as part of the construction process.

7.4.7 Where the Made Ground materials are less than 600 mm thick, only the made ground materials will require removal.

7.4.8 Excavations should not be left open for longer than necessary, should be safely battered back and should be securely cordoned-off using 2.00m high safety fencing, with appropriate warning signs whenever excavation works are suspended.

7.5 Export to Landfill

7.5.1 Any material exported from the site to landfill should be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991 and the Landfill (England and Wales) Regulations 2005.

7.5.2 A transfer note should be completed, signed and retained by the parties involved.

7.5.3 All hazardous waste going for disposal at landfills must be classified according to the new European Waste Catalogue (EWC).

7.5.4 A Hazardous Waste Assessment has been carried out on one sample. This has indicated that the material would be classified as non-hazardous due to the slightly elevated TOC concentration. However, the results of the WAC testing should be presented to the landfill operator for their confirmation of waste category.

7.6 Dust Control

7.6.1 At all times during the excavation works, Best Practicable Means shall be employed to minimise dust and odour generation and their emission off site.

7.7 Previously Unidentified Contaminants

7.7.1 Should any suspected contaminated materials other than those detailed in this, and previous reports be encountered during the re-development, then it should be excavated and stockpiled on an impermeable material and sampled and tested for an appropriate range of determinants.

7.7.2 Should any visual or olfactory evidence of contamination be identified during the removal of below ground obstructions and the turning over of made ground appropriate samples shall be taken by the Engineer for chemical analysis. The Engineer shall check the nature of materials excavated for visual and olfactory evidence of hydrocarbon contamination throughout the remedial works. Depending on the results, the excavated materials shall either be returned to the works beneath the proposed cover system or disposed of, off-site to a suitable licensed facility.

7.7.3 Any grossly contaminated soil/fill found during construction works shall be placed in temporary stockpiles on hardstanding or high density Visqueen and be suitability covered to minimize the potential for dust/odour nuisance and prevent surface water runoff. Samples of arisings material will be taken to determine whether this material is suitable for re-use on site following crushing in line with the earthwork specification.

7.7.4 Once the laboratory analysis of the material is available an assessment should be undertaken to determine whether it can be retained on-site as part of the Material Management Plan or whether it should be disposed off-site.

7.7.5 Depending on the nature of any such impact it may be necessary to undertake validation testing of the excavation faces in order to demonstrate that no such materials are left in-situ.

7.8 Drainage and Services Installations

7.8.1 It is recommended that statutory services are consulted at an early stage, with respect to the ground conditions within which they will lay services, in order to enable them to assess if any protection measures are required.

7.8.2 Underground services, comprising BT Lines, gas mains, combined and foul sewers, CCTV and possible fibre optic cables may all impact the site, as such the design team and the Client should familiarise themselves with their presence.

7.8.3 Drainage installations are anticipated to encounter made ground. Any suitable made ground arisings from drainage trenches etc., if not returned to the original excavation must be placed beneath proposed hard end-use areas of the site, placed beneath a cover of suitable thickness in garden and landscaped areas, or disposed off-site adhering to the guidelines outlined above.

7.9 Soakaway Drainage

7.9.1 Should soakaways be utilised at the site, these should not be placed within significantly contaminated made ground, thereby preventing the potential for leachate generation.

7.10 Materials Management Plan

7.10.1 The Materials Management Plan should allow for remediation of the site soils in the landscaped areas during the appropriate phase of the works.

7.10.2 The Materials Management Plan should also refer to this strategy in respect to:

- Materials arising from the encountering of previously unidentified contamination.
- Materials arising from the removal of below ground obstructions.
- Control of water.
- Contamination related Health and Safety issues, including dust control.

7.10.3 GeoCon does not provide advice on Materials Management Plans, expert advice should be sought.

8.0 VALIDATION

8.1.1 Validation chemical testing should be provided by the supplier of any capping material to be imported to confirm its suitability for use on site. All soil imported should be certified prior to import to be suitable for use as a BS2883:2015 compliant for topsoil.

8.1.2 Irrespective of the above, all materials to be used within soft landscaping areas, irrespective of its source, should be independently tested for its chemical composition in terms of soil contamination as identified in Section 8.1.3 below.

8.1.3 GeoCon has adopted the approach as identified in the YALPAG Verification Requirements for Cover Systems: Technical Guidance for Developers, Landowners and Consultants: Version 3.4 – November 2017 in its verification process. The minimum analysis to be undertaken on materials for use within the cover system is detailed in Table 8.1 below.

Table 8.1: Proposed Testing frequency and analysis

Soil Source	Testing Frequency	Minimum	Analysis suite
Site sourced soils	1 sample per 50m^3	6	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.
Imported soils: brownfield source	1 sample per 50m^3	6	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.
Imported soils: greenfield / manufactured soil source	1 sample per 250m^3	3	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.

8.1.4 Where any material is deemed to be unsuitable for use in the capping layer, either by GeoCon or the Local Authority/Environment Agency, the Contractor shall make provision for the costs of sampling, testing and removal of, said unacceptable materials from excavations and shall make provisions for delays associated with material testing and classification prior to disposal.

8.1.5 Depth validation of the capping system will be required within landscaped areas. The validation will comprise a hand dug pits, with photographic record and insitu testing of all soil will be undertaken as part of the verification. Samples should be taken from each validation pit for subsequent testing. The Validation Report will include the following:

- Details of the provenance of the subsoil and topsoil (to be provided by contractor).
- Logs indicating the thickness of cover soils within each validation trial pit excavated.
- A drawing indicating the location of cover thickness validation trial pits.
- Detailed drawings showing all sampling locations for chemical testing.
- Photographic evidence of the validation trial pits.
- Laboratory analysis of validation soil samples and assessment of suitability for use.
- Details of any variation from the adopted strategy due to unforeseen circumstances.
- Details of any previously unidentified contamination encountered.
- Details of any potentially contaminative activity occurrences that took place.
- Production of a Validation Report.

9.0 REFERENCES

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- *R&D Publication CLR 10: The Contaminated Land Exposure Model (CLEA)*
- *R&D Publication CLR 11: Model Procedure for the Management of Contaminated Land DEFRA 2004*
- *Stroud M.A: The standard penetration test in insensitive clays, Proceedings of the European Symposium on Penetration Testing, Stockholm, 1975, Vol 2, pp 367 – 75.*
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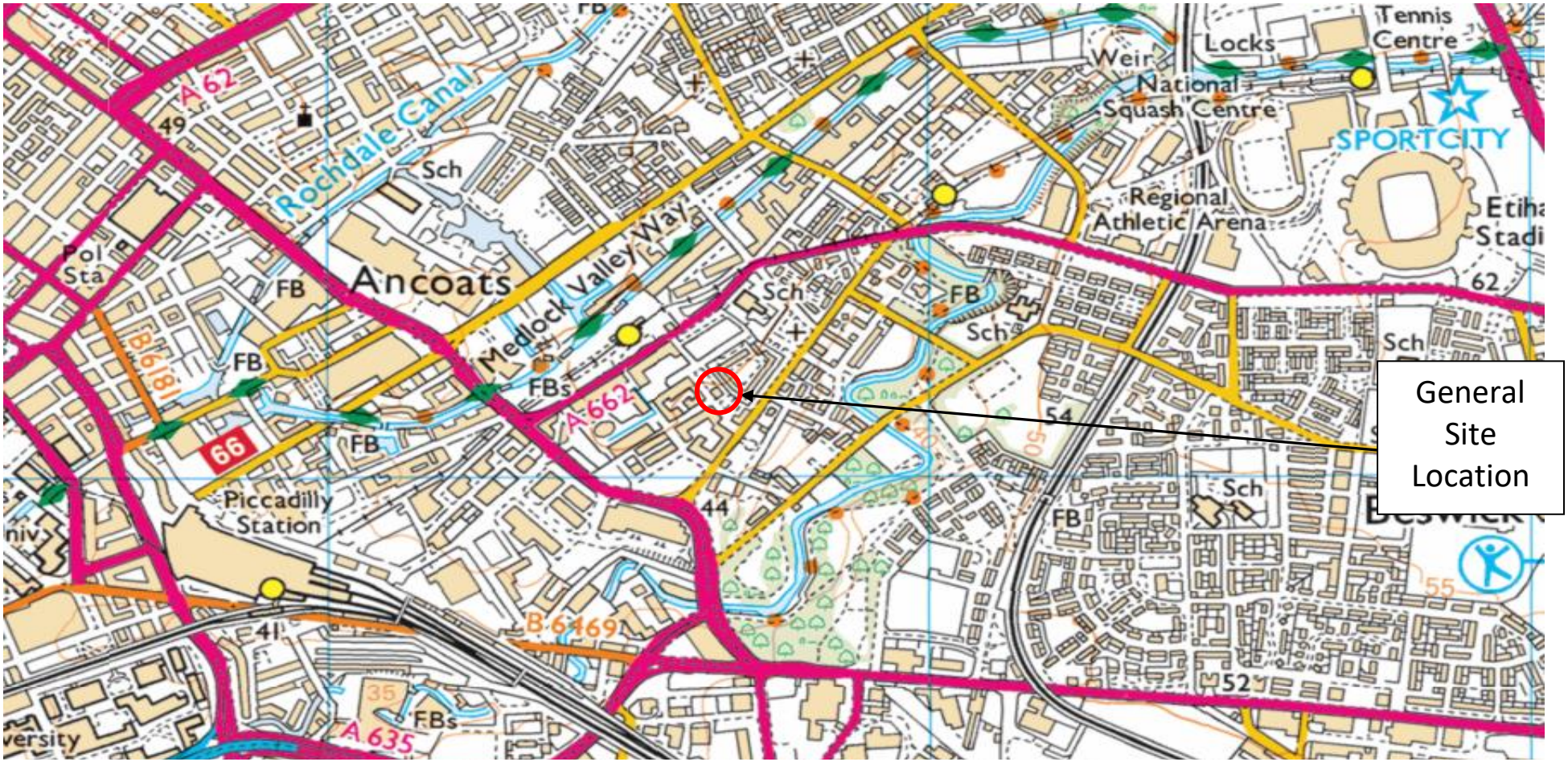
APPENDIX A

DRAWINGS



GEOCON

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N

SITE NAME/CONTRACT	DRAWING NO.	SCALE
Snell Street, Manchester	GSI 1450/01	N.T.S
TITLE	**DATE**	**DRAWN BY**
Site Location Plan	March 2021	AD

CALDERPEEL.COM

© CALDERPEEL PARTNERSHIP LTD

NOTE: DO NOT SCALE FROM THIS DRAWING

REV	DESCRIPTION	DATE	DRAWN
*	--	00-00-00	--

PROPOSED SITE PLAN
9 UNITS - TOTAL 13,167 SQFT

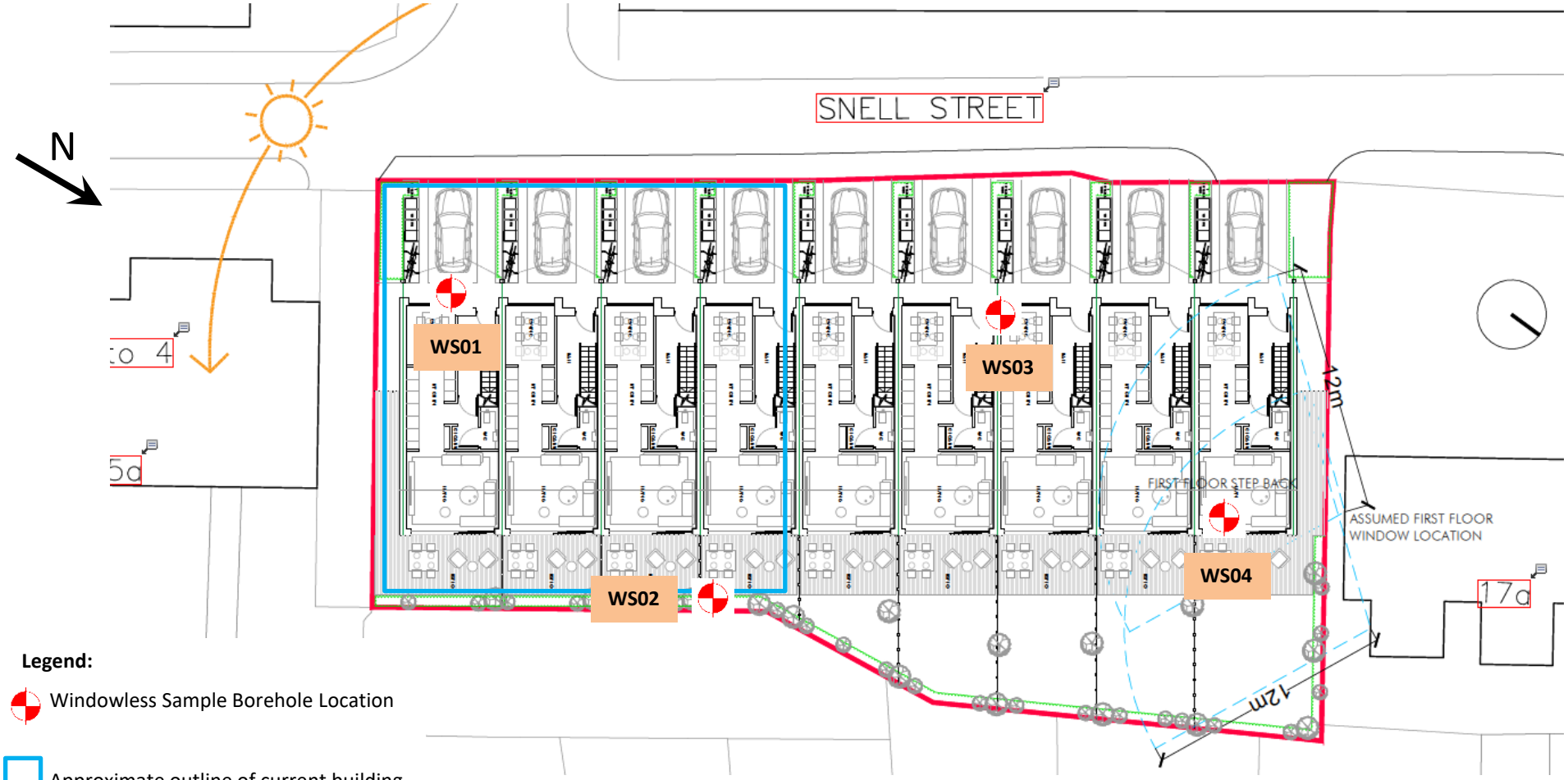
CHESHIRE	SURREY	SHEFFIELD	MANCHESTER	LIVERPOOL
Market Court	100 High St	Electric Works	All Work and Social	AvenueHQ
20-24 Church St	Esher	3 Concourse Way	XYZ Building	17 Mann Island
Altrincham	Surrey	Sheffield	2 Hardman Boulevard	Liverpool
WA14 4DW	KT10 9QJ	S1 2BJ	M3 3AQ	L3 1BP
0161 929 7622	01372 203 335	0114 250 7983	0161 929 7622	0151 662 0122

SNELL STREET

BROOKFINCH

CALDERPEEL ARCHITECTS

PROPOSED SITE PLAN
DWG: 20096 (FE) 001 *
DATE: 05.10.20
SCALE: 1:200 @ A3
DRAWN: AG



Legend:

Windowless Sample Borehole Location

Approximate outline of current building
Basedrawing provided by Calderpeel Architects
ref: 0096 (FE) 001 * dated 05th October 2020

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SITE NAME/CONTRACT	DRAWING NO.	SCALE
Snell Street, Manchester	GSI1450/02	N.T.S
TITLE	**DATE**	**DRAWN BY**
Proposed Exploratory Hole Location Plan	April 2021	GB

APPENDIX B

CHEMICAL TESTING RESULTS

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/05212
Issue Number: 1 **Date:** 26 May, 2021

Client: Geocon Site Investigations Ltd
Suite 2 Marple House,
39 Stockport Road,
Marple
Stockport
UK
SK6 6BD

Project Manager: Use - Mailing list/Use - Mailing list 2
Project Name: Snell Street, Manchester
Project Ref: GSI 1450
Order No: PO 21/024
Date Samples Received: 14/04/21
Date Instructions Received: 13/05/21
Date Analysis Completed: 25/05/21

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
% Stones >10mm$_{A}$	21.1	13.1	41.6	<0.1	3.5	<0.1	<0.1	% w/w	0.1	A-T-044
pH$_{D}^{M\#}$	7.96	8.49	6.55	-	7.79	-	-	pH	0.01	A-T-031s
pH BRE$_{D}^{M\#}$	-	8.49	6.55	7.45	-	8.16	8.07	pH	0.01	A-T-031s
Ammonium NH4 BRE (water sol 2:1)$_{D}$	-	<1.00	1.29	<1.00	-	<1.00	1.63	mg/l	1	A-T-033s
Chloride BRE, SO4 equiv. (water sol 2:1)$_{D}^{M\#}$	-	144	<7	10	-	12	<7	mg/l	7	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1)$_{D}$	-	63.8	2.3	1.4	-	0.8	<0.4	mg/l	0.4	A-T-026s
Sulphate (water sol 2:1)$_{D}^{M\#}$	0.58	0.55	<0.01	-	0.04	-	-	g/l	0.01	A-T-026s
Sulphate BRE (water sol 2:1)$_{D}^{M\#}$	-	548	<10	31	-	54	30	mg/l	10	A-T-026s
Sulphate BRE (acid sol)$_{D}^{M\#}$	-	0.45	0.03	<0.02	-	0.03	<0.02	% w/w	0.02	A-T-028s
Sulphur BRE (total)$_{D}$	-	0.52	0.02	0.02	-	0.02	0.01	% w/w	0.01	A-T-024s
Magnesium BRE (water sol 2:1)$_{D}$	-	7	<1	5	-	9	6	mg/l	1	A-T-SOLMETS
Cyanide (total)$_{A}^{M\#}$	<1	<1	<1	-	<1	-	-	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC$_{A}$	<0.2	<0.2	<0.2	-	<0.2	-	-	mg/kg	0.2	A-T-050s
Arsenic$_{D}^{M\#}$	101	204	7	-	21	-	-	mg/kg	1	A-T-024s
Cadmium$_{D}^{M\#}$	0.9	1.7	0.5	-	1.4	-	-	mg/kg	0.5	A-T-024s
Copper$_{D}^{M\#}$	86	143	32	-	75	-	-	mg/kg	1	A-T-024s
Chromium$_{D}^{M\#}$	25	79	11	-	146	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent)$_{D}$	<1	<1	-	-	-	-	-	mg/kg	1	A-T-040s
Lead$_{D}^{M\#}$	378	721	50	-	218	-	-	mg/kg	1	A-T-024s
Mercury$_{D}$	0.80	0.40	<0.17	-	4.66	-	-	mg/kg	0.17	A-T-024s
Nickel$_{D}^{M\#}$	17	31	10	-	43	-	-	mg/kg	1	A-T-024s
Selenium$_{D}^{M\#}$	2	2	<1	-	<1	-	-	mg/kg	1	A-T-024s
Zinc$_{D}^{M\#}$	133	64	47	-	115	-	-	mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (2 no)$_{A}$	*	*	-	-	-	-	-			A-T-001
pH (leachable)$_{A}^{\#}$	7.48	7.52	-	-	-	-	-	pH	0.01	A-T-031w
Sulphate (leachable)$_{A}^{\#}$	3090	2320	-	-	-	-	-	mg/l	1	A-T-026w
Cyanide (total) (leachable)$_{A}^{\#}$	0.019	0.008	-	-	-	-	-	mg/l	0.005	A-T-042wTCN
Phenols (total by HPLC) (leachable)$_{A}$	<0.01	<0.01	-	-	-	-	-	mg/l	0.01	A-T-050w
Arsenic (leachable)$_{A}^{\#}$	480	1310	-	-	-	-	-	µg/l	1	A-T-025w
Cadmium (leachable)$_{A}^{\#}$	<5	<5	-	-	-	-	-	µg/l	1	A-T-025w
Copper (leachable)$_{A}^{\#}$	721	213	-	-	-	-	-	µg/l	1	A-T-025w
Chromium (leachable)$_{A}^{\#}$	65	61	-	-	-	-	-	µg/l	1	A-T-025w
Lead (leachable)$_{A}^{\#}$	445	146	-	-	-	-	-	µg/l	1	A-T-025w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
Mercury (leachable)$_{A}$#	<0.5	<0.5	-	-	-	-	-	µg/l	0.1	A-T-025w
Nickel (leachable)$_{A}$#	111	30	-	-	-	-	-	µg/l	1	A-T-025w
Selenium (leachable)$_{A}$#	109	239	-	-	-	-	-	µg/l	1	A-T-025w
Zinc (leachable)$_{A}$#	446	47	-	-	-	-	-	µg/l	1	A-T-025w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil$_{D}^{\#}$	NAD	NAD	NAD	-	NAD	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_{D}$	N/A	N/A	N/A	-	N/A	-	-			A-T-045

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
PAH-16MS										
Acenaphthene$_{A}^{M\#}$	0.09	<0.01	0.63	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene$_{A}^{M\#}$	0.03	<0.01	<0.01	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Anthracene$_{A}^{M\#}$	0.25	<0.02	0.90	-	<0.02	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene$_{A}^{M\#}$	0.86	<0.04	1.24	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene$_{A}^{M\#}$	0.73	<0.04	1.13	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene$_{A}^{M\#}$	0.91	<0.05	1.30	-	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene$_{A}^{M\#}$	0.26	<0.05	0.39	-	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_{A}^{M\#}$	0.34	<0.07	0.48	-	<0.07	-	-	mg/kg	0.07	A-T-019s
Chrysene$_{A}^{M\#}$	0.91	<0.06	1.33	-	<0.06	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene$_{A}^{M\#}$	0.06	<0.04	0.08	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Fluoranthene$_{A}^{M\#}$	2.10	<0.08	3.56	-	<0.08	-	-	mg/kg	0.08	A-T-019s
Fluorene$_{A}^{M\#}$	0.12	<0.01	0.47	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene$_{A}^{M\#}$	0.30	<0.03	0.45	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Naphthalene $_{A}^{M\#}$	0.04	<0.03	0.29	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Phenanthrene$_{A}^{M\#}$	1.51	<0.03	3.34	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Pyrene$_{A}^{M\#}$	1.70	<0.07	3.10	-	<0.07	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS$_{A}^{M\#}$	10.2	<0.08	18.7	-	<0.08	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
PAH 16MS (leachable)										
Acenaphthene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Acenaphthylene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Anthracene (leachable)A	0.09	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable)A	0.04	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Chrysene (leachable)A	0.23	0.09	-	-	-	-	-	µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Fluoranthene (leachable)A	0.12	0.07	-	-	-	-	-	µg/l	0.02	A-T-019w
Fluorene (leachable)A	0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable)A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Naphthalene (leachable) A	0.06	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Phenanthrene (leachable)A	0.12	0.06	-	-	-	-	-	µg/l	0.02	A-T-019w
Pyrene (leachable)A	0.15	0.08	-	-	-	-	-	µg/l	0.02	A-T-019w
Total PAH 16MS (leachable)A	0.83	0.30	-	-	-	-	-	µg/l	0.02	A-T-019w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
TPH CWG										
Ali >C5-C6$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C6-C8$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C8-C10$_{A}$	<1	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C10-C12$_{A}^{M\#}$	<1	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C12-C16$_{A}^{M\#}$	2	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C16-C21$_{A}^{M\#}$	2	2	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C21-C35$_{A}^{M\#}$	71	53	-	-	-	-	-	mg/kg	1	A-T-055s
Total Aliphatics$_{A}$	75	55	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C5-C7$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C7-C8$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C8-C10$_{A}$	2	1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C10-C12$_{A}$	2	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C12-C16$_{A}$	11	1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C16-C21$_{A}^{M\#}$	30	5	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C21-C35$_{A}^{M\#}$	69	19	-	-	-	-	-	mg/kg	1	A-T-055s
Total Aromatics$_{A}$	114	26	-	-	-	-	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35)$_{A}$	189	82	-	-	-	-	-	mg/kg	1	A-T-055s
BTEX - Benzene$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Toluene$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
MTBE$_{A}^{\#}$	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
TPH CWG (leachable)										
Ali >C5-C6 (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Ali >C6-C8 (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Ali >C8-C10 (leachable)$_A$	17	11	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C10-C12 (leachable)$_A$	<10	<10	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C12-C16 (leachable)$_A$	<10	<10	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C16-C21 (leachable)$_A$	51	11	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C21-C35 (leachable)$_A$	732	364	-	-	-	-	-	µg/l	20	A-T-055w
Total Aliphatics (leachable)$_A$	800	386	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C5-C7 (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C7-C8 (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C8-C10 (leachable)$_A$	77	59	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C10-C12 (leachable)$_A$	16	11	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C12-C16 (leachable)$_A$	329	135	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C16-C21 (leachable)$_A$	2090	788	-	-	-	-	-	µg/l	10	A-T-055w
Total Aromatics (leachable)$_A$	5640	2008	-	-	-	-	-	µg/l	20	A-T-055w
TPH (Ali & Aro >C5-C35) (leachable)$_A$	6440	2394	-	-	-	-	-	µg/l	20	A-T-055w
BTEX - Benzene (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - Toluene (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - Ethyl Benzene (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - o Xylene (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - m & p Xylene (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
MTBE (leachable)$_A$	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C21-C35 (leachable)$_A$	3128	1015	-	-	-	-	-	µg/l	20	A-T-055w

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

envirolab
Units 7 & 8, Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

Final Test Report

Envirolab Job Number:	21/05212		
Issue Number:	1	Date:	26-May-21
Client:	Geocon Site Investigations Ltd Suite 2 Marple House, 39 Stockport Road, Marple Stockport UK, SK6 6BD		
Project Manager:	Use - Mailing list/Use - Mailing list 2		
Project Name:	Snell Street, Manchester		
Project Ref:	GSI 1450		
Order No:	PO 21/024		
Date Samples Received:	14-Apr-21		
Date Instructions Received:	13-May-21		
Date Analysis Completed:	25-May-21		

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

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

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Prepared by:

MMarshall

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Landfill WAC analysis must not be used for hazardous waste classification purposes. This analysis is only applicable for landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Sample Details								Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	21/05212/4						
Client Sample Number								Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample ID				WS02						
Depth to Top				0.25						
Depth to Bottom										
Date Sampled				12/04/2021						
Sample Type				Soil - ES						
Sample Matrix Code				6AE						
Solid Waste Analysis										
pH (pH Units)$_D$	A-T-031	N	N	**6.55**				-	>6	-
ANC to pH 4 (mol/kg)$_D$	A-T-ANC	N	N	**0.03**				-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg)$_D$	A-T-ANC	N	N	**<0.01**				-	to be evaluated	to be evaluated
Loss on Ignition (%)$_D$	A-T-030	N	N	**5.4**				-	-	10
Total Organic Carbon (%)$_D$	A-T-032	N	N	**3.72**				3	5	6
PAH Sum of 17 (mg/kg) $_A$	A-T-019	N	N	**18.8**				100	-	-
Mineral Oil (mg/kg)$_A$	A-T-007	N	N	**36**				500	-	-
Sum of 7 PCBs (mg/kg)$_A$	A-T-004	N	N	**<0.007**				1	-	-
Sum of BTEX (mg/kg)$_A$	A-T-022	N	N	**<0.01**				6	-	-
Eluate Analysis				**2:1**	**8:1**	**2:1**	**Cumulative 10:1**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)**		
				mg/l		**mg/kg**				
Arsenic	A-T-025	N	N	0.007	0.002	0.016	**0.030**	0.5	2	25
Barium	A-T-025	N	N	0.489	0.106	1.134	**1.530**	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	**<0.01**	0.04	1	5
Chromium	A-T-025	N	N	0.008	0.004	0.019	**0.050**	0.5	10	70
Copper	A-T-025	N	N	0.120	0.038	0.278	**0.490**	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	**<0.005**	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.001	<0.002	**<0.01**	0.5	10	30
Nickel	A-T-025	N	N	0.089	0.022	0.206	**0.300**	0.4	10	40
Lead	A-T-025	N	N	0.152	0.047	0.352	**0.600**	0.5	10	50
Antimony	A-T-025	N	N	0.002	<0.001	0.005	**<0.01**	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.001	<0.002	**<0.01**	0.1	0.5	7
Zinc	A-T-025	N	N	0.069	0.037	0.160	**0.420**	4	50	200
Chloride	A-T-026	N	N	8	8	20	**79**	800	15000	25000
Fluoride	A-T-026	N	N	1.2	0.6	2.7	**7.0**	10	150	500
Sulphate as SO_4	A-T-026	N	N	15	21	35	**212**	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	30	<20	70	**<200**	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.01	<0.02	**<0.1**	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	20.6	25.40	48	**257**	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	6.3	6.6					
Conductivity (µS/cm)	A-T-037	N	N	61	26					
Mass Sample (kg)				0.231						
Dry Matter (%)	A-T-044	N	N	75.8						
Stage 1										
Volume Leachant, L_2 (l)	A-T-046			0.350						
Filtered Eluate Volume, VE_1 (l)	A-T-046			0.200						
Stage 2										
Volume Leachant, L_8 (l)	A-T-046			1.400						

Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation

APPENDIX C

CHEMICAL SCREENING CRITERIA

(SOILS)

GeoCon Site Investigations Ltd

GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

January 2020

Compound / Analyte	Source Reference	Residential WITH consumption of home-grown vegetables			Residential WITHOUT consumption of home-grown vegetables			Commercial			Allotments			Public Open Space - Residential			Public Open Space - Parks		
		1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Metals																			
Antimony	A	141	-	222	437	-	437	4650	-	4650	-	-	58.3	749	-	749	3090	-	3090
Arsenic	C	-	-	37	-	-	40	-	-	640	-	-	43	-	-	79	-	-	170
Barium	A	56.8	-	110	1340	-	1340	22000	-	22000	-	-	18.1	2680	-	2680	5770	-	63
Beryllium	C	-	-	1.7	-	-	1.7	-	-	12	-	-	35	-	-	2.2	-	-	532
Boron	C	-	-	290	-	-	11000	-	-	240000	-	-	45	-	-	21000	-	-	46000
Cadmium (pH 6, 7, 8)	C	-	-	11	-	-	85	-	-	190	-	-	1.9	-	-	120	-	-	532
Chromium III	C	-	-	910	-	-	910	-	-	8600	-	-	18000	-	-	1800	-	-	33000
Chromium VI	C	-	-	6	-	-	6	-	-	33	-	-	1.8	-	-	7.7	-	-	220
Copper	C	-	-	2400	-	-	7100	-	-	68000	-	-	520	-	-	12000	-	-	44000
Lead	B	-	-	210	-	-	330	-	-	6000	-	-	84	-	-	760	-	-	1400
Mercury (elemental)	C	-	-	1.2	-	-	1.2	-	-	58	-	-	21	-	-	16	-	-	30
Mercury (Inorganic)	C	-	-	40	-	-	56	-	-	1100	-	-	19	-	-	120	-	-	240
Mercury (methyl)	C	-	-	11	-	-	15	-	-	320		-	6		-	40		-	68
Molybdenum	A	95.2	-	97.4	-	-	673	-	-	17600	-	-	17	1360	-	1360	2880	-	2880
Nickel	C	-	-	180	-	-	180	-	-	980	-	-	230	-	-	230	-	-	3400
Selenium	C	-	-	250	-	-	430	-	-	12000	-	-	88	-	-	1100	-	-	1800
Vanadium	C	-	-	410	-	-	1200	-	-	9000	-	-	91	-	-	2000	-	-	5000
Zinc	C	-	-	3700	-	-	40000	-	-	730000	-	-	620	-	-	81000	-	-	170000
Non-Metals / Inorganics																			
Free-Cyanide (Total)	A		34			34			373			34			34			34	
Phenol and Chlorophenols																			
Phenol	C	280	550	1100	750	1300	2300	760	1500	3200	66	140	280	760	1500	3200	760	1500	3200
Chlorophenols	C	0.87	2	4.5	94	150	210	3500	4000	4300	0.13	0.3	0.7	620	620	620	1100	1100	1100
Pentachlorophenol	C	0.22	0.52	1.2	27	29	31	400	400	400	0.03	0.08	0.19	60	60	60	110	120	120
Poly Aromatic Hydrocarbons (PAH)																			
Acenaphthene	C	210	510	1100	3000	4700	6000	84000	97000	100000	34	85	200	15000	15000	15000	29000	30000	30000
Acenaphthylene	C	170	420	920	2900	4600	6000	83000	97000	100000	28	69	160	15000	15000	15000	29000	30000	30000
Anthracene	C	2400	5400	11000	31000	35000	37000	520000	540000	540000	380	950	2200	74000	74000	74000	150000	150000	150000
Benzo(a)anthracene	C	7.2	11	13	11	14	15	170	170	180	2.9	6.5	13	29	29	29	49	56	62
Benzo(a)pyrene	C	2.2	2.7	3	3.2	3.2	3.2	35	35	36	0.97	2	3.5	5.7	5.7	5.7	11	12	13
Benzo(b)fluoranthene	C	2.6	3.3	3.7	3.9	4	4	44	44	45	0.99	2.1	3.9	7.1	7.2	7.2	13	15	16
Benzo(ghi)perylene	C	320	340	350	360	360	360	3900	4000	4000	290	470	640	640	640	640	1400	1500	1600
Benzo(k)fluoranthene	C	77	93	100	110	110	110	1200	1200	1200	37	75	130	190	190	190	370	410	440
Chrysene	C	15	22	27	30	31	32	350	350	350	4.1	9.4	19	57	57	57	93	110	120
Dibenzo(ah)anthracene	C	0.24	0.28	0.3	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.43	0.57	0.57	0.58	1.1	1.3	1.4
Fluoranthene	C	280	560	890	1500	1600	1600	23000	23000	23000	52	130	290	3100	3100	3100	6300	6300	6400
Fluorene	C	170	400	860	2800	3800	4500	63000	68000	71000	27	67	160	9900	9900	9900	20000	20000	20000
Indeno(123-cd)pyrene	C	27	36	41	45	46	46	500	510	510	9.5	21	39	82	82	82	150	170	180
Naphthalene	C	2.3	5.6	13	2.3	5.6	13	190	460	1100	4.1	10	24	4900	4900	4900	1200	1900	3000
Phenanthrene	C	95	220	440	1300	1500	1500	2200	22000	23000	15	38	90	3100	3100	3100	6200	6200	6300
Pyrene	C	620	1200	2000	3700	3800	3800	54000	54000	54000	110	270	620	7400	7400	7400	15000	15000	15000
PAH (Total 16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbons (TPH CWG)																			
MTBE	A	27.6	-	220	33.3	-	318	3140	-	22400	-	-	108	73600	-	75000	70800	-	117000
Benzene	C	0.087	0.17	0.37	0.38	0.7	1.4	27	47	90	0.017	0.034	0.075	72	72	73	90	100	110
Toluene	C	130	290	660	880	1900	3900	56000	110000	180000	22	51	120	56000	56000	56000	87000	95000	100000
Ethylbenzene	C	47	110	260	83	190	440	5700	13000	27000	16	39	91	24000	24000	25000	17000	22000	27000
o-Xylene	C	60	140	330	88	210	480	6600	15000	33000	28	67	160	41000	42000	43000	17000	24000	33000
m-Xylene	C	59	140	320	82	190	450	6200	14000	31000	31	74	170	41000	42000	43000	17000	24000	32000
p-Xylene	C	56	130	310	79	180	430	5900	14000	30000	29	69	160	41000	42000	43000	17000	24000	31000
TPH Aliphatic EC5-6	C	42	78	160	42	78	160	3200	5900	12000	730	1700	3900	570000	590000	600000	95000	130000	180000
TPH Aliphatic EC>6-8	C	100	230	530	100	230	530	7800	17000	40000	2300	5600	13000	600000	610000	620000	150000	220000	320000
TPH Aliphatic EC>8-10	C	27	65	150	27	65	150	2000	4800	11000	320	770	1700	13000	13000	13000	14000	18000	21000
TPH Aliphatic EC>10-12	C	130	330	760	130	330	770	9700	23000	47000	2200	4400	7300	13000	13000	13000	21000	23000	24000
TPH Aliphatic EC>12-16	C	1100	2400	4300	1100	2400	4400	59000	82000	90000	11000	13000	13000	13000	13000	13000	25000	25000	26000
TPH Aliphatic EC>16-35	C	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	260000	270000	270000	250000	250000	250000	450000	480000	490000
TPH Aliphatic EC>35-44	C	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	260000	270000	270000	250000	250000	250000	450000	480000	490000
TPH Aromatic EC5-7	C	70	140	300	370	690	1400	26000	46000	86000	13	27	57	56000	56000	56000	76000	84000	92000
TPH Aromatic EC>7-8	C	130	290	660	860	1800	3900	56000	110000	180000	22	51	120	56000	56000	56000	87000	95000	100000
TPH Aromatic EC>8-10	C	34	83	190	47	110	270	3500	8100	17000	8.6	21	51	5000	5000	5000	7200	8500	9300
TPH Aromatic EC>10-12	C	74	180	380	250	590	1200	16000	28000	34000	13	31	74	5000	5000	5000	9200	9700	10000
TPH Aromatic EC>12-16	C	140	330	660	1800	2300	2500	36000	37000	38000	23	57	130	5100	5100	5000	10000	10000	10000
TPH Aromatic EC>16-21	C	260	540	930	1900	1900	1900	28000	28000	28000	46	110	260	3800	3800	3800	7600	7700	7800
TPH Aromatic EC>21-35	C	1100	1500	1700	1900	1900	1900	28000	28000	28000	370	820	1600	3800	3800	3800	7800	7800	7900

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Compound / Analyte	Source Reference	Residential WITH consumption of home-grown vegetables			Residential WITHOUT consumption of home-grown vegetables			Commercial			Allotments			Public Open Space - Residential			Public Open Space - Parks		
		1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH Aromatic EC>35-44	C	1100	1500	1700	1900	1900	1900	28000	28000	28000	370	820	1600	3800	3800	3800	7800	7800	7900
TPH Aliphatic + Aromatic EC>44-70	C	1600	1800	1900	1900	1900	1900	28000	28000	28000	1200	2100	3000	3800	3800	3800	7800	7800	7900

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APPENDIX D

CHEMICAL SCREENING CRITERIA

(WATERS)

GeoCon Site Investigations Ltd

GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

Atkins ATRISK SSV's Screening Criteria - WATERS

Compound	WSV's Residential		WSV's Commercial		DWS		EQS	
	mg/l	Ref	mg/l	Ref	µg/l	Ref	µg/l	Ref
Metals								
Antimnoy					5	F		
Arsenic					10	F	50	G
Barium								
Beryllium								
Boron					1000	F	2000	G
Cadmium (pH 6, 7, 8)					5	F	1.5	G
Chromium III					50	F	4.7	G
Chromium VI							3.4	G
Copper					2000	F	1	G
Lead					10	F	14	G
Mercury (elemental)	0.00463	J	0.428	J				
Mercury (Inorganic)								
Mercury (methyl)	45.5	J	5660	J	1	F	0.07	G
Molybdenum								
Nickel					20	F	34	G
Selenium					10	F		
Vanadium							100	G
Zinc					5000	F	20	G
Non-Metals								
Free-Cyanide (Total)					50	F	1	G
Phenol and Chlorophenols								
Phenol	1690	J	269000	J	0.5	F	7.7	G
Chlorophenols								
Pentachlorophenol							1	G
Poly Aromatic Hydrocarbons (PAH) (1.0% SOM)								
Acenapthene	375	J	-	-				
Acenapthylene								
Anthracene							0.1	G
Benzo(a)anthracene	0.0536	J	-	-				
Benzo(a)pyrene	0.0638	J	-	-	0.01	F	0.27	G
Benzo(b)fluoranthene					0.1	F	0.017	G
Benzo(ghi)perylene					0.1	F	0.00082	G
Benzo(k)fluoranthene					0.1	F	0.017	G
Chrysene								
Dibenzo(ah)anthracene	0.0237	J	-	-				
Fluoranthene							0.12	G
Fluorene								
Indeno(123-cd)pyrene					0.1	F		
Napthalene	0.952	J	99.8	J			130	G
Phenanthrene								
Pyrene								
PAH (Total 16)					0.1	F		
Petroleum Hydrocarbons (TPH CWG)								
MTBE	352	J	33800	J				
Benzene	0.0888	J	8.46	J	1	F	50	G
Toluene	96.4	J	9090	J			74	G
Ethylbenzene	13.4	J	1250	J			200	G
o-Xylene	5	J	503	J			30	G
m-Xylene	4.1	J	413	J			30	G
p-Xylene	4.29	J	432	J			30	G
TPH Aliphatic EC5-6	1.9	J	198	J				
TPH Aliphatic EC6-8	1.4	J	144	J				
TPH Aliphatic EC8-10	0.0296	J	2.9	J				
TPH Aliphatic EC10-12	0.0228	J	2.23	J				
TPH Aliphatic EC12-16	0.00547	J	-	-				
TPH Aliphatic EC16-35								
TPH Aliphatic EC35-44								
TPH Aromatic EC5-7	0.0888	J	8.46	J				
TPH Aromatic EC7-8	96.4	J	9090	J				

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GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

Compound	WSV's Residential		WSV's Commercial		DWS		EQS	
	mg/l	Ref	mg/l	Ref	µg/l	Ref	µg/l	Ref
TPH Aromatic EC8-10	0.985	J	96.5	J				
TPH Aromatic EC10-12	3.87	J	380	J				
TPH Aromatic EC12-16	10.5	J	-	-				
TPH Aromatic EC16 – 21								
TPH Aromatic EC21-35								
VOC and SVOC								
1,1,1-Trichloroethane	13.1	J	1270	J			100	G
1,1,1,2-Tetrachloroethane	1.05	J	96.7	J				
1,1,2,2-Tetrachloroethane	6.89	J	650	J				
1,2-Dichloroethane	0.0373	J	3.54	J	3	F	10	G
1,1,2 Trichloroethane	2.23	J	208	J			400	G
1,1-Dichloroethane	11.4	J	1110	J				
1,1-Dichloroethene	0.683	J	65.6	J				
1,2,4-Trimethylbenzene	0.11	J	9.83	J				
1,2-Dichloropropane	0.0969	J	11.1	J				
2-Chloronaphthalene	0.695	J	62.7	J				
2-Methylphenol	11000	J	-	-				
2,4-Dichloro-o-cresol	1960	J	-	-				
2,4-Dimethylphenol	291	J	30900	J				
2,4-Dinitrotoluene	3250	J	-	-				
2,4,6-Trinitrotoluene								
2,6-Dinitrotoluene	921	J	-	-				
2,6-bis(1,1-dimethyl)-4-(1-methylpropyl)-phenol	13.2	J	-	-				
3-Methylphenol	17900	J	-	-				
4-Methylphenol	12000	J	-	-				
Biphenyl	64.4	J	-	-			25	G
Bis (2-ethylhexyl) phthalate								
Bromobenzene	0.941	J	87.7	J				
Bromodichloromethane	0.0725	J	6.82	J	100	F		
Bromoform	15.9	J	1770	J	100	F		
Butyl benzyl phthalate							51	G
Carbon disulphide								
Carbon tetrachloride	0.0229	J	3.31	J				
Chlorobenzene	13.7	J	1300	J				
Chloroethane	41.5	J	4180	J				
Chloroform / Trichloromethane	3.88	J	369	J	100	F		
Chloromethane	0.0531	J	5.5	J				
Cis 1,2 Dichloroethene	0.548	J	54.6	J				
DDD	7.18	J	-	-			0.025	G
Dibromochloromethane	0.394	J	38.7	J	100	F		
Dichloromethane	13.6	J	1500	J			20	G
Diethyl Phthalate	4340	J	-	-			1000	G
Di-n-butyl phthalate	230	J	-	-			40	G
Di-n-octyl phthalate								
Dinoseb	0.11	J	>52	J				
Formaldehyde	21.6	J	2360	J			50	G
Hexachlorobutadiene							0.6	G
Hexachloroethane	0.0388	J	>50	J				
HMX								
Isopropylbenzene	3.89	J	389	J				
Methyl tert-butyl ether	352	J	33800	J				
Nicotine	573	J	58900	J				
Prochloraz							40	G
Propylbenzene	12.3	J	1100	J				
RDX								
Styrene	38.6	J	3530	J			500	G
Tetrachloroethene	1.66	J	174	J	10	F	140	G
Total Cresols (2-, 3- and 4-methylphenol)								
Trans 1,2 Dichloroethene	0.676	J	65.7	J				
Tributyl tin oxide	0.423	J	54.5	J			0.0015	G
Trichloroethene	0.222	E	20.7	E	10	F		
Trichloromethane	3.88	E	369	E			2.5	G

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GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

Compound	WSV's Residential		WSV's Commercial		DWS		EQS	
	mg/l	Ref	mg/l	Ref	µg/l	Ref	µg/l	Ref
Trichloromethylbenzene	0.00069	J	0.0609	J				
Vinyl chloride	0.00248	J	0.249	J	0.5	F		
Pesticides								
Aldrin					0.03			
Dieldrin					0.03			
Atrazine							2	G
Dichlorvos								
Alpha-Endosulfans							0.01	G
Beta-Endosulfans								
Alpha-Hexachlorocyclohexane								
Beta-Hexachlorocyclohexane								
Gamma-Hexachlorocyclohexane								
Polychlorinated Biphenols (PCB)								
Sum of PCDDs, PCDFs and dioxin-like PCBs								
Chlorobenzenes								
Chlorobenzene								
1,2-Dichlorobenzene								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
Hexachlorobenzene							0.05	G
Pentachlorobenzene								
1,2,3-Trichlorobenzene								
1,2,4-Trichlorobenzene								
1,3,5-Trichlorobenzene								
1,2,3,4-Tetrachlorobenzene								
1,2,3,5-Tetrachlorobenzene								
1,2,4,5-Tetrachlorobenzene								

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GENERIC SCREENING CRITERIA

FOR

GENERIC QUANTITATIVE RISK ASSESSMENT

Screening Criteria Reference Guide:

Soil GAC Source Reference	
A	UK (CLEA) Soil Guideline Value 2009
B	LQM/CIEH S4ULs for Human Health Risk Assessment Values 2015
C	UK (CLEA) Soil Guideline Value 2002
D	CL:AIRE GAC Values December 2009
E	AtRisk Soil Screening Values and Water Screening Values Produces by Atkins 2011
F	UK Drinking Water Standards (DWS)
G	Environment Agency, Environmental Quality Standards (EQS) 2015
H	Defra C4SL's 2014
I	NHBC Technical Extra 15 - 2014
J	Atkins AtRisk SSV's and WSV's Produced by Atkins 2017
Abbreviations	
SOM	Soil Organic Matter
N/P	No pathway - no risk is posed by this substance under the specific land-use scenario
MTBE	Methyl Tertiary Butyl Ether - a petroleum fuel additive which is a common groundwater contaminant

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APPENDIX E

RISK EVALUATION MATRIX

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008) sets out a methodology for the estimation of risk.

At Phase I the risk estimation will take the form of a qualitative risk assessment, which will be entirely based on the conceptual model for each potential end-use of the site. Comments on level of uncertainty will also need to be included for each source-pathway-target linkage to allow the confidence in the assessed risks to be understood. The results of the qualitative risk assessment will allow the risk evaluation to be concisely described in the following chapters.

The methodology for risk evaluation is a qualitative method for interpreting the output for the risk estimation stage of the assessment. It involves the classification of the:

The magnitude of probability (i.e. likelihood).
[takes into account both the presence of the hazard and receptor and the integrity of the pathway]

The magnitude of the potential consequence (i.e. severity).
[takes into account both the potential severity of the hazard and the sensitivity of the receptor]

Classification of Probability

Classification	Definition	Examples
High likelihood (Hi)	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor or harm or pollution.	*Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.* *Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50 years*
Likely (Li)	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	*Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.* *Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.*
Low likelihood (Lw)	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	*Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.* *Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.*
Unlikely (Ul)	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.	*Elevated concentrations of toxic contaminants are present below hardstanding.* *Light industrial unit <10 yrs old containing a double skinned UST with annual integrity testing results available.*

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

Classification of Consequence

	Definition	Examples
Severe (Sv)	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. A Category 1: Human Health risk is present. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long - term maintenance of the population. Catastrophic damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Major fish kill in surface water from large spillage of contaminants from site.* *Highly elevated concentrations of List I and substances present in groundwater close to small potable abstraction (high sensitivity).* *Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).*
Medium (Md)	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. A Category 2: Human Health risk is present. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease* serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability.* *Ingress of contaminants through plastic potable water pipes.*
Mild (Ml)	Exposure to human health unlikely to lead to "significant harm". A Category 3 Human Health risk is present. Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population Minor damage to crops, buildings or property.	*Exposure could lead to slight short - term effects (e.g. mild skin rash).* *Surface spalling of concrete.*
Minor (Mr)	No measurable effect on humans.A Category 4: Human Health risk is present. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	*The presence of contaminants at such concentrations that protective equipment is required during site works.* *The loss of plants in a landscaping scheme.* *Discolouration of concrete.*

* For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.

The classification of consequence does not take into account the probability of the consequence being realized. Therefore, there may be more than one consequence for a particular pollutant linkage. Both a severe and medium classification can result in death. Severe relates to short term (acute) risk while medium relates to long

term (chronic) risk. Mild relates to significant harm but to less sensitive receptors. Minor classification relates to harm which is not significant but could have a financial cost.

The classification gives a guide as to the severity and consequence of identified risk when compared with other risk presented on the site. It should be noted that if a risk is identified it cannot be classified as "no risk" but as "very low risk". Differing stakeholders may have a different view on the acceptability of a risk.

Risk Evaluation Matrix

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High likelihood (Hi)	Very high risk (VH)	High Risk (H)	Moderate Risk (M)	Mod/low risk (M/L)
	Likely (Li)	High risk (H)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)
	Low likelihood (Lw)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)
	Unlikely (Ul)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)	Very low risk (VL)

Risk Categorizations

Very high risk (VH)	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realized, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk (H)	Harm is likely to arise to a designated receptor from an identified hazard. Realization of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk (M)	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk (L)	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realized, would at worst normally be mild.
Very low risk (VL)	There is a low possibility that harm could arise to a receptor. In the event of such harm being realized it is not likely to be severe.

Reference

Rudland, D J, Lancefield, R M, Mayell, P N; 2001; Contaminated land Risk Assessment. A guide to Good Practice; CIRIA Report C552.

The NHBC (National House-Building Council) the Environment Agency and the Chartered Institute of Environmental Health, 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66.