



**BROWNFIELD
SOLUTIONS LTD**

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

LIDL GB LTD

Lowry House, Chorlton

Phase II Geo-Environmental Assessment Report

MS/C5061/11249

August 2022

EXECUTIVE SUMMARY	
Location and Brief Site Description	The site is located at Lowry House, Chorlton, M21 7AA. It is situated approximately 5.25 Km south of Manchester City Centre, centred on National Grid Reference 382509, 393220 as shown on the Site Location Plan, Drawing No. C5061/01. The site comprises an existing four storey office building appearing of brick masonry/concrete frame construction with associated hardstanding car park and soft landscaping areas. A large sewer is known to traverse through the site. Additional underground services appear to be present associated with the onsite office building including lighting and drainage for the car park, with several manhole covers noted. A potential borehole standpipe cover was also noted at one location, potentially suggestive that a third party may have carried out intrusive ground investigations at the site at some point in the recent past.
Ground Conditions	Generalised ground conditions from the ground investigation comprise (top down): - Made ground encountered from ground level to between 0.60m and 2.60m bgl. Generally, less than 1.00m thick. Deeper deposits encountered outside the proposed building footprint (WS02 & WS03). - Natural strata encountered to between 5.45m and 10.65m bgl. - Groundwater recorded between 2.07m and 3.59m bgl.
Human Health - Soils Contamination	Testing of the made ground at the site did not reveal any exceedances of heavy metals, petroleum hydrocarbons, BTEX or MTBE compounds. No asbestos was identified in any of the six samples tested. An exceedance in PAHs has been identified in one sample of made ground (WS08 at 03.0m to 0.60m bgl).
Controlled Waters – Surface and Groundwater Contamination	The overall risk to controlled waters is considered to be low and no further action is required.
Ground Gas	Based on the monitoring to date, the site is provisionally classified as CS2. Ground gas monitoring is ongoing, and a full assessment will be undertaken on completion of the scheduled monitoring.
Outline Remedial Strategy	Subject to regulatory approval, the following outline remedial strategy is recommended: - Cover system with 300mm thick of 'clean' validated topsoil/subsoil soft landscaping areas in the north corner of the site by the proposed HGV turning circle. - Ground gas protection measures are required to comply with Characteristic Situation 2 (CS2). - Verification of the above with validation reports produced.
Waste	Waste classification for the made ground at the site has revealed the majority of the soils to be non-hazardous. However, one of the samples tested (WS02 at 0.50-0.70m bgl) has been classified as hazardous.
Foundations and Floor Slabs	Strip/pad foundations are considered suitable. Safe bearing capacity of 275kN/m² should be available at a minimum depth of between circa. 0.70m and 1.20m bgl, keeping total and differential settlement within acceptable limits. Suspended or ground bearing floor slabs may be adopted.
Concrete Classification	DS-1 AC-1 conditions prevail.
Highways Design	Made Ground CBR – 2.1% - 24.5%. Superficial Strata CBR – granular/coarse soils– 5% Cohesive strata unlikely to be encountered at formation depths. The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction.
Sustainable Drainage Systems (SUDS)	Drainage to soakaways is considered potentially suitable for this site. Indicative soil infiltration rates range from 1.24x10⁻⁴ m/s to 2.62x10⁻⁶m/s.

EXECUTIVE SUMMARY**Further Work**

The following further works will be required to progress to the construction phase:

- Completion of ground gas monitoring programme.
- Issue gas assessment / update gas assessment within this report.
- Demolition Asbestos survey.
- Tree survey by qualified arboriculturist.
- Detailed foundation design by a structural engineer.
- Design of Remedial Strategy and confirmation with the Local Authority.
- Implementation of the Remedial Strategy and verification of the remedial works.

This executive summary should be read in conjunction with the full report, reference MS/C5061/11249 and not as a standalone document.

PROJECT QUALITY CONTROL DATA SHEET

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Document Name:	Phase II Geo-Environmental Assessment Report		
Reference:	MS/C5061/11249		
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Brownfield Solutions Ltd William Smith House 173 – 183 Witton Street Northwich Cheshire CW9 5LP Tel: 01606 334 844 brownfield-solutions.com	Lidl GB Ltd Manor Park Runcorn WA7 1NT	
	Contact: Mr Robert Lawton	Contact:

Written by:

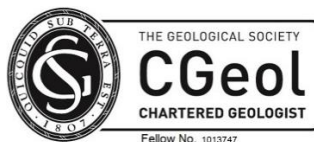


M Shore
BSc (Hons) AMIEnvSc
Project Engineer

Checked by:



J M Jacob
BSc (Hons) CGeol FGS
Director



Approved by:



A J Stokoe
BSc (Hons) CSci MEnvSc FGS
Associate



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DRAWINGS

Drawing Number	Rev	Title
XX-XX-DR-A-91002	-	Proposed Site Plan – Option 2
C5061/01	-	Site Location Plan
C5061/02	-	Exploratory Hole Location Plan

APPENDICES

Appendix	Title
Appendix A	BSL Methodology and Guidance
Appendix B	Exploratory Hole Logs
Appendix C	Chemical Testing Results
Appendix D	Geotechnical Testing Results
Appendix E	Monitoring Results
Appendix F	Waste Assessment Report
Appendix G	Detailed UXO Desk Study

1.0 INTRODUCTION

1.1 Context

This report describes a Phase II Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Lidl GB Ltd on a site at Lowry House, Chorlton and has been completed in general accordance with the following guidance:

- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
- BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
- BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
- BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.

Definitions of terms and acronyms used within this report is presented in Section 11.0.

1.2 Proposed Development

The proposed development is for commercial end use comprising the demolition of the existing structure on site and the construction of a steel framed Lidl retail building with associated car park and soft landscaping areas as shown on drawing No. XX-XX-DR-A-91002 Proposed Site Plan -Option 2 provided by the client.

1.3 Previous Reports

This report should be read in conjunction with BSL Desk Study Assessment Report (JEM/C5061/11005) issued in April 2022.

1.4 Objectives and Scope

The objectives of this report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime.

This report has been produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

An intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The exploratory investigation was undertaken using trial pitting, window sampling, cable percussive drilling, ground gas and groundwater monitoring, laboratory chemical and geotechnical testing, with reporting on the findings.

1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable.

Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used reasonable skill, care and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Lidl GB Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g. to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g. due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

2.0 THE SITE

2.1 Location

The site is located at Lowry House, Chorlton, M21 7AA. It is situated approximately 5.25 Km south of Manchester City Centre, centred on National Grid Reference 382509, 393220 as shown on the Site Location Plan, Drawing No. C5061/01.

2.2 Site Description

The main site features and potential issues identified are detailed below:

Feature	Description
Site Area	Approximately 0.7 hectares.
Site Access	Access to the site is gained off Nell Lane to the southwest.
Current Land Use and Site Features	The site comprises an existing four storey office building appearing of brick masonry/concrete frame construction with associated hardstanding car park and soft landscaping areas. A large sewer is known to traverse through the site. Additional underground services appear to be present associated with the onsite office building including lighting and drainage for the car park, with several manhole covers noted. A potential borehole standpipe cover was also noted at one location, potentially suggestive that a third party may have carried out intrusive ground investigations at the site at some point in the recent past.
Potential Sources of Gross Contamination	There are no apparent potential sources of gross contamination. However, given the apparent age of the building, it may contain ACMs.
Vegetation	There is an area of soft landscaping of grass with occasional hedges and semi/mature trees along the north-eastern, eastern and southern site boundary. An area of grass is present on the western boundary.
Topography	The site is generally flat. However, the car parking area to the south is raised above street level to maintain the level across the site.
Site Boundaries	The site is bound to the north, east, south and west by panel form wire mesh security fencing. The only exceptions to this are on the eastern boundary to Mauldeth Road West where there is a masonry wall with a gate topped with panel form wire mesh security fencing and additional semi/mature trees to the northeast, and at the north of the western boundary where the wall of the onsite office building makes up the boundary.
Surrounding Area	The site is set within a predominantly residential area, bordered by Chorlton High School to the north, residential properties to the east, south and northwest. Chorlton park is present to the southwest of the site.

3.0 SUMMARY OF PREVIOUS REPORTS

3.1 BSL Desk Study

A summary of the relevant points from the Desk Study completed by BSL (reference JEM/C5061/11005) is presented below:

- The site has had previous development since 1849. Buildings associated with Houghend Hall in the south of the site. By 1974 an office block was erected in the northeast half of the site. An infilled pond was also noted in the southeast of the site.
- Geology comprises Glaciofluvial Sheet deposits (Secondary (A) Aquifer) over Wilmslow Sandstone Formation (Principal Aquifer).
- A fault is shown to traverse the site in a north to south direction, downthrown to the west. However, any movements associated with this fault should now have stopped.
- The nearest watercourse is the Chorlton Brook circa 99m to the north of the site.
- The site is not indicated to lie within an EA designated Zone 2 or Zone 3 flood plain.
- The risk to human health is considered to be low to moderate/low.
- The risk from ground gas is considered to be moderate and the site is not located in an area requiring radon protection measures.
- The risk to controlled waters is low.
- The site is located in the UXO moderate risk zone.
- Recommendations were for an appropriate Phase II ground investigation to be carried out to confirm the identified risks and obtain information for preliminary design.

3.2 Brimstone Detailed UXO Desk Study

A summary of the relevant points from the detailed UXO Desk Study completed by Brimstone (reference DRA-22-1423-BROW69R-LowryHouse,Chorlton) is presented below. The full report can be found in Appendix G.

- There is a low-Moderate risk from German UXBs, incendiaries and bomblets.
- There is a low risk from Allied AAA ordnance.
- There is a low risk from other Allied military ordnance.
- The overall risk is low-Moderate.
- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works is recommended.

4.0 METHOD OF INVESTIGATION

4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Desk Study Assessment.

The aim of the fieldwork was to:

- Investigate ground conditions on the site and the potential need for detailed investigation.
- Install standpipes to allow future monitoring.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.
- Give an assessment of the geo-environmental risks associated with redevelopment of the site.

4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation between the dates of 21st and 24th June 2022.

Method	No.	Range Depths (m bgl)	Purpose
Window sample boreholes – Tracked WS rig	7	2.00 – 3.00	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination and geotechnical and testing. Installation of ground gas and water monitoring wells. WS02 placed to target infilled pond.
Cable percussive boreholes	2	10.55 – 10.65	Assess deeper ground conditions, carry out SPTs and obtain samples for contamination and geotechnical and testing.
Lightweight Deflectometer tests	5	0.10 – 0.45	Obtain indicative CBR values.

The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C5061/02. The exploratory hole logs are presented in Appendix B.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

- BS 5930:2015+A1:2020 Code of Practice for Site Investigations.
- BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.

As a specialist preliminary UXO study, commissioned as part of the BSL Desk Study, identified a medium risk of UXO and order to minimise the risk to operatives during the ground investigation works, all borehole locations were scanned with a hand-held magnetometer during drilling.

4.3 Sampling

During the drilling of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental and geotechnical guidance.

The distribution of samples taken across the site is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Type	Number
Environmental (ES)	27
Disturbed (D)	50
U100 (U)	2

4.4 Laboratory Testing

As part of the initial assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

In the absence of particularly contaminative processes on site and the lack of visual evidence of potential hydrocarbon impactation representative soil samples were screened for the following general suite of determinands at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	6
Petroleum Hydrocarbons (TPH CWG) inc BTEX and MTBE.	2
Asbestos Screen.	6
Waste Acceptance Criteria (WAC).	2
Coal Tar Suite	2

The Chemical Laboratory Testing Results are presented in Appendix C.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892- Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil'.

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
Natural Water Content.	5
Plasticity Index Analysis.	5
pH Value.	4
Water Soluble Sulphate Contents.	4
Undrained Triaxial Compression Test with Measurement of Pore Pressure.	2

The Geotechnical Laboratory Testing Results are presented in Appendix D.

4.5 Monitoring

Ground gas and ground water monitoring standpipes were installed in 4 boreholes and subsequently 3 monitoring visits were undertaken out of 4 proposed as part of the current scope, in line with the recommendations of CIRIA C665. All gas monitoring was undertaken using GFM436 infrared gas meter with integral electronic flow analyser.

Flow measurements on each standpipe (l/hr) were taken. Measurements of the percentage volume in air (%v/v) of oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) were recorded in addition to the percentage Lower Explosive Limit (%LEL) of methane (Note: 100% LEL equates to 5% by volume), the atmospheric pressure (mb) and average temperature during the visit (°C).

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS02	35mm PVC	0.60 – 2.60	Made Ground	Ground Gas
WS03	35mm PVC	1.00 – 2.00	Made Ground	Ground Gas
WS04	35mm PVC	1.00 – 4.00	Sand & Clay	Ground Gas & Groundwater
WS07	35mm PVC	1.00 – 5.00	Sand & Clay	Ground Gas & Groundwater

The gas monitoring visits recorded peak and steady state conditions. Peak results are those that occur on opening the valve on the borehole tap. Steady state conditions are those that occur a period of time afterwards when the initial (accumulated) gases have been purged from the borehole.

Interim ground gas monitoring results are presented in Appendix E of this report.

5.0 GROUND CONDITIONS

5.1 Summary

A brief summary of the ground conditions encountered is presented in the table below:

Stratum	Range Depths - Top (m bgl)	Range Depths - Base (m bgl)	Range Thickness' (m)	Brief Description
Made Ground	0.00	0.60 – 2.60	0.60 – 2.60	Sands and Gravels / Sandy gravelly Clay
Natural Superficial Strata	0.60 – 2.60	5.45 – 10.65	4.85 – 9.55	Gravelly Sand / Sandy gravelly Clay

Details are provided in the logs in Appendix B and the individual strata are described in the sections below.

5.2 Made Ground

Made Ground – Topsoil

Made Ground Topsoil was encountered in WS02 and WS03 from ground level to between 0.30m and 0.40m bgl, comprising dark brown gravelly sand with rootlets and anthropogenic inclusions of gravel sized brick, sandstone and mudstone.

Made Ground – General

Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 0.60m and 2.60m bgl. The made ground was generally found to be less than 1.00m thick across the site with the deeper deposits encountered in exploratory holes located outside the proposed building footprint (WS02 & WS03).

Hardstanding surfacing of Tarmacadam or paving slab was present across the majority of the site recorded to generally be between 0.05m and 0.15m thick. Tarmacadam was found to be 0.35m thick at LWD03.

The composition of the made ground was fairly consistent across the site and represented demolition material comprising sand and gravel. Cobbles of brick were found to be of low content.

Deeper made ground encountered in WS02 and WS03 comprised sandy gravelly clay to depths between 2.10m and 2.60m bgl.

5.3 Natural Superficial Strata

The natural strata underlying the site was generally medium dense sands followed by stiff clay with varying amounts of sand and gravel as minor constituents.

5.4 Solid Geology

The solid geology of the Wilmslow Sandstone Formation was not encountered in this investigation.

5.5 Groundwater

The depths to groundwater and locations present are shown in the table below:

Location	Depth During Site Works (m)	Depth During Monitoring Period (range) (m)
BH01	3.10	N/A
BH02	3.10	N/A
WS01	2.70	N/A

Location	Depth During Site Works (m)	Depth During Monitoring Period (range) (m)
WS02	3.40	NGW
WS03	2.90	NGW
WS04	2.90	2.05 - 2.07
WS05	2.80	N/A
WS06	3.10	N/A
WS07	3.00	3.26 - 3.59
WS08	2.90	N/A

*NGW = No groundwater.

5.6 Observations

Contamination

During the works undertaken by BSL, observations for both visual and olfactory evidence of contamination were undertaken.

No evidence of contamination was observed at the site.

Stability of Boreholes

The borehole sidewalls at shallow depth were generally stable and window sampling progressed without the need to install casing.

Casing was required within the deeper boreholes to prevent collapse with the granular materials during drilling of the cable percussive boreholes.

UXO

No magnetic anomalies were encountered in any of the window sample or cable percussive boreholes.

6.0 TEST RESULTS

6.1 Geotechnical Laboratory Testing

Plasticity Index Analysis

Plasticity index results ranged between 9% and 28% indicating the cohesive soils to be of low to medium plasticity. Associated water contents ranged between 14.1% and 29.0%.

After modification of particle size in accordance with BRE 240 the modified plasticity indices are in the range 8.28% to 28% indicating the cohesive soils to be of low to medium volume change potential.

Undrained Shear Strength

Undrained shear strength in triaxial compression ranged from 50 to 70kPa indicating the cohesive soils to be of medium to high strength. The results of the tests are shown in the table below:

Location	Depth (m)	Shear Strength (kPa)	Undrained Shear Strength to EC7
BH01	4.20 – 4.65	50	Medium
BH02	5.50 – 5.95	70	Medium

6.2 Aggressive Ground Conditions – Geotechnical Chemical Testing

The test results for the assessment of aggressive ground conditions are presented in Appendix D. The results are summarised and assessed within Section 8.0 of this report.

6.3 In Situ Geotechnical Testing

In Situ Standard Penetration Tests

Standard Penetration Tests (SPTs) were carried out within the window sample and cable percussive boreholes at regular 1.0m to 1.5m intervals. The results of the individual blows and the N-values are recorded on the Exploratory Hole Logs in Appendix B.

All SPT N values are uncorrected. Density and strength descriptors are reported in accordance with the guidelines stated in BS 5930:2015+A1:2020, incorporating requirements of BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003.

Permeability Test Results (Boreholes)

The results of permeability testing in boreholes using falling head methods are presented in the table below. These were carried out in general accordance with BS 5930 & BS 22282.

Location	Response Zone (m)	Stratum Type	Hydraulic Conductivity (m/sec)
WS04	1.00 – 4.00	SAND and CLAY	1.24×10^{-4}
WS07	1.00 – 5.00	SAND and CLAY	2.62×10^{-6}

The full test results are presented in Appendix D.

In Situ CBR Testing

The in situ CBR testing results are summarised in the table below:

Method	Location	Stratum Type	Indicative CBR (%)	Modulus Subgrade Reaction K^{762} (kN/m ² /mm)
	LWD01	Sandy Gravel	24.5	92.13

Method	Location	Stratum Type	Indicative CBR (%)	Modulus Subgrade Reaction K^{762} (kN/m ² /mm)
Lightweight Deflectometer (LWD)	LWD02	Sandy Gravel	20.1	82.24
	LWD03	Sandy Gravel	2.1	22.36
	LWD04	Sandy Gravel	6.8	44.12
	LWD05	Sandy Gravel with cobbles	13.3	64.71

The full test results are presented in Appendix D.

6.4 Geo-Environmental Testing

Chemical Laboratory Testing

The chemical test results for soils are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

Ground Gas Monitoring

Ground gas monitoring installations have been monitored on 3 occasions to date out of 4 visits scheduled. The results are presented in Appendix E and are summarised and assessed within Section 8.0 of this report.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Ground Model Summary

The site is currently disused and unoccupied and comprises a four storey office building (Lowry House) appearing of brick masonry/concrete frame construction with associated hardstanding car park and soft landscaping areas.

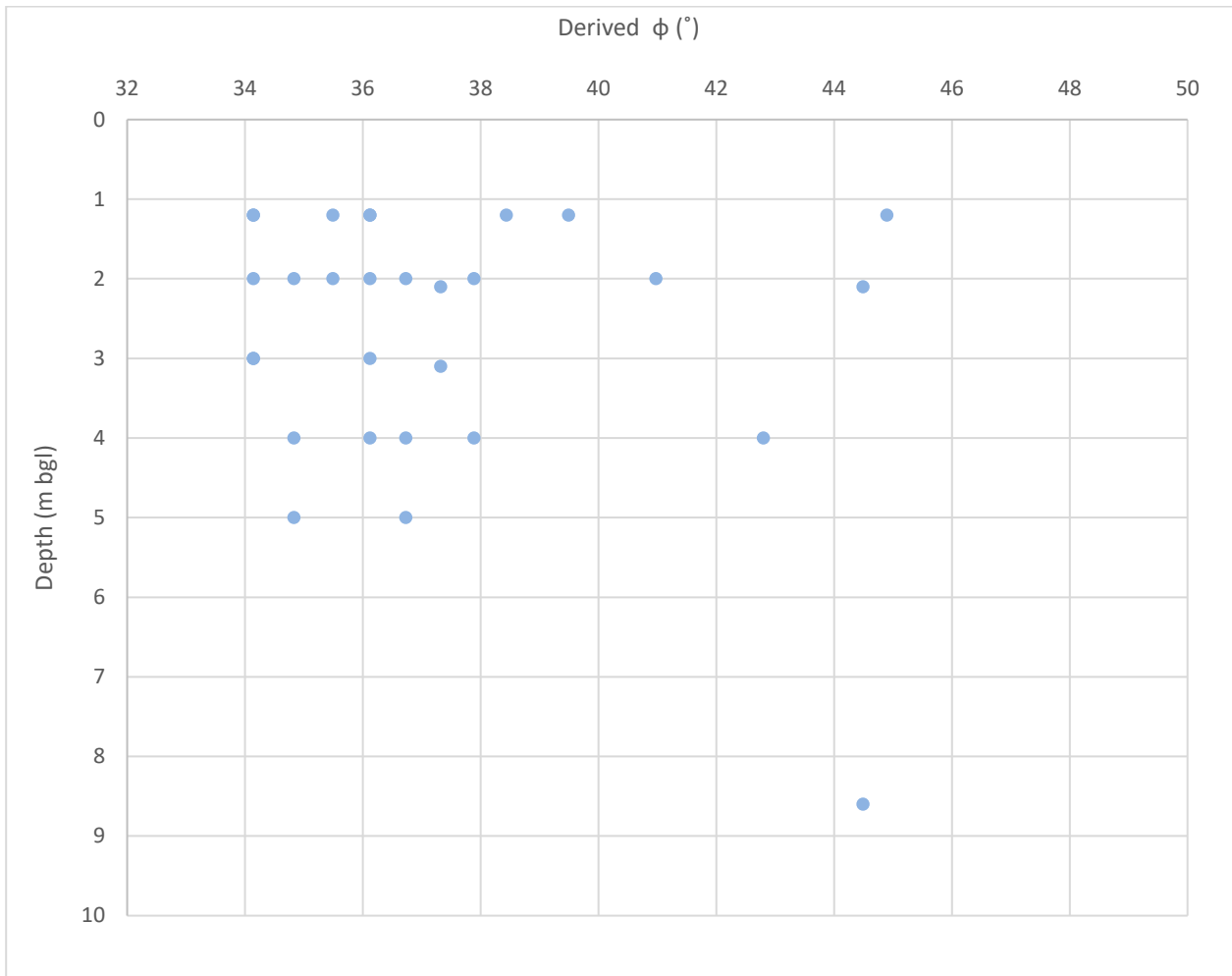
The ground conditions can be summarised as below (top down):

-
- Made ground generally comprising sands and gravels / sandy gravelly clay from ground level to between 0.60m and 2.60m bgl. Generally, less than 1.00m thick. Deeper deposits encountered outside the proposed footprint (WS02 & WS03).
 - Natural superficial deposits comprising sand / clay proven to depths between 5.45m and 10.65m bgl.
 - Groundwater levels ranging between 2.70m and 3.10m bgl during site works.
 - Post site works monitoring levels ranging between 2.07m and 3.59m bgl.
-

7.2 Design Soil Parameters

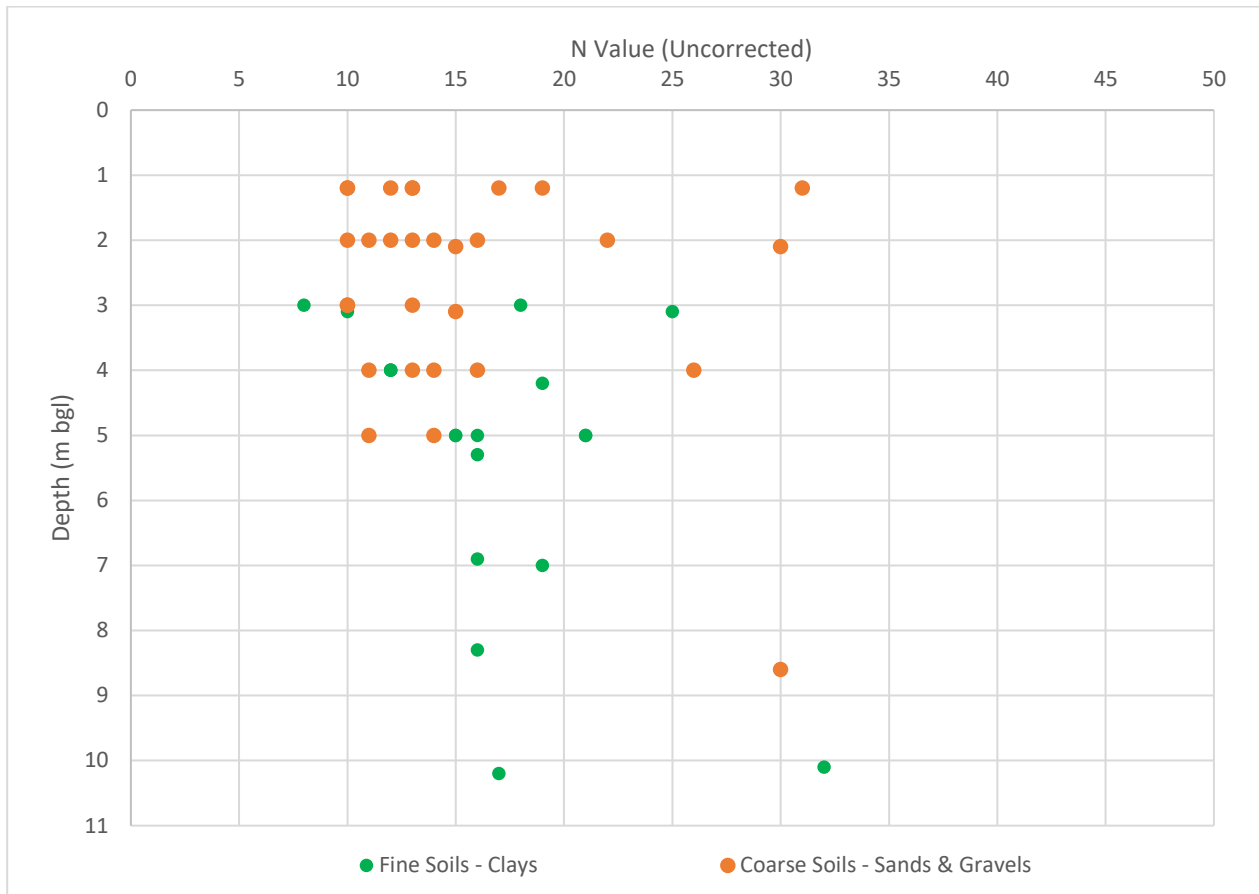
The relevant test results from the prior section have been evaluated to derive geotechnical soil parameters for the site in the following section.

The angle of shearing resistance (ϕ') of the granular (coarse) soils within the first 5.00m has been derived from the uncorrected SPT N value data and the correlation of Hatanaka and Uchida (1996).



The above graph shows that the density of the granular material generally remains similar with increased depth.

A depth (m bgl) vs SPT N value graph is also provided below to provide a profile of the cohesive and granular materials underlying the site.



The above graph shows there is no significant increase in soil strength or density as depth increases.

Characteristic Values

Characterisation of the geotechnical parameters above has been undertaken to obtain characteristic values, which are a cautious estimate of the values affecting the occurrence of the limit state.

Based on the above graphs, the characteristic ϕ' value at 1.00mbgl is interpreted to be 34° for Ultimate Limit State conditions and with extrapolation, is interpreted to be 33° at 0.45m bgl (i.e. minimum founding depths in granular strata).

7.3 Foundations

The development will comprise a single storey food store with a steel frame and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7

Preliminary design by calculation has been undertaken to determine the design resistance of the bearing strata in the following section. No proposed structural loads were available at the time of writing, therefore the following recommendations are provisional and should be reviewed at the detailed design stage.

Shallow Foundations – Strip and Pads

The most suitable foundations for the proposed Lidl store are likely to be strip or pad foundations, taken through any made ground and placed within the natural gravelly sand strata at depths ranging between 0.70m and 1.20m bgl due to the variation of depths of made ground encountered within the proposed store's footprint. Foundations should extend a minimum of 100mm into the specified/required bearing strata.

At this depth, an allowable bearing capacity not exceeding 275kN/m² should be assumed for the gravelly sand. This adopts a factor of safety of 3 which should limit settlements to within acceptable limits.

Based on the investigation data, cohesive strata are not anticipated at or within influencing distance of the foundations. If, however, foundations do encounter cohesive strata or changes between cohesive and granular strata, then BSL should be contacted for further advice. Options could include deepening to found on the same strata or reinforcing the foundation.

The existing drain underlying the site will need to be considered when designing the foundations. It is unadvisable for construction to be undertaken over the drain, foundations will either need to be taken to below the base of the drain or situated 3 to 4 times the breadth of the foundation away from the drain, this would ensure that the feature is outside the pressure bulb of the foundation and that no load is being transferred to the drain.

General Advice for Shallow Foundations

The bearing stratum should be inspected for 'soft spots' within the natural clay strata, resulting for instance from localised groundwater perched within the overlying fill materials. If soft soils are encountered, then foundations will need to be deepened to found on suitable strata. The stratum should also be inspected for 'hard spots' which may require removal.

If the ground conditions encountered during the construction phase differ significantly to the conditions encountered during construction, work should cease and BSL contacted for further advice.

During the construction phase supervision should be on a continuous basis to check the design assumptions are correct and construction conforms to design. Supervision should include inspections, Control Ground Investigations and monitoring.

7.4 Building Near Trees

Due to the presence of non-shrinkable granular soils beneath the building footprint at traditional foundation depths, it is not considered that special precautions will be required in respect to trees. Should any clay soils be identified on site during construction at or near founding depths, then this should be reported to the Geotechnical Engineer immediately and remedial actions agreed.

For information purposes the clay soils on site, where encountered at depth, are of medium volume change potential.

7.5 Floor Slabs

A ground bearing floor slab may be adopted providing the following criteria are satisfied:

-
- Any other compressible or unsuitable materials (topsoil containing vegetation and organic matter, including tree roots, are excavated and either improved or removed and replaced with suitable materials.
 - Any fill beneath the slab is suitable, well-compacted granular material placed in an appropriate thickness in accordance with a suitable specification (e.g. SHW Series 600) designed and supervised by an appropriately qualified engineer, with the end performance validated.
 - The slab is adequately reinforced.
 - Regular construction joints and ties are provided to allow for differential settlement.
-

The final floor slab design should be of sufficient thickness and sufficiently reinforced to accept the envisaged applied loads, without unacceptable total or differential movement.

Vertical elements within the structure, such as columns and walls will need to be isolated from the ground bearing slab in order to allow for the slab to expand against them without resulting in cracking.

Incorporation of geogrid reinforcement at formation level, before granular material is placed and compacted, will likely minimise required excavation depths and help provide a suitable foundation for the ground bearing slab.

Ground floor slabs should also be designed to incorporate any ground gas protections measures (CS2 at present).

7.6 Site Preparation and Construction

The existing structures will need to be demolished and relict foundations/infrastructure grubbed out. Topsoil and subsoil should be removed from beneath all buildings and hardstanding areas.

There is a main sewer running adjacent to the existing office block building. To allow construction, this will need to be diverted or suitable measures in put place to prevent damage to the asset. Any other suspected dead services should be confirmed as dead by testing.

Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) is recommended to maintain the build programme. Breaking equipment may also be required locally to penetrate old foundations associated with former construction.

To protect against the effects of heave, any new drainage in cohesive soils should be designed to take account of potential ground movement, including where pipes and services which pass through substructure walls or foundations. The volume change potential on this site is medium and the potential ground movements that need to be considered for design are 100mm.

Recorded post site works groundwater levels ranged between 2.05m and 3.59m bgl and are unlikely to be encountered within likely excavation depths.

7.7 Concrete Classification

The soluble sulphate and Ph test results have been assessed in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in the table below.

For the purposes of this assessment, the made ground and natural strata is considered to be relatively permeable, therefore the groundwater has been classed as mobile.

Stratum	No. Samples	Characteristic SO ₄ (g/l)	Characteristic pH	DS Class	ACEC Class
Made Ground	6	0.14	8.05	DS-1	AC-1
Natural Superficial Strata	4	0.064	7.7	DS-1	AC-1

Based on the above, the results of laboratory pH and sulphate content, indicate that sulphate class DS-1 and ACEC Class AC-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

7.8 Highways

Based on the test results equilibrium CBR values of 2.1-24.5% have been achieved in the granular made ground soils underlying the existing hardstanding surfacing.

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 5% are likely to be achieved in undisturbed natural granular soils, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Clay soils are unlikely to be encountered at formation depths.

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 300mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

7.9 Sustainable Drainage Systems (SUDS)

In accordance with CIRIA C753 "The SUDS Manual", infiltration viability should be given full consideration where rates of 10^{-6} m/s or greater exist on the site. Where rates are less than this value, the soils can still usefully be used for interception delivery, but disposal of significant volumes of run-off may not be appropriate unless a large area is available, or some form of attenuation can be incorporated.

Therefore, based on the rates obtained in the borehole falling head tests, SUDS are potentially suitable at the site. We recommend the design of infiltration drainage is carried out in accordance with BRE 365 and CIRIA C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

If drainage to soakaways is to be considered, it is suggested that this is discussed with the Local Authority at the earliest opportunity, to confirm the adequacy of proposed testing and to allow their inspection of any test results.

8.0 GEO-ENVIRONMENTAL RISK ASSESSMENT

8.1 Introduction

The samples were tested for an assessment of the chemical contamination that may pose a risk to human health. The results were examined with reference to a selection of guidance documents as detailed in Appendix A. In this case the LQM/CIEH S4ULs commercial end use have been adopted as Tier 1 generic screening values.

The apparent exceedance of the relevant screening value is taken as indicating further detailed assessment or remedial action is required.

A summary assessment sheet is presented in Appendix C alongside the chemical test results. Results are discussed in detail in the sections below.

8.2 Soils Test Results and Risk Assessment – Human Health

Metals

No metals have been detected above the adopted screening criteria.

Asbestos

No asbestos fibres have been detected in any of the 6 samples screened.

Poly Aromatic Hydrocarbons (PAHs)

BSL consider the main risk drivers for PAHs to be benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P being one of the most toxic of the PAHs, and naphthalene the most volatile and soluble. Category 4 Screening Levels (C4SLs) indicate B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible. Given the difference in chemical properties between the two, naphthalene will be treated separately using the LQM S4ULs.

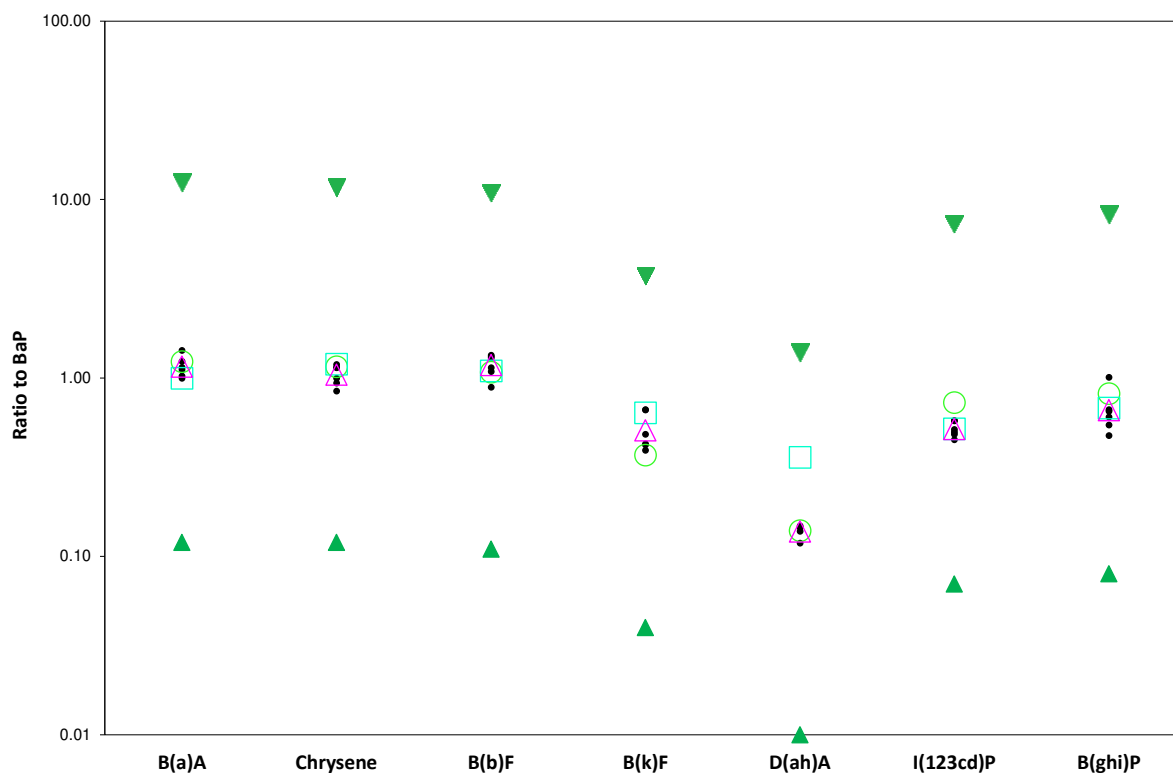
PAHs and B(a)P as a Surrogate Marker

In line with CL:AIRE and Public Health England (PHE) guidance, benzo(a)pyrene is considered to be one of the most potent PAHs, and it would be appropriate to assume the cancer risk in a mixture is proportional to the concentration of a surrogate marker PAH (benzo(a)pyrene) in the mixture. The ratio of PAHs within the mixture can be assessed to ensure that the profile is similar to that seen for the test material (coal tar mixtures) in the toxicological study by Culp et al. The International Programme on Chemical Safety (IPCS) considered that the PAH profile of the soil sample may deviate from the average profile by about an order of magnitude (up or down).

A more recent study by Bull et al (2013) which analysed PAH concentrations in soil samples from 274 sites, showed that the levels of PAH relative to B(a)P showed little variability and were similar to that recorded for the coal tar mix used in the Culp et al study. Given this, it was concluded that benzo(a)pyrene is a suitable surrogate marker to represent mixtures of PAH in soil.

In order to risk assess the PAH mixture in the site soil samples using human health guideline values, notably C4SLs, the PAH profile in the soil samples, the ratio of the seven genotoxic PAHs shown below, relative to B(a)P, should be calculated to ensure it is similar to the test material used in the Culp study (PHE 2010). To be considered sufficiently similar, the ratio relative to B(a)P should fit within the upper and lower limits (representing an order of magnitude above and below the mean ratio to B(a)P of test material used in the Culp et al study). In such cases B(a)P is considered an adequate surrogate marker and the Low Levels of Toxicological concern (LLTC) for B(a)P may be used in the risk assessment.

The graph below summarises the site data with respect to how the ratios of carcinogenic PAHs relate to B(a)P, within the confidence limits provided in the PHE documents.



Key:

- Ratio to B(a)P for all data
- △ Mean ratio to B(a)P from all data at the site
- ▼ Upper and Lower limits (order of magnitude from Culp data)
- Mean ratio to B(a)P for Culp data
- Mean ratio to B(a)P for UK data presented by PHE

All the data points that could be used to calculate ratios fall inside the upper or lower limits (order of magnitude above or below that of the study material). Based on this distribution of data it is considered that B(a)P can be used as a surrogate marker for carcinogenic PAHs and the C4SL criteria is suitable for this dataset.

Based on the above, elevated PAHs were recorded in one location to date. The location and elevated species of PAH's are shown in the table below:

Exploratory Hole	Depth (m)	Species	Concentration (mg/kg)	Adopted Screening Value (mg/kg)
WS08	0.30-0.60	Benzo(a)pyrene	84	76

* Based on Soil Organic Matter content

Total Petroleum Hydrocarbons (TPH CWG)

No petroleum hydrocarbons have been identified above the adopted screening criteria.

BTEX and MTBE

No BTEX or MTBE compounds have been identified above the adopted screening criteria.

Coal Tar

Two samples of the asphalt surfacing (LWD03 & LWD04) were screen for the presence of Coal Tar. Neither of the samples are indicated to contain coal tar.

8.3 Summary – Human Health Risk Assessment

Based on the testing and assessment undertaken it would appear that there is localised contamination within the made ground in the form of PAHs within the made ground strata.

The above poses a risk to human health and will require further consideration.

8.4 Controlled Waters Risk Assessment

The site is not considered to pose a significant risk to controlled water for the following reasons:

- No significant contamination has been identified on site in soils based on the results obtained as a potential indicator of groundwater contamination.
- The nearest watercourse is 99m away, which provides considerable distance for attenuation and contaminant degradation.
- The site is underlain by low permeability clays at depth which will inhibit lateral and vertical contaminant migration.
- The site does not lie within 500m of an SPZ.
- There are no groundwater abstractions within 1000m.
- There are no potable (sensitive) water abstractions within 2000m.

8.5 Permanent Ground Gas and Vapours Results

Three ground gas monitoring visits have been carried out between the dates of 7th July and 16th August 2022. A further visit is scheduled. Results are summarised in the table below:

	CH ₄ (%)		CO ₂ (%)		O ₂ (%)		CO (ppm)		H ₂ S (ppm)		Steady Flow (l/hr)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Peak	0.1	0.1	1.0	9.0	11.9	19.6	0.0	0.0	0.0	0.0	0.1	0.1
Steady	0.1	0.1	0.5	8.2	12.2	20.4					0.1	0.1

Notes: CH₄ = Methane; CO₂ = Carbon dioxide; O₂ = Oxygen; CO = Carbon Monoxide; H₂S = Hydrogen Sulphide; ppm = Parts Per Million.

The highest carbon dioxide concentrations were recorded within WS07 (9.0% v/v) on the third monitoring visit, whilst methane was not recorded above the limit of detection (0.1% v/v) in any of the boreholes during either of the visits. The maximum flow of 0.1 l/hr was recorded in all boreholes during both visits.

The atmospheric pressure ranged between 983mb and 1024mb over the monitoring period, of which visits were conducted over a range of falling and rising pressure trends.

8.6 Ground Gas Risk Assessment

In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' and BS8485:2015+A1:2019 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

As the proposed end-use a commercial development, guidance dictates that the gas monitoring results should be assessed in accordance with the Wilson and Card methodology.

The Wilson and Card methodology uses the concept of a Gas Screening Value (GSV) which is derived using the following equation: (max gas concentration / 100) x maximum flow.

A maximum positive flow of 0.1l/hr has been used to derive the GSVs. The GSV's for the site are presented below.

Gas	GSV (l/h)	Typical Threshold Concentration Exceeded	Classification
Methane	0.0001	No	CS-1
Carbon Dioxide	0.0090	Yes	CS-2

The GSV for carbon dioxide and methane place the site the site into Characteristic Situation 1 (CS1), however due to concentrations of carbon dioxide being greater than 5% v/v recorded at the site then the site will be provisionally classified as Characteristic Situation 2 (CS2).

Confirmation of the Characterisation Situation will be made following completion of the current monitoring period.

8.7 Potable Water Supply

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

As the site is brownfield, there is the assumption that barrier pipe would be utilised, although requirements should be confirmed by risk assessment and with the water supply company.

8.8 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf. Unless stated otherwise, in respect to off-site sources, only risks that are assessed as moderate and above within the preliminary CSM have been carried forward to this section, or where a previously unidentified potential source, pathway and / or receptor has been identified from the recent site works.

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Made Ground Metals, PAH's, asbestos	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Likely	Medium	Moderate	One elevation in PAHs has been identified (WS08 at 0.30-0.60m bgl) in the made ground soils located in the north corner of the site. The risks is considered to be moderate and remedial measures in the form of a cover system (300mm) in areas of soft landscaping are required to mitigate the risk to site end-users. However, generally, the made ground soils across the site are not considered contaminated. Furthermore, the presence of hardstanding across the majority of the development will break the pathway to site end users therefore the likelihood of site end-users coming into contact with contaminated soils is considered low.
On site Made Ground Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / property / structures	Unlikely	Medium	Low	Monitoring to date has identified elevated carbon dioxide has been recorded in WS07 under the proposed building footprint. However, the response zone lies within the natural strata and not made ground deposits. The standpipe with response zone situated in the made ground deposits (WS02) has not had significant ground gas concentrations recorded. Therefore, the risk from ground gas as a result of the made ground is considered to be low.
On site Infilled Pond Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / property / structures	Unlikely	Medium	Low	WS02 is located within the area of the infilled pond. A monitoring standpipe was installed with a response zone situated in the made ground deposits (infill material). Gas monitoring to date has revealed no significant concentrations of ground gas in WS02. The risk is considered to be low, although this will be reviewed upon completion of the gas monitoring programme.
Off site Infilled Features Ground Gas (carbon dioxide and methane)	Migration into confined spaces	End-users/ Buildings	Low likelihood	Severe	Moderate	Elevated carbon dioxide has been identified in WS07 and it is unclear what the source of gas is. Given the distance of these infilled features from the site, and the propensity for ground gas to migrate upwards there is considered unlikely that the elevated concentrations are because of the off-site infilled ponds. However, elevated carbon dioxide has been recorded in one installation below the proposed building footprint and the site has been classified as CS2 at this stage. The risk is considered to be moderate. A full assessment will be made upon completion of the gas monitoring programme.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Made Ground PAHs, Metals	Overland flow, / migration through saturated zone	Chorlton Brook 99m away (Surface waters)	Unlikely	Medium	Low	It is considered contaminants associated with the made ground are unlikely to impact the Chorlton Brook. Gross contamination has not been identified in the tested made ground soils and there is also potential for contaminants to attenuate and degrade over this distance. Therefore, a low risk is posed to the brook from the made ground.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary A Aquifer (Groundwater)	Unlikely	Medium	Low	Made ground was not observed to be substantial in thickness and gross contamination has been identified in the tested made ground soils. In addition, the site is currently surfaced in hardstanding and will remain so in the majority, with a new surface water drainage system installed which will further reduce the risk to controlled waters.
	Migration through saturated zone	Principal Aquifer (Groundwater)	Unlikely	Medium	Low	Made ground was not observed to be substantial in thickness and gross contamination has been identified in the tested made ground soils. There are no groundwater abstraction licences within 500m of the site, additionally, clays are noted to be underlying the area in all BGS logs surrounding the site, this relatively impermeable material would help break the pathway between any contaminants and the Principal Aquifer. Furthermore, as stated above, the site is currently surfaced in hardstanding and will remain so in the majority, with a new surface water drainage system installed which will further reduce the risk to controlled waters.

8.9 Outline Remedial Measures

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

One sample of made ground (WS08 at 0.30-0.60m bgl) located in the north corner of the site has had elevated PAHs identified. Generally, the made ground across the site is not considered contaminated, with all other samples tested having no elevations when screen against commercial values.

In the area of the proposed HGV turning circle in the north corner of the site, as shown on the 'Proposed Site Plan – Option 2' (XX-XX-DR-A-91002), any areas of soft landscaping should have a cover of "clean" subsoil and topsoil should be provided to break the pathway to site end users. This should be 300mm thick. This will allow plants to be grown and prevent undesirable soils being brought to the surface.

Prior to import or re-use of clean cover soils, they should be tested to confirm chemical suitability. After installation of the clean cover, soil depths should be verified by a suitably qualified independent geo-environmental engineer, such as BSL.

Ground Gas Protection Systems

Gas monitoring is ongoing, however monitoring to date has revealed mitigation measures will be required. However, as carbon dioxide greater than 5%v/v has been detected in an installation below the proposed building footprint on all three monitoring visits, the ground gas levels recorded place the site within CS2 and protection measures are required.

The design of a gas protection system according to BS8485:2015+A1:2019 requires the proposed structures to be categorised into one of four building types (Type A to D).

For CS2 in accordance with BS 8485 for a Type C building placed within CS2, a minimum of 2.5 points is required to be obtained from gas protection measures. The gas protection system should consist of at least two separate elements including a structural barrier, ventilation measures and/or a gas resistant membrane.

The required level of protection should be obtained from a combination at least two or more different elements from the following options in line with BS8485:

-
- Structural barrier of the floor slab, or of the basement slab and walls if the basement is present– i.e. A cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations [1 or 1.5 point score dependant on construction quality].
 - Ventilation measures–i. e A pressure relief pathway [0.5 point score] (Required as a minimum in all systems) or passive sub-floor dispersal layer [1.5 point score - good performance or 2.5 point score - very good performance]. Note for type A buildings active ventilation measures are inappropriate.
 - Gas resistant Membrane- i.e. a gas resistant membrane which is suitably impervious to carbon dioxide / methane [2 point score].
-

Note that if the installation of the membrane is not verified by a suitably qualified independent engineer in accordance with CIRIA C735, then this will score 0 points and the criteria will not be met. This may have serious implications in terms of achieving regulatory sign off, potentially causing costly delays and potentially placing end users of the site and the structure at risk.

All installations should be subject to verification. The verifier should be independent, competent and suitably trained; BSL can provide this service. We recommend validation requirements should be discussed with the Local Authority prior to installation.

General

It is recommended that the approval of the Regulators (Local Authority) is obtained in regard to the above prior to any irrevocable action is taken at the site.

Once the above bodies have approved the above outline remedial proposals, a Remedial Strategy and a Verification Plan for Ground Gas Protection Measures will need to be produced to meet planning requirements and submitted to the regulatory authorities for approval. This will also give guidance to enable a suitably qualified contractor to carry out the works.

Once remediation is complete, verification reports will need to be produced by a suitably qualified independent geo-environmental engineer, such as BSL, in order to achieve regulatory sign off.

8.10 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals, PAHs, petroleum hydrocarbons)	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Low likelihood	Mild	Low
Asbestos	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Unlikely	Medium	Low
Ground gas	Inhalation in confined spaces/trenches	Construction Workers	Low likelihood	Severe	Moderate

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and/or 0.5% for long term exposure. Furthermore, soil concentrations of oxygen are below the HSE recommendations of 18%.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, all contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land". In summary, the following measures are suggested to provide a minimum level of protection:

-
- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
 - Hand-washing and boot-washing facilities should be provided.
 - Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
 - Good practices relating to personal hygiene should be adopted on the site.
 - The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.
-

9.0 WASTE SOIL CLASSIFICATION & ASSESSMENT

9.1 Summary

BSL have undertaken a preliminary assessment of potential excavation waste to arise from the site during redevelopment to:

- Classify the excavation waste to arise as either hazardous or non-hazardous.
- Identify the most sustainable options for the wastes to arise in accordance with the waste hierarchy.
- Provide a written description of the waste required as part of the Duty of Care.
- Provide details of “hazardous properties” to complete hazardous waste consignment note (where applicable).
- Be able to provide a basic classification report to a landfill operator (where waste is destined for landfill disposal).

9.2 Waste Classification Procedure

As described in the ‘Waste Duty of Care Code of Practice (2016)’ any substance or object that the holder discards, intends to discard or is required to discard is a waste. It is the responsibility of the waste producer to classify this waste. The classification process is described in the ‘Guidance on the classification and assessment of waste’ WM3 and aims to determine whether the waste is Hazardous or Non-Hazardous to human health and the environment.

Hazardous wastes are signified by entries where the code is followed by an asterisk, where some wastes are deemed hazardous without further assessment, which are termed “Absolute Entries” e.g. most waste oils. Alternatively, waste entries are termed “Mirror” entries that require further assessment of hazardous properties, in order to determine whether they are hazardous waste or not (e.g. soil and stones). The EWC codes relevant to excavation wastes are:

- 17 05 03* - soil and stones containing dangerous substances.
- 17 05 04 – soil and stones other than those mentioned in 17 05 03.

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste, Decision 2003/33/EC and Landfill Regulations 2005) led to the establishment of a methodology for classifying wastes.

Wastes first need to be classified based on their total concentrations and classified as either hazardous or non-hazardous waste. WAC testing is only required if the end disposal route is a landfill and WAC analysis must not be used for waste classification.

Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. A waste must comply with the WAC limits for the relevant landfill, otherwise the soil will need to be pre-treated. There are three different WAC criteria, these are:

- Inert waste.
- Stable Non-Reactive Hazardous Waste (SNRHW).
- Hazardous waste.

There are no standard set of WAC limits for non-hazardous landfill sites and each non-hazardous landfill will have its own set of criteria under which it is licenced to accept non-hazardous waste. These will need to be determined through the selected waste receiver prior to disposal.

A non-hazardous waste should not be compared with WAC limits for hazardous or SNRHW waste sites and the WAC test should only be used to determine if the waste is suitable for disposal at an inert waste landfill site. Likewise, wastes classified as hazardous based on their total concentrations should not be compared with WAC limits for inert waste landfill sites, as these will not be accepted.

Details of how material should be classified for waste disposal are presented in the BSL Methodology and Guidance in Appendix A and are summarised in the table below:

Classification based on Total Concentrations ¹	PRIOR TO LEAVING SITE			
	Non-Hazardous Waste		Hazardous Waste	
	IF SOILS CANNOT BE RE-USED ELSEWHERE AND MUST GO TO LANDFILL			
WAC testing	Below inert WAC limit values	Above inert WAC limit values	Below hazardous WAC limit values ⁴	> WAC limit values
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

Individual sites may have certain limit values pre-determined in their licence.

After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Possibility that wastes could be classified as stable Nonreactive HAZARDOUS waste in non-hazardous Landfill (e.g. soils containing low concentrations of asbestos, gypsum or sulphate bearing soils).

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC.

Soils above hazardous WAC limit values require pre-treatment prior to disposal. The effective pre-treatment, typically involving separation, sorting and screening, can offer cost savings through reducing the hazardous nature and volumes of soil. Costs for disposal of non-hazardous/hazardous soils are significant compared to the disposal of inert material.

Inert Waste

The possibility of automatic inert classification of the naturally occurring “clean” soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing. This is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other classes of landfill.

9.3 Waste Classification and Waste Acceptance Criteria (WAC)

We have reviewed the testing results and assessed them through a waste classification database which allows users to code and classify waste as defined in the EWC (European Waste Catalogue) based on EC Regulation 1272/2008 on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste - Technical Guidance”).

6 samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3 using the HazWasteOnline tool.

The Waste Classification Report and WAC testing results are presented in Appendix F. The results of the waste assessment based on total concentrations are presented in the table below, alongside the WAC analysis test results.

Location	Depth (m)	Stratum	Waste Classification	WAC Analysis	Landfill	Comments
WS01	0.40 – 0.50	MADE GROUND	Non-hazardous	-	-	-
WS02	0.20 – 0.40	MADE GROUND	Non-hazardous	-	-	-
WS02	0.50 – 0.70	MADE GROUND	Hazardous	Exceeds Inert WAC	HAZARDOUS landfill	HP7, HP11 TOC, Mineral Oil, PAH & pH all exceed inert levels.
WS03	0.40 – 0.60	MADE GROUND	Non-hazardous	-	-	-
WS07	0.20 – 0.40	MADE GROUND	Non-hazardous	Inert	INERT landfill	-
WS08	0.30 – 0.60	MADE GROUND	Non-hazardous	-	-	-

Based on the waste classification database assessment, the majority of the made ground soils have been classified as **non-hazardous**. WS02 0.50-0.70m bgl has been classed as hazardous.

Note that further testing of the soils (WAC testing) may be required on the actual arisings in order to satisfactorily categorise the soil for its suitability for disposal to landfill.

9.4 Options Assessment

Following the classification of waste materials, the options available for the waste can be considered in the context of the waste hierarchy as below:

- Onsite re-use (with or without prior treatment) under suitable exceptions/permits.
- Offsite processing for recycling or recovery e.g. screening.
- Offsite disposal (with or without prior treatment) i.e. landfill.

Where feasible, efforts should be made to retain soils for onsite re-use to minimise costs and maximise the sustainability of projects.

Based on the above, the possible options for the generation of waste soils at the site are described in the table below:

Waste Generation Source	Comments
Crush	The crushed concrete is site derived from structures which had not been used for potentially contaminative activities. These should be subject to an asbestos survey and removal of asbestos as required, prior to demolition and crushing of structures. Assuming the above criteria are met, with materials containing no asbestos or ACM, crushed concrete is considered to be inert without testing. Where samples of crushed concrete have been subject to totals testing this is likely to be hazardous due to pH, and where subject to WAC testing, the sulphate and TDS limits are breached, this is to be expected due to the presence of concrete.
Made Ground from site levelling/foundations excavations/services excavations	Samples of made ground from across the site have been classified as non-hazardous and hazardous for off-site disposal purposes, although should be suitable for re-use on site if required under suitable exemptions/permits.

Waste Generation Source	Comments
Natural ground from site levelling/foundations excavations/services excavations	The superficial deposits may be considered suitable for re-use onsite as fill where the criteria of the WFD exception for re-use of naturally occurring soils can be met. Naturally occurring clean materials could also be exported to another site under the direct transfer scenario of the DoWCoP.

General

If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Where it is necessary to dispose material off site it is recommended that materials are segregated and sufficient time is allowed to further classify the actual soil arisings that constitute the waste, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is illegal to dilute and mix soils without a suitable permit.

As a significant proportion of the soils likely to be generated on site are clean it is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

9.5 Re-use of Soils

By definition in law, any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a “waste”) is then placed on another part of the development site (or used on another development site) without an appropriate materials management plan, permit or exemption being in place, by law this material is defined as “illegally deposited waste”.

Landfill tax rules allow HM Revenue & Customs (HMRC) to recover landfill tax on illegally deposited waste on construction sites. This could lead to excessive costs without the correct documentation in place. In addition, a person who makes, knowingly causes or knowingly facilitates a disposal to be made at an unauthorised site is also liable to pay Landfill Tax.

In order to comply with UK legislation and avoid excessive costs, if the re-use of soils is proposed on site, this should be done in accordance with the relevant exemptions or permits in place.

Soils Re-use Under DoWCoP

One of the main industry mechanisms for allowing the re-use of soils in construction is the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP) also known as a Materials Management Plan (MMP). Further guidance is provided in the BSL Methodology and Guidance in Appendix A.

To implement the DoWCoP (for Route A), there is a requirement to notify the Environment Agency and Local Authority of the intention to use the code of practice in principal, after which there is a 21-day notice period for their response.

In order to re-use soils under the DoWCoP, there are four key criteria that need to be met:

- The aims and objectives of the project meet the requirements of the Waste Framework Directive (does not harm human health or the environment).
- The soils can be demonstrated to be suitable for use (backed up by chemical/geotechnical testing and assessment).
- There is certainty of use (planning consents are in place alongside materials tracking, which should be in place as part of good site practice in any case).

- Quantity (the quantity of materials used should be known).

Information on existing site levels, proposed levels, volumes generated (e.g. foundation / drainage excavation arisings) would need to be known in order to complete the MMP.

If the DoWCoP is the chosen route, the MMP should be in place and declared by a Qualified Persons (QP) before works commence, otherwise excavated soils could constitute an illegal deposit of waste and enforcement action could be taken by the EA and HMRC.

The declared MMP should be amended as new import sources are added.

Once the project is complete, a verification report detailing soils re-use/import will need to be produced and submitted to CL:AIRE, which may be subject to a random audit process. Sites found to be non-compliant with the CoP can be referred to the EA for further investigation.

Regardless of implementing re-use under the code of practice or not, all sites should have some form of materials tracking in place in compliance with current legislation. Any re-use scheme should also be designed to minimise disposal costs.

Re-use of soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CAR-SOIL™) and CAR 2012.

In terms of the re-use of brick/concrete crush materials, the DoWCoP does cover aggregates, but only on the site of origin, and the EA WRAP aggregate Quality Protocol might best apply to ensure quality standards, which are discussed further below.

Soils Re-use under Exemptions and Permits

Suitable options to allow the re-use and/or import of soils and aggregates on site are provided in the table below:

Re-use Mechanism	Description
U1 Exemption	Can be applied to re-use/import of soils and stones, but only up to 1000 tonnes or for brick and concrete up to 5000 tonnes. This is usually an efficient way to re-use small volumes of waste materials. However, only one U1 can be filled in per site in any 3-year period. Quick and free via online registration.
WRAP Quality Protocols	Describes how processed demolition arisings can be removed from regulatory waste regime. Requires a demonstration of appropriateness by: Factory Production Control Manual. Facility Permit (or Exemption). Grading Analysis.
Waste Framework Directive (WFD) exclusion	In regard to "clean" naturally occurring soils only that are to be re-used on their site of origin, these are covered by a Waste Framework Directive (WFD) exclusion which is an EA regulatory position statement. So long as the project can prove the four criteria listed above for the DoWCoP, then permits or the DoWCoP are not required. However, many projects still use the CoP to ensure compliance.

Re-use Mechanism	Description
T5 Screening and blending of waste	The T5 exemption allows you to temporarily treat waste on a small scale to produce aggregate or soil at a particular location, such as a construction or demolition site. The limit is 5,000 tonnes. This applies to: Screening soil on a demolition site to remove wood and rubble. Blending soil and compost that has been produced under an exemption on a construction site to produce better soil for landscaping on that site (e.g. peaty deposits). Crushing waste (except bricks, tiles and concrete) before screening or blending Grading waste concrete after it has been crushed to produce a certain type of aggregate.
T7 Exemption	The T7 allows treatment of waste bricks, tiles and concrete by crushing, grinding or reducing in size. This needs to be registered with the Local Authority.
Other Permitting Routes	Other options include use under an Environmental Permit (Standard or Bespoke Rules), however these may be a time consuming and costly route, where use of the other above options (if applicable) are likely to be more feasible in construction.

10.0 CONCLUSIONS

10.1 Geo-Environmental

Geo-Environmental – Human Health

Testing of the made ground at the site did not reveal any exceedances of heavy metals, petroleum hydrocarbons, BTEX or MTBE compounds. No asbestos was identified in any of the six samples tested.

An exceedance in PAHs has been identified in one sample of made ground (WS08 at 0.30m-0.60m bgl).

The above is considered to pose a risk to human health and remedial measures are required in the form of a cover system (300mm) in soft landscaping areas in the north corner of the site to mitigate the risk.

Ground gas monitoring has revealed a maximum peak carbon dioxide concentration of 9.0%v/v. Based on the gas monitoring the site is provisionally classified as Characteristic Situation 2 and ground gas protection measures are required, subject to ongoing monitoring and assessment.

Geo-Environmental – Controlled Waters

The overall risk to controlled waters is considered to be low and no further action is required.

Waste

Waste classification for the made ground at the site has revealed the majority of the soils to be non-hazardous. However, one of the samples tested (WS02 at 0.50-0.70m bgl) has been classified as hazardous.

10.2 Geotechnical

Foundations

The most suitable foundations for the proposed Lidl store are likely to be strip foundations placed within the natural gravelly sand strata at depths ranging between circa 0.70m and 1.20m bgl given the depth of made ground encountered within the proposed store's footprint.

At this depth, an allowable bearing capacity not exceeding 275kN/m² should be assumed for the gravelly sand. This adopts a factor of safety of 3 which should limit settlements to within acceptable limits.

Floor slabs

Ground bearing floor slabs may be adopted.

Concrete classification

DS-1 AC-1 conditions prevail in both made ground and natural soils.

Highways

Based on the test results equilibrium CBR values of 2.1-24.5% are likely to be achieved in the granular made ground soils underlying the existing hardstanding surfacing.

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 5% are likely to be achieved in undisturbed natural granular soils, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Cohesive soils are unlikely to be encountered at formation depths.

Drainage (SUDS)

Based on the rates obtained in the borehole falling head tests, SUDS are potentially suitable at the site. We recommend the design of infiltration drainage is carried out in accordance with BRE 365 and CIRIA

C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

10.3 Further Work

The following further work is considered necessary to progress the site to construction phase:

-
- Completion of ground gas monitoring programme.
 - Issue gas assessment / update gas assessment within this report.
 - Demolition Asbestos survey.
 - Tree survey by qualified arboriculturist.
 - Detailed foundation design by a structural engineer.
 - Design of Remedial Strategy and confirmation with the Local Authority.
 - Implementation of the Remedial Strategy and verification of the remedial works.
-

11.0 ABBREVIATIONS AND DEFINITIONS

GLOSSARY	
Term / Abbreviation	Definition
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater or ground gas.
Controlled Waters	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.

GLOSSARY	
Term / Abbreviation	Definition
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
pH	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).

GLOSSARY	
Term / Abbreviation	Definition
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	Definition
°	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m ²)
KN/m ² /mm	Kilo Newton per metered squared per millimeter
kN/m ²	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m ²)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M ² /MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
µg/l	Micrograms per Litre (parts per billion)
µm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m ³	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million

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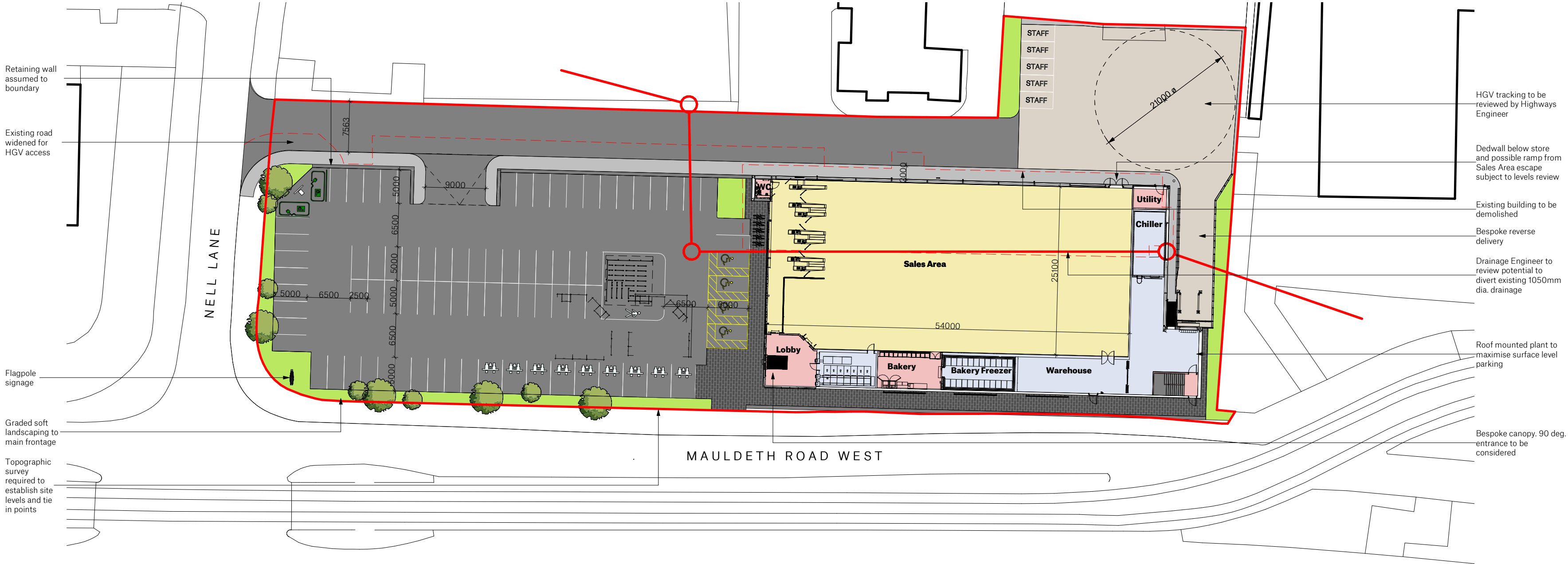
UKTAG-WFD. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. 2014.-

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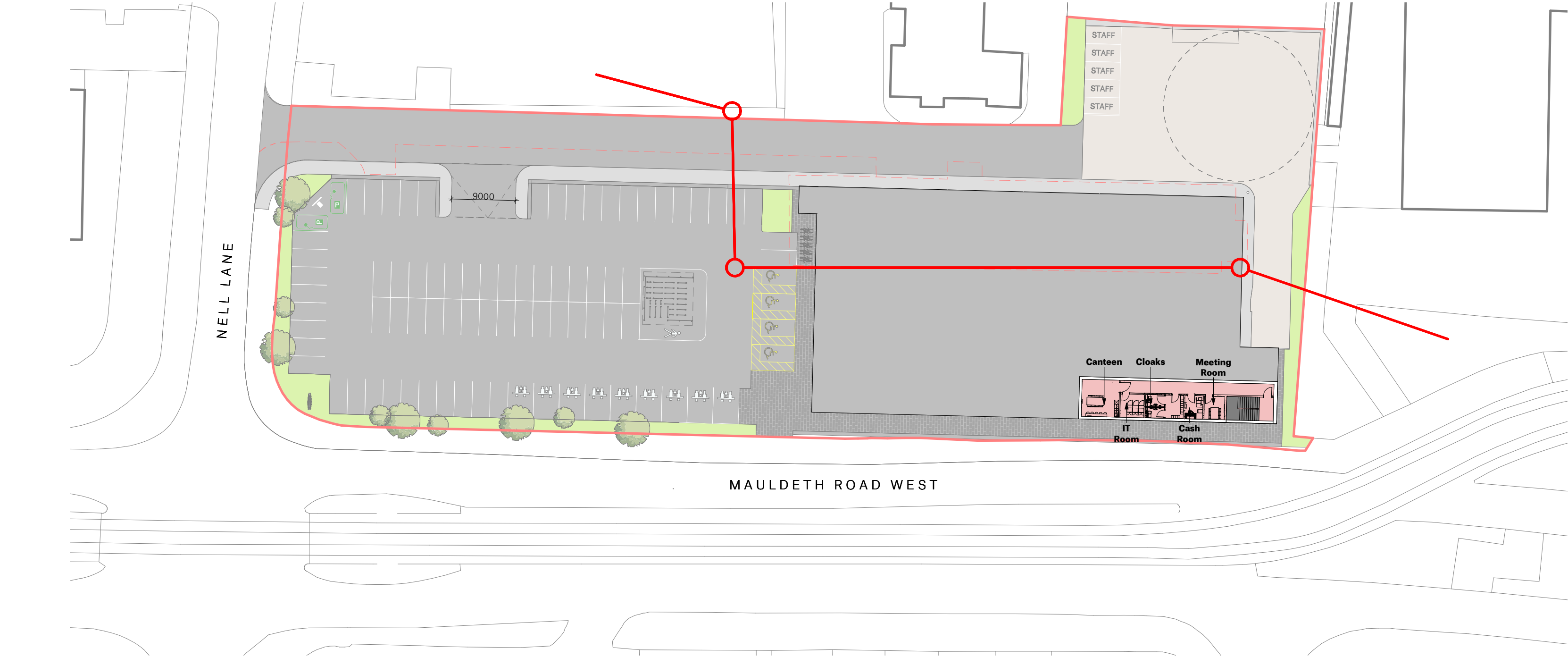
DRAWINGS



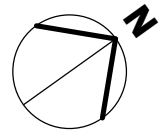
Proposed Ground Floor Site Plan
1:500

OVERALL		
— SITE AREA (Approx.):		6893 m ²
BUILDING AREAS - LIDL		
— Ancillary Area		154 m ²
— Sales Area		1343 m ²
— Warehouse Area		379 m ²
GROSS INTERNAL AREA (TOTAL)		1876 m ²
FIRST FLOOR		
Ancillary		140m ²
PARKING - LIDL		
Disabled		4
Electric Vehicle Charging		2
Parent & Child		9
Staff		5
Standard		68
TOTAL		88
Short Stay Bicycles		10

■ Tarmac (Vehicles)	■ Tarmac (Pedestrians)
■ Block paving, stretcher bond	■ Concrete cast in-situ
■ Soft landscaping	■ Tactile paving



Proposed First Floor Plan
1:500



Store Specification
Bespoke BBS 2021 Store

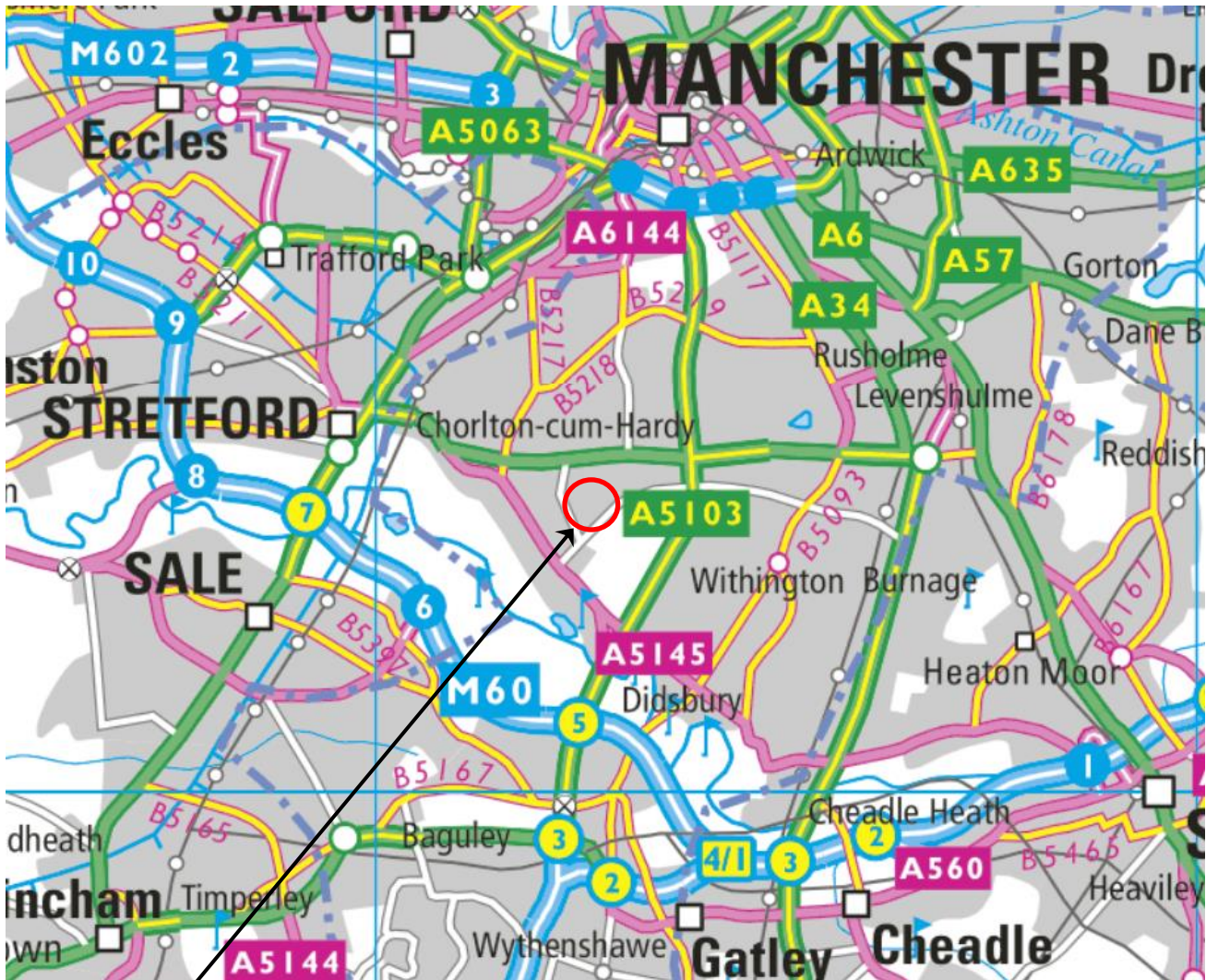
Drawing Purpose
FEASIBILITY

This drawing has been prepared for the sole purpose of forming part of a feasibility study, and should not be used for any other purpose.

SPACE

Spaceworks, Benton Park Road, Newcastle upon Tyne, NE7 7LX
T: +44 (0)844 800 6660
www.spacearchitects.co.uk

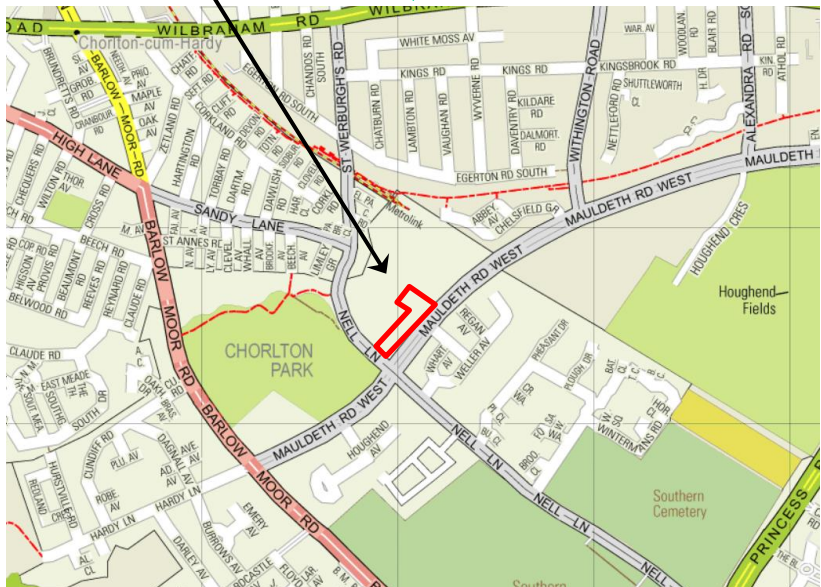
Project Lowry House - Mauldeth Road West				
Drawing Title Proposed Site Plan - Option 2				
Project No. 08474	Drawing No. XX-XX-DR-A-91002	Status S3	Rev. P04	Scale at A2 1:500
File Reference: 08474-SPACE-XX-XX-DR-A-91002-S3-P04				



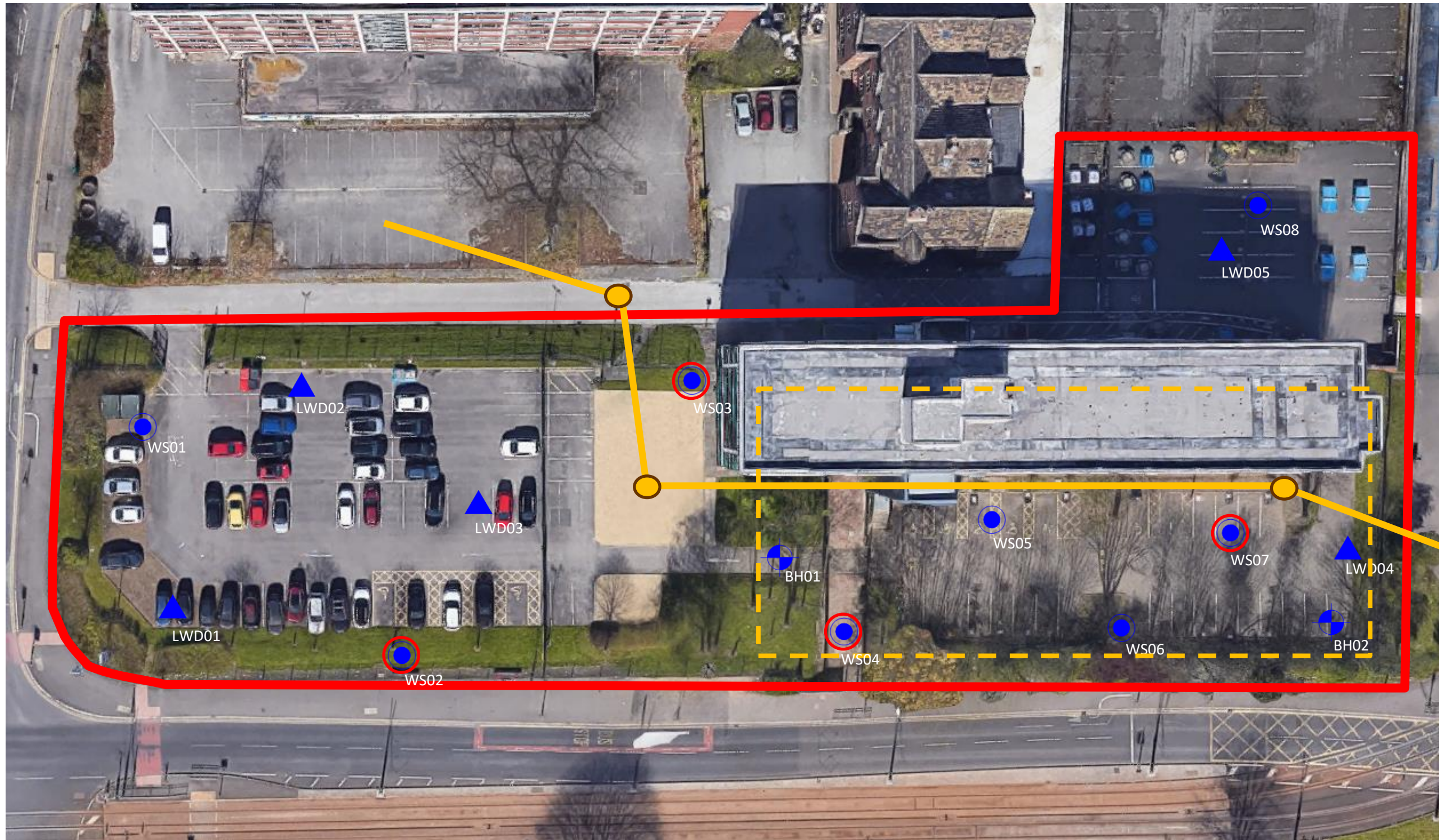
SITE LOCATION

NEAREST POSTCODE: M21 7AA

SITE ENTRANCE WHAT3WORDS:
///REAR.LEGEND.ROPES



REV	DATE	DESCRIPTION	BY	CKD
 BROWNFIELD SOLUTIONS LTD GEO ENVIRONMENTAL ENGINEERING EXCELLENCE				
CLIENT				
LIDL GB LTD				
PROJECT TITLE				
LOWRY HOUSE, CHORLTON				
DRAWING TITLE				
SITE LOCATION PLAN				
DRAWING No.	REVISION	SCALE	DATE	
C5061/01	-	NTS	04/04/22	
DRAWN BY		CHECKED BY		
SD		JEM		



KEY

- APPROXIMATE SITE BOUNDARY
- WINDOW SAMPLE BOREHOLE
BHXX
- CABLE PERCUSSIVE BOREHOLE
WSXX
- BOREHOLE INSTALLATION
- LIGHTWEIGHT DEFLECTOMETER TEST
LWDXX
- APPROXIMATE SEWER LOCATION
- APPROXIMATE MANHOLE LOCATION
- APPROXIMATE PROPOSED STORE FOOTPRINT

REV	DATE	DESCRIPTION	BY	CKD



CLIENT			
LIDL GB LTD			
PROJECT TITLE			
LOWRY HOUSE, CHORLTON			
DRAWING TITLE			
PROPOSED EXPLORATORY HOLEPLAN			
DRAWING No.	REVISION	SCALE	DATE
C5061/02	-	NTS	16/06/22
DRAWN BY		CHECKED BY	
MS		AJS	

APPENDIX A

BSL Methodology and Guidance

BSL Phase I & II Geo-Environmental Assessment Reports - Methodology and Guidance

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report.

Phase I reports are written in general accordance with the description of a Preliminary Investigation as defined in BS10175:2011+A2:2017 and are also produced in general accordance with the recommendations for a Tier 1 Preliminary Risk Assessment as described in LCRM guidance

The first stage of the investigation and assessment of a site is the Preliminary Investigation/Tier 1 Preliminary Risk Assessment, often referred to as a Phase 1 Desk Study, comprising a desk study and walk-over survey and collation of desk-based searches, which culminates in the Preliminary Risk Assessment and the development of a preliminary/initial Conceptual Site Model (CSM). From this are identified any potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them.

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment as part of Phase II investigations and reports.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Contaminated Land - Legislative Background

Land contamination can be addressed in several ways, e.g. during planning, under Part 2A, following an incident, during an investigation into environmental damages, or during the application of an environmental permit, or its surrender.

For the planning process the key test is **as a minimum the site cannot be determined as contaminated land**, e.g. there is not significant harm, significant possibility of significant harm to human health or that there is not significant harm to, or the significant possibility that the pollution of controlled waters will occur.

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act.
- The Contaminated Land Statutory Guidance, DEFRA – April 2012.
- The Contaminated Land (England) Regulations 2006.
- The Contaminated Land (England) Amendment Regulations 2012.
- Water Resources Act.
- Water Framework Directive.
- Environmental Damage Regulations.
- Environment Agency (EA) - Land Contamination Risk Management (LCRM) 2019.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused.
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

Source - substances that are potential contaminants or pollutants that may cause harm.

Pathway - a potential route by which contaminants can move from the source to the receptor , and the impact of that migration on the source e.g. ;attenuation.

Receptor - a receptor that may be harmed, for example the water environment, humans and water, considering the sensitivity of the receptor

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the S-P-R approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below, however the list is not exhaustive:

- DETR: Circular 02/2000: Environmental Protection Act 1990: Part IIA: Contaminated land. 2012.
 - Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
 - BS 10175:2011+A2:2017.
 - Environment Agency (EA) - Land Contamination Risk Management (LCRM). 2019.
-

- Groundwater Protection - <https://www.gov.uk/government/collections/groundwater-protection>.
- UK Technical Advisory Group (UKTAG) - - Water Framework Directive
- Incidents and their classification: the Common Incident Classification Scheme (CICS) – Used by the Environment Agency to classify pollution incidents.

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
- The Environment Protection Act (1990).
- The Water Resources Act (1991).
- The Environment Act (1995).
- The Contaminated Land (England) Act (2000).
- The Pollution Prevention and Control (England and Wales) Regulations (2000).
- The Landfill Regulations (England and Wales) Regulations (2002).
- The Landfill (England and Wales) (Amendment) Regulations (2004).
- Contaminated Land (England) Regulations (2012).
- The Environmental Damage (Prevention and Remediation) Regulations (2009).
- Environmental Permitting Regulations (England and Wales) Regulations (2010).
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- Health and Safety at Work Act.
- National Planning Policy Framework (NPPF)(2021).

Contaminated Land Risk Assessment Approach

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification ➡ Hazard Assessment ➡ Risk Estimation ➡ Risk Evaluation.

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under LCRM, three tiers of risk assessment exist – Stage/Tier Preliminary Risk Assessment, Stage 2 Generic Quantitative and Stage 3 Detailed Quantitative.

Further information can be found at the below site:

<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme

(CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report if applied.

The likelihood of a given receptor being impacted is related to a number of factors, e.g. the geology which could inhibit contaminant migration. For example, a site with a significant thickness of clay between it and a receptor may reduce migration of contamination via the subsurface, which will reduce the likelihood of a given receptor being impacted. The geology or drainage for example could offer a preferential pathway e.g. mines shafts/faults increasing the likelihood and potential magnitude of an impact. The depth of contamination will also affect the exposure pathway, for example petroleum hydrocarbons at depth are unlikely to reach a receptor via dermal contact but could via vapour pathways which will influence the likelihood of an impact being felt e.g. if there are no buildings on site.

The terms and definitions used for the assessment of the likelihood are provided below:

High likelihood: There is a pollution linkage and an event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.

Examples - Extensive areas with concentrations above saturation limits for mobile contamination e.g. petroleum hydrocarbons within the water table.

Likely: There is a pollution linkage and all the elements are present and in the right place, which means it is probable that an event will occur. Circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term.

Examples – Localised areas of contaminants with concentrations above saturation limits for mobile contamination e.g. localised petroleum hydrocarbons within the water table; shallow contamination above relevant human health generic assessment criteria is present with little or no hardstanding,

Low likelihood: There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain even over a longer period such event would take place, and is less likely in the short term.

Examples - A thickness/distance of low permeability deposits preventing contaminant migration to a receptor is present; a site is mostly covered hard standing preventing exposure to soil contamination.

Unlikely: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

Examples – A site is underlain by a substantial thickness of low permeability clays, between the source and potential receptors which will inhibit significantly, but not completely rule out migration to sensitive receptors.

The severity is also classified using a system based on CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report, if applied. The terms and definitions are:

Severe: Short term (acute) risk to human health likely to result in ‘significant harm’ as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);

Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse.

Medium: Chronic damage to human health (‘significant harm’ as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);

Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve.

Mild: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment.

Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.

Minor: harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low
	No Linkage	Negligible			

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

Very high: 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 is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required.

High: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term.

Moderate: 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 would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.

Low: It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.

Very Low: There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled 'no linkage' in the summary table, which give rise to a **negligible** risk category and no further action is required.

Ground Gas Risk Assessment Guidance

BS8485:2015+A1:2019, BS 8576:2013, CIRIA C665 and CL:AIRE RB17 are the current guidance which gives up-to-date advice on all aspects of ground gas. They outline good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to ground gas contamination.

Within BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665, two semi-quantitative methods are set out for the assessment of risk:

- 1 For low rise housing with a ventilated under floor void at minimum 150 mm (Boyle and Witherington).
- 2 For all other development types (Wilson and Card).

Both methods use the concept of Gas Screening Values (GSVs) to identify levels of risk. The mitigation and management of potentially unacceptable risk is described with reference to both passive and active systems of gas. Source removal is also discussed as an option. A separate approach is discussed under the RB17 header further below.

The aim of the guidance is for a consistent approach to decision making, particularly relating to the scope of protective design measures on a site-specific basis.

Legislative Framework

BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665 provides technical guidance, however they also recognise the context into which the guidance has to be employed. Government policy is based upon a “suitable for use approach”, which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the “source” in a “pollutant linkage” which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be “contaminated land” under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land*.

Generation Potential of Sources

BS 8576:2013 Figure 6 provides a basis for assessing the generation potential from sources identified as part of the Phase I Assessment. These are summarised below:

Generation Potential	Typical Sources
Very Low	- Natural carbonate soil and strata, e.g. chalk and limestone. - Natural soil strata with a low degradable organic content, e.g. alluvium, peat. - In-filled pond less than 15 m diameter, in-filled before 1930s to 1940s. - Made ground with low degradable organic content (e.g. up to 5% organic material such as pieces of wood, pieces of paper, rags, etc. with a high proportion of ash and no food or other easily degradable waste). - Mine workings shallow or shaft (where there is clear evidence that they are flooded). - Inert landfill sites.
Low	- Natural soil strata with a high degradable organic content (DOC). - Made ground with total organic carbon (TOC) up to 6% (e.g. dock silt, no food or other easily degradable waste). - Foundry sand (includes phenolic binders, rags and wood that decay, albeit at low rates). - Landfill 1945 to mid 1960s (see also Moderate below).
Moderate	- Sewage sludge. - Mine workings – unflooded, more than 50 years since last worked (gas is liberated from coal when mine workings are excavated; this continues for up to about 50 years). - Landfill 1945 to mid 1960s (this could also be “low” or, if disturbed, “high”).

Generation Potential	Typical Sources
High	- Landfill mid 1960s to early 1990s. - Mine workings – unflooded – less than 50 years since last worked.
Very High	- Municipal landfill sites. - Landfill early 1990s onward.

Frequency and Duration of Monitoring

The monitoring period for a specific site covers the “worst case” scenario. A “worst case” scenario will typically occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of the additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with soil gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection. CL:AIRE publication TB17 “Ground Gas Monitoring and ‘Worst-Case’ Conditions” provides further guidance.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

Typical/idealised periods of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (Apartments)	2 months	3 months	6 months	12 months	24 months
	High (Low rise Residential)	3 months	6 months	6 months	12 months	24 months

Typical/idealised frequency of monitoring/Number of Visits Required

		Gas Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4	6	6	12	12
	Moderate (Apartments)	6	6	9	12	24
	High (Low rise Residential)	6	9	12	24	24

Note

- NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).
- Generation potential of sources based on descriptions within BS 8576:2013.
- At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

It is recommended that newly installed monitoring wells are left for 24 hours to allow the soil gas to reach equilibrium. It should be recognised, however, that some soil gas regimes could take considerably longer (up to seven days). Interpretation of any initial readings should take this equilibrium process into account.

RB17 Approach

CL:AIRE RB17 (Card et al 2012) is a pragmatic approach to ground gas risk assessment and was developed because gas concentration, pressure and flow rate measured in a well headspace may not be representative of the conditions in the surrounding formation.

In these low-risk situations, the approach is to use the conceptual site model and the estimation of the likely gas generation from a source to identify where or if gas monitoring is required to better define the risks.

Under this approach, for sites with natural soils only with no credible methane source, then no action is required (no monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1).

Unexploded Ordnance (UXO) Guidance

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA report C681.

BSL carry out non-specialist UXO screening exercises by considering any evidence of UK defence activities on or near the site evident from gathered desk study information and the unexploded aerial delivered bomb (UXB) online risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available online Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experienced and considered competent in the assessment of UXO.

Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

General

The current recommended method for assessing contamination is on the basis of:

Source-Pathway-Receptor

Where any one of these “pollution linkages” is absent there is deemed to be no risk.

Fundamentally, receptors can be considered as humans (human health) and controlled waters (surface and ground waters).

The purpose of using generic Tier 1 screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

Human Health

Current UK guidance is provided by DEFRA and the Environment Agency (EA). Publications forming part of the guidance include the CLEA Model and toxicological reports collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions over time. Tier 1 generic S4UL values have been published using the CLEA 1.06 Model by CIEH/LQM. These are the third set of generic assessment criteria generated by CIEH and replace the previous two sets of GACs (Generic Assessment Criteria). The revised S4UL values are based on greater knowledge of relevant toxicology and further consideration of exposure frequencies.

C4SL values for six determinands including lead was published by DEFRA/CL:AIRE in December 2014 and they represent a low risk as opposed to minimal risk. These screening values were published by DEFRA for Part 2A use, although with the dual purpose for use under planning. However, S4ULs remain the first reference due to the broader range of end uses and soil organic content.

The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances the following data sources are used in the order of preference given below:

- CIEH S4UL values (derived by CIEH/LQM).
- DEFRA/CL:AIRE C4SL's.
- CL:AIRE GAC values.
- Guidance from other European countries.
- Guidance from the outside Europe.

Controlled Waters

The European Water Framework Directive (WFD) became UK law in December 2003. It was created to ensure that European countries manage their rivers, groundwater and lakes so that they stay healthy for people and for wildlife.

This is achieved by the use of chemical standards for surface waters and groundwater. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental regimes, and for different protection objectives.

Statutory Standards are set in legislation and if exceeded, this constitutes non-compliance with statutory obligations. European Directives are implemented in England and Wales by corresponding statutory instruments (i.e. regulations). The statutory instruments can be the exact same standards as they appear in the Directive or be more stringent.

A number of non-statutory standards also exist, these are set by various organisations (including the EA) for chemicals that are considered to be of concern, but are not covered by any specific legislation.

The chemical standards used in the UK to control impaction of contamination on controlled waters are Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.

Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

Further Assessment

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further additional detailed investigation, including the deriving of site-specific values to better define the risk, and to design appropriate remedial measures.

Re-Use Of Waste - Guidance Note

Definition of Waste

The Environment Agency considers waste to be “...any material that is discarded, or intended to be discarded...” This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

CL:AIRE: Code of Practice

Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP), also commonly referred to as a “Materials Management Plan”.

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

- 1) Protection of human health and protection of the environment.
- 2) Suitability of use, without further treatment.
- 3) Certainty of use.
- 4) Quantity of material.

In order to satisfy these requirements the following are required:

- i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
- ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
- iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
- iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
- v) Volume calculations.
- vi) Planning permission for the development.
- vii) Contractual details to be clear, regarding who steps in if a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.

Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use. Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

Waste Classification for Soils

Introduction

Waste producers have a duty of care to classify the waste they are producing:

- Before it is collected, disposed of or recovered.
- To identify the controls that apply to the movement of the waste.
- To complete waste documents and records.
- To identify suitably authorised waste management options.
- To prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

Background for Landfill Disposal

In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points:

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept hazardous, non-hazardous or inert wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

Classification

Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

17 05	soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 03*	soil and stones containing dangerous substances
17 05 04	soil and stones other than those mentioned in 17 05 03

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific “hazardous properties” which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

Waste Definitions

Inert	- Will not undergo any significant physical, chemical or biological transformations. - Will not dissolve. - Will not burn. - Will not physically or chemically react. - Will not biodegrade. - Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. - Has insignificant total leachability and pollutant content. - Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).
Non-Hazardous	Is not inert (see above) Is not hazardous (see below)
Hazardous	Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance)
Stable Non-reactive hazardous waste#	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas).

This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

WAC Testing

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the WAC is not relevant. Furthermore, the WAC limits **cannot** be used to make an assessment of whether a waste is hazardous. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

Classification based on Total Concentrations ¹	Non-Hazardous Waste		Hazardous Waste	
	Below inert WAC limit values:	Above inert WAC limit values:	Below hazardous WAC limit values	Above hazardous WAC limit values
WAC testing				
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

2 Individual sites may have certain limit values pre-determined in their licence.

3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Hydrocarbons in Soils

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However, hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

Known Oils

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

Unknown Oils

Where hydrocarbons are contaminating soils, it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

For contaminated land specific consideration must be given to the following before proceeding;

- The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
- The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of marker compounds is optional; however, it is recommended that where possible the marker compounds should be used. WM3 states:

If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:

- The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
- This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
- The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

TPH Concentration (mg/kg)	Petrol or Diesel	BaP (mg/kg)	Classification
10,000	No	0.9	Non- Hazardous
1,000	No	Not available	Hazardous
1,000	Yes	Not relevant	Hazardous

References

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

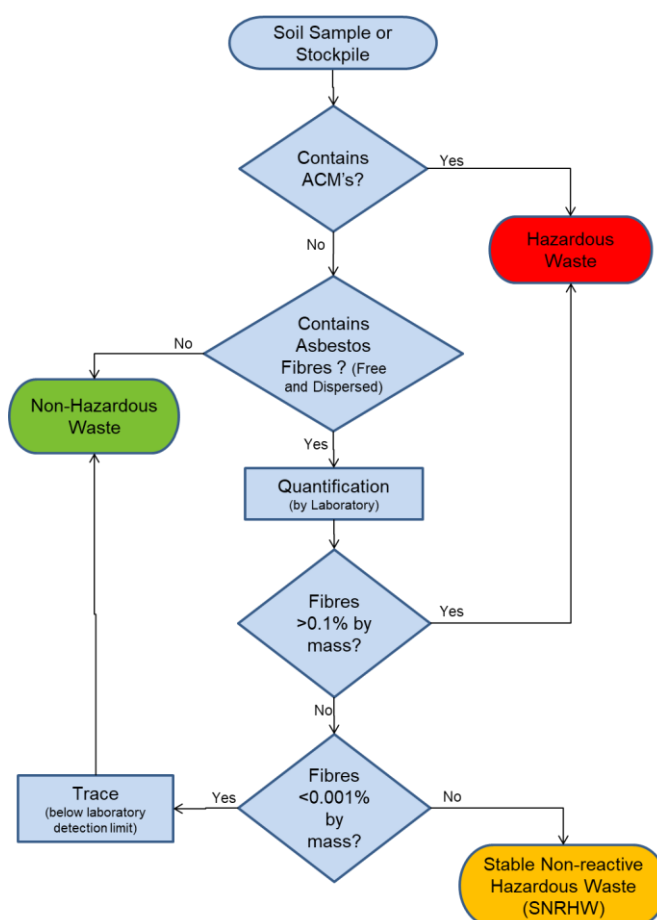
Additional Asbestos Guidance Notes

Disposal

The 1st Edition of WM3 "Guidance on the classification and assessment of waste", details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)



Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.

Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site¹. These levels are often termed "trace" by laboratories.

Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)¹. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.

The following codes should be assigned to the asbestos waste as appropriate:

17 06	Insulation materials and asbestos-containing construction materials
17 06 01	Insulation materials containing asbestos
17 06 03	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05	Construction material containing asbestos

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and "*other suitable materials*" may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

Construction

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However, where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However, it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four-hour period. The control limit is not a 'safe' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 "the release of dispersed asbestos fibres from soil" 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m³.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (e.g. by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

End Use

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk. There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However, the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

Asbestos in Soil as Free Fibres

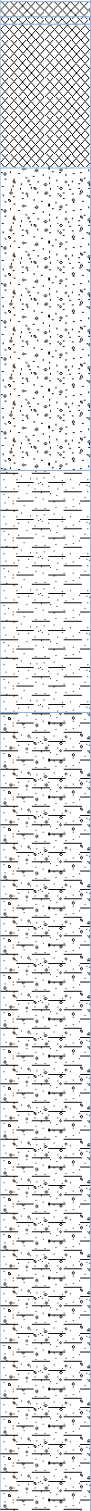
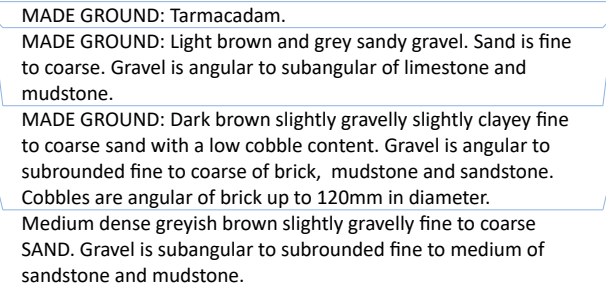
Concentration (by weight)	Waste Disposal				Construction Issues	End Use	
	Recyc	Inert	SNR	Hazardo		Suitable for re-use on site	Precautions
Not detected	√	√			No precautions necessary, however on a brownfield site asbestos not previously identified may be found during works and a statement within the contractors method statement for how they will deal with this unforeseen asbestos would be good practice to ensure compliance with CAR2012.	Yes	None
Trace (<0.001%)		√ ²			Precautions are unlikely to be required, however a detailed method statement may be required to ensure compliance with CAR2012. Basic asbestos management good practice will be required. Typically precautions would include: - Ensuring soils do not dry out to become dusty. - Site personnel have the risk communicated at induction stage.	Yes Soils can be re-used under CL:AIRE CoP with the correct precautions in place.	Generally clean cover or hardstanding cover required.
0.001% – 0.099%			√		Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes.	Possibly Soils may be able to be re-used under CL:AIRE CoP, subject to a satisfactory Risk Assessment and regulatory agreement with the correct precautions in place.	Clean cover or hardstanding cover required.
0.1+%				√	Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Site wide and or perimeter monitoring. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes. - Decontamination unit	Unlikely ³ Re-use of soils containing asbestos within an earthworks scheme will involve significant engineering and the Risk for generating dusts will be significantly increased with	Clean cover and a hard dig layer. A plan should be in place for future excavations as part of the Health and Safety File.

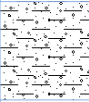
Concentration (by weight)	Waste Disposal				Construction Issues	End Use	
	Recyc	Inert	SNR	Hazardo		Suitable for re-use on site	Precautions
						repeated handling and compaction.	

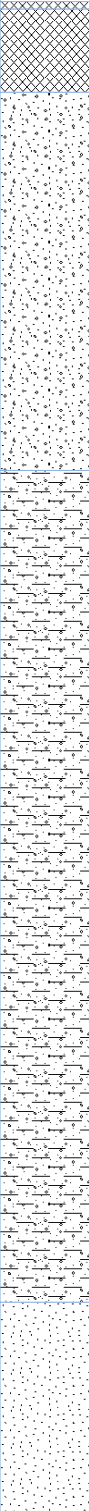
1. The standard laboratory detection limit is normally 0.001%. Below 0.001% is trace and currently regarded as not containing asbestos for the purposes of disposal off site. However the waste producer has a duty to fully classify the waste and the presence of trace asbestos should be declared. Consequently it is unlikely that a waste treatment site will take this soil and an inert landfill may make a commercial decision to only take it under some circumstances.
2. The re-use of soils containing asbestos at concentrations above hazardous waste is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be warranted where there a long program for implementation.

APPENDIX B

Exploratory Hole Logs

Borehole Log							Borehole No.		
							BH01		
							Sheet 1 of 2		
PROJECT NO: C5061							CO-ORDS:		
PROJECT NAME: LOWRY HOUSE, CHORLTON							Hole Type		
							CP		
							Scale		
							1:50		
CLIENT: LIDL GB LTD							DATES: 23/06/22		
							Logged	Checked	
							AN	JMJ	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20-0.40	ES		0.10 0.15			MADE GROUND: Tarmacadam.	
		0.50	D					MADE GROUND: Light brown and grey sandy gravel. Sand is fine to coarse. Gravel is angular to subangular of limestone and mudstone.	
		0.80-1.00	ES					MADE GROUND: Dark brown slightly gravelly slightly clayey fine to coarse sand with a low cobble content. Gravel is angular to subrounded fine to coarse of brick, mudstone and sandstone. Cobbles are angular of brick up to 120mm in diameter.	
		1.00	D		1.10			Medium dense greyish brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.	
		1.20-1.65	D						
		1.20	SPT	N=19 (2,4/4,5,5,5)					
		2.00-2.45	D						
		2.00	SPT	N=22 (4,5/5,5,6,6)					
		3.00-3.45	D		3.10			Stiff brown slightly sandy CLAY. Sand is fine to coarse.	
		3.00	SPT	N=18 (3,4/4,4,5,5)					
		4.20-4.65	U					Stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone.	
		4.70	D		4.70				
		5.30-5.75	D						
		5.30	SPT	N=16 (3,3/4,4,4,4)					
		6.90-7.35	D						
		6.90	SPT	N=16 (3,3/3,4,4,5)					
		8.30	SPT	N=16 (3,4/4,4,4,4)					
		8.50-8.95	D						
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.10m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Borehole No. BH01 Sheet 2 of 2	
PROJECT NO: C5061						CO-ORDS:		Hole Type CP	
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		Scale 1:50	
CLIENT: LIDL GB LTD						DATES: 23/06/22		Logged AN	Checked JMJ
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.20-10.65 10.20	D SPT	N=17 (3,3/4,4,4,5)	10.65			End of Borehole at 10.65m	11.0
									12.0
									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.10m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Borehole No.	
PROJECT NO: C5061		CO-ORDS:		BH02					
				Sheet 1 of 2					
PROJECT NAME: LOWRY HOUSE, CHORLTON		LEVEL:		Hole Type		CP			
						Scale			
CLIENT: LIDL GB LTD		DATES: 24/06/22		1:50		Logged	Checked		
						AN	JMJ		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D		0.05			MADE GROUND: Tarmacadam.	
		0.30	ES					MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of brick, concrete, mudstopne and sandstone.	
		0.80	D		0.60			Dense greyish brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.	
		1.20-1.65	D						
		1.20	SPT	N=31 (3,5/7,7,8,9)					
		2.10-2.55	D						
		2.10	SPT	N=30 (3,5/6,8,8,8)					
		3.10-3.55	D		3.10			Stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone.	
		3.10	SPT	N=25 (3,4/5,6,7,7)					
		4.20-4.65	D						
		4.20	SPT	N=19 (3,5/4,5,5,5)					
		5.50-5.95	U						
		6.00	D						
		7.00-7.45	D						
		7.00	SPT	N=19 (3,4/4,5,5,5)					
		8.60-9.05	D		8.60			Medium dense brown fine to coarse SAND.	
		8.60	SPT	N=20 (3,4/5,5,5,5)					
Remarks									
1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.10m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane		

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Borehole No. BH02 Sheet 2 of 2	
PROJECT NO: C5061						CO-ORDS:		Hole Type CP	
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		Scale 1:50	
CLIENT: LIDL GB LTD						DATES: 24/06/22		Logged AN	Checked JMJ
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.10-10.55	D SPT	N=32 (4,5/7,7,8,10)	10.10			Very stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mudstone.	
		10.10			10.55				
									11.0
									12.0
									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.10m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. LWD01 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged MS Checked JMJ	
PROJECT NO: C5061						CO-ORDS:			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:			
CLIENT: LIDL GB LTD						DATES: 21/06/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.00-0.05	ES		0.10 0.15		MADE GROUND: Block paving. MADE GROUND: Grey very sandy fine to medium gravel. Sand is medium to coarse. Gravel is angular to subangular of limestone, sandstone and glass. End of Trial Pit at 0.15m			
								1.0	
								2.0	
								3.0	
								4.0	
								5.0	
Remarks		1. No groundwater encountered. 2. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. LWD02 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged MS Checked JMJ	
PROJECT NO: C5061						CO-ORDS:			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:			
CLIENT: LIDL GB LTD						DATES: 21/06/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.00-0.05	ES		0.05 0.10		MADE GROUND: Tarmacadam. MADE GROUND: Black and grey sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of quartz, limestone and mudstone. End of Trial Pit at 0.10m			
								1.0	
								2.0	
								3.0	
								4.0	
								5.0	
Remarks		1. No groundwater encountered. 2. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	



No.	
LWD03	
Sheet 1 of 1	
Hole Type	
TP	
Scale	
1:25	
Logged	Checked
MS	JMJ

CO-ORDS:

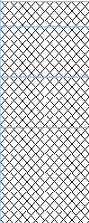
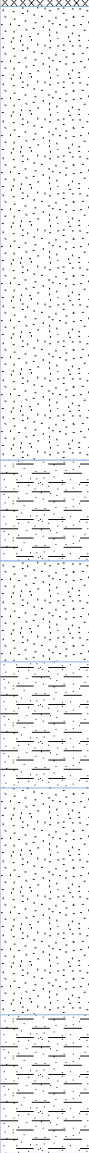
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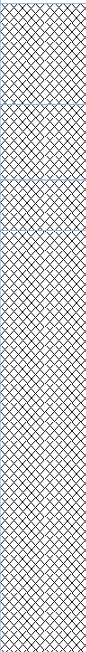
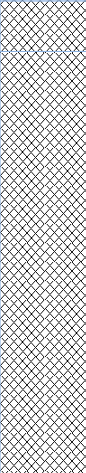
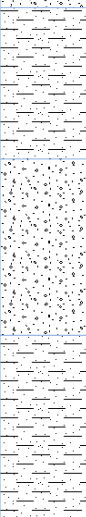
DATES: 21/06/22

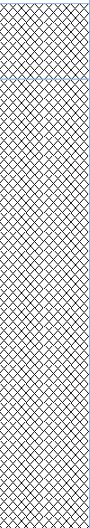
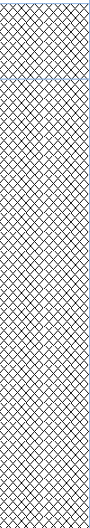
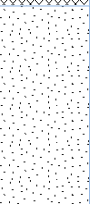
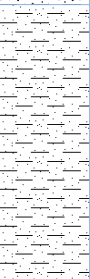
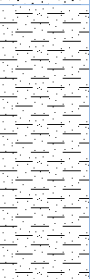
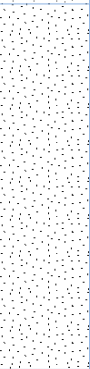
Remarks	1. No groundwater encountered. 2. Hole backfilled with arisings upon completion.	ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane
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 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. LWD04 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged MS Checked JMJ	
PROJECT NO: C5061						CO-ORDS:			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:			
CLIENT: LIDL GB LTD						DATES: 21/06/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.00-0.05	ES		0.05 0.10		MADE GROUND: Tarmacadam. MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of quartrz, limestone and mudstone. End of Trial Pit at 0.10m			
1.0									
2.0									
3.0									
4.0									
5.0									
Remarks		1. No groundwater encountered. 2. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

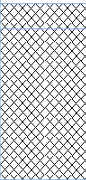
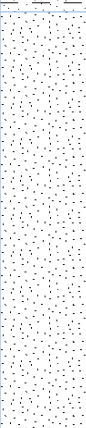
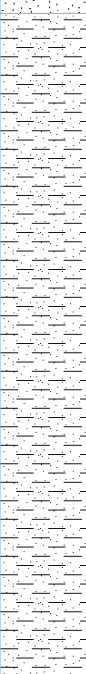
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. LWD05 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged MS Checked JMJ	
PROJECT NO: C5061						CO-ORDS:			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:			
CLIENT: LIDL GB LTD						DATES: 21/06/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.00-0.05	ES		0.07 0.13		MADE GROUND: Tarmacadam. MADE GROUND: Brown and grey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, limestone, concrete and sandstone. Cobbles are angular of brick up to 100mm in diameter. End of Trial Pit at 0.12m			
1.0									
2.0									
3.0									
4.0									
5.0									
Remarks		1. No groundwater encountered. 2. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

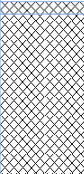
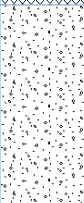
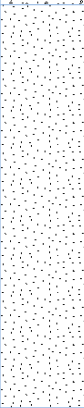
BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.			
								WS01			
								Sheet 1 of 1			
PROJECT NO: C5061						CO-ORDS:		Hole Type			
								WS			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		Scale			
								1:30			
CLIENT: LIDL GB LTD						DATES: 24/06/22		Logged	Checked		
								MS	JMJ		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.20-0.30	ES		0.10			MADE GROUND: Block paving.	1.0		
		0.40-0.50	ES		0.30			MADE GROUND: Grey very sandy fine to medium gravel. Sand is medium to coarse. Gravel is angular to subangular of limestone, sandstone and glass.			
		0.60-0.80	ES		0.50			MADE GROUND: Black gravelly sand. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, mudstone and sandstone.			
		0.95	D		0.90			MADE GROUND: Dark brown slightly clayey gravelly sand. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, mudstone and sandstone.			
		1.20	SPT	N=13 (2,3/3,3,3,4)				Medium dense brown fine to coarse SAND.			
		2.00	SPT	N=14 (2,2/3,3,4,4)					2.0		
		2.70	D		2.70			Firm brown slightly sandy CLAY. Sand is fine to coarse.	3.0		
		3.00	SPT	N=15 (2,2/3,4,4,4)	3.10			Medium dense grey medium to coarse SAND.			
		3.60	D		3.50			Firm brown slightly sandy CLAY. Sand is fine to coarse.		4.0	
		4.00	SPT	N=13 (2,3/3,3,3,4)	4.00			Medium dense grey medium to coarse SAND.			
		5.00	SPT	N=15 (2,3/3,3,4,5)	4.90			Firm brown slightly sandy CLAY. Sand is fine to coarse.	5.0		
					5.45				End of Borehole at 5.45m	6.0	
		Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 2.70m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

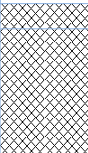
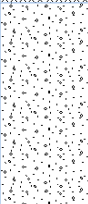
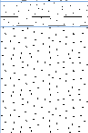
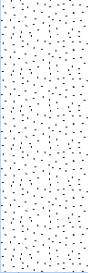
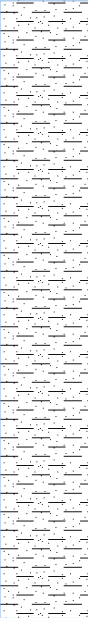
BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.		
PROJECT NO: C5061								WS02		
								Sheet 1 of 1		
PROJECT NAME: LOWRY HOUSE, CHORLTON						CO-ORDS:		Hole Type		
								WS		
CLIENT: LIDL GB LTD						LEVEL:		Scale		
								1:30		
DATES: 24/06/22						Logged		Checked		
						MS		JMJ		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20-0.40	ES					MADE GROUND: Grass over dark brown gravelly fine to medium sand with rootlets. Gravel is subangular to rounded fine to coarse of sandstone and mudstone.		1.0
		0.50-0.70	ES		0.40			MADE GROUND: Dark brown gravelly sand. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, concrete, mudstone and sandstone.		
		0.80	D		0.70			MADE GROUND: Dark brown slightly gravelly slightly clayey fine to coarse sand. Gravel is angular to subrounded fine to coarse of brick, wood, mudstone and sandstone.		
		1.00-1.20	ES		0.90			MADE GROUND: Soft dark brown slightly gravelly slightly sandy clay. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, wood, slate, mudstone and sandstone.		
		1.20	D SPT	N=6 (1,1/1,1,2,2)						2.0
		2.00	SPT	N=10 (3,2/2,2,3,3)						
		2.60			2.60					
		3.00	SPT	N=10 (3,4/4,2,2,2)				Medium dense brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.		
		3.40	D		3.40			Firm brown slightly sandy CLAY. Sand is fine to coarse.		4.0
		4.00	SPT	N=14 (2,3/3,3,4,4)	4.00			Medium dense brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.		
		4.70	D		4.70			Firm brown slightly sandy CLAY. Sand is fine to coarse.		
		5.00	SPT	N=16 (3,3/3,4,4,5)						
						5.45		End of Borehole at 5.45m		6.0
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.40m bgl. 3. Terminated at required depth. 4. Installation down to 2.60m bgl. 0.60m plain, 2.00m slotted.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane		

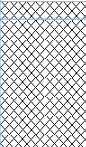
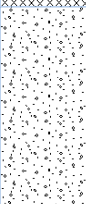
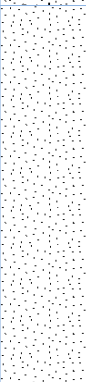
BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.					
								WS03					
								Sheet 1 of 1					
PROJECT NO: C5061						CO-ORDS:		Hole Type					
								WS					
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		Scale					
								1:30					
CLIENT: LIDL GB LTD						DATES: 24/06/22		Logged	Checked				
								MS	JMJ				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description					
		Depth (m)	Type	Results									
		0.10-0.30	ES		0.30			MADE GROUND: Grass over dark brown gravelly fine to medium sand with rootlets. Gravel is subangular to rounded fine to coarse of brick, sandstone and mudstone.	1.0				
		0.40-0.60	ES					MADE GROUND: Dark brown slightly gravelly slightly clayey fine to coarse sand. Gravel is angular to subrounded fine to coarse of brick, clinker, slate, mudstone and sandstone.					
		1.00-1.20	ES										
		1.20	SPT	N=12 (2,2/1,2,4,5)									
		2.00	SPT	N=15 (3,3/4,5,4,2)	2.10				2.0				
		2.10	D					Medium dense brown fine to coarse SAND.					
		2.90	D		2.90				3.0				
		3.00	SPT	N=10 (2,2/2,3,2,3)				Firm brown slightly sandy CLAY. Sand is fine to coarse.					
		3.50	D										
		4.00	SPT	N=11 (2,2/2,3,3,3)									
		5.00	SPT	N=14 (2,3/3,3,4,4)	5.45				5.0				
End of Borehole at 5.45m									6.0				
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 2.90m bgl. 3. Terminated at required depth. 4. Installation down to 2.00m bgl. 1.00m plain, 2.00m slotted.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane					

Borehole Log						Window Sampler No.				
PROJECT NO: C5061						WS04				
						Sheet 1 of 1				
						Hole Type				
						WS				
PROJECT NAME: LOWRY HOUSE, CHORLTON						Scale				
						1:30				
CLIENT: LIDL GB LTD						Logged	Checked			
						MS	MJM			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.10-0.30	ES		0.05			MADE GROUND: Paving slab.		
		0.40-0.60	ES		0.30			MADE GROUND: Light brown gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of limestone and sandstone.		
		0.70	D		0.60			MADE GROUND: Brown gravelly sand. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, mudstone and sandstone.		
		1.20	SPT	N=12 (2,2/2,3,3,4)				Medium dense brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.		
		2.00	D SPT	N=11 (2,2/3,3,2,3)						
		2.90	D		2.90					Firm brown slightly sandy CLAY. Sand is fine to coarse.
		3.00	SPT	N=13 (2,3/3,3,3,4)	3.00					Brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.
		3.30	D		3.20					Firm brown slightly sandy CLAY. Sand is fine to coarse.
		4.00	SPT	N=16 (2,3/4,4,4,4)	4.00			Medium dense brown slightly gravelly medium to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.		
		4.50	D		4.20			Stiff brown slightly sandy CLAY. Sand is fine to coarse.		
		5.00	SPT	N=21 (3,4/4,5,6,6)						
					5.45			End of Borehole at 5.45m		
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 2.90m bgl. 3. Terminated at required depth. 4. Installation down to 4.00m bgl. 1.00m plain, 3.00m slotted.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane		

BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.	
WS05									
Sheet 1 of 1									
PROJECT NO: C5061						CO-ORDS:			
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:			
CLIENT: LIDL GB LTD						DATES: 23/06/22			
								Logged	Checked
								MS	JMJ
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10-0.30	ES		0.10			MADE GROUND: Tarmacadam.	
								MADE GROUND: Brown and grey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, limestone, concrete and sandstone. Cobbles are angular of brick up to 120mm in diameter.	
		0.70-0.80	ES		0.70			Brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.	
		0.80	D		0.80			Firm brown slightly sandy CLAY. Sand is fine to coarse.	
		1.20	SPT	N=10 (1,2/2,2,3,3)	1.10			Medium dense brownish grey medium to coarse SAND.	
		2.00	SPT	N=10 (1,2/2,2,4,2)					
		2.80	D		2.80			Firm brown slightly sandy CLAY. Sand is fine to coarse.	
		3.00	SPT	N=10 (2,2/2,2,3,3)					
		3.50	D						
		4.00	SPT	N=12 (2,3/3,3,3,3)					
5.00	D SPT	N=15 (2,2/2,3,5,5)							
				5.45			End of Borehole at 5.45m		
Remarks								1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 2.80m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.	
								ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.	
WS06									
Sheet 1 of 1									
PROJECT NO: C5061						CO-ORDS:		Hole Type	
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		WS	
								Scale	
								1:30	
CLIENT: LIDL GB LTD						DATES: 23/06/22		Logged	Checked
								MS	JMJ
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.05			0.05			MADE GROUND: Tarmacadam.	
		0.30-0.50	ES					MADE GROUND: Dark brown very gravelly sand with a low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, limestone, concrete and sandstone. Cobbles are angular of brick up to 100mm in diameter.	
		0.70-0.80 0.75	ES D		0.70			Medium desne brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.	
		1.20	SPT	N=13 (2,2/3,3,3,4)					
					1.50			Medium dense brownish grey medium to coarse SAND.	
		2.00	D SPT	N=13 (2,2/3,3,3,4)					
		3.00	SPT	N=10 (2,2/3,2,2,3)					
		3.10	D		3.10			Firm brown slightly sandy CLAY. Sand is fine to coarse.	
		4.00	SPT	N=12 (2,2/3,3,3,3)					
		5.00	SPT	N=21 (3,4/4,5,6,6)				Becoming stiff from 5.00m bgl.	
				5.45		End of Borehole at 5.45m			
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.10m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

BROWNFIELD SOLUTIONS LTD						Borehole Log		Window Sampler No.		
								WS07		
PROJECT NO: C5061						CO-ORDS:		Sheet 1 of 1		
PROJECT NAME: LOWRY HOUSE, CHORLTON						LEVEL:		Hole Type		
								WS		
CLIENT: LIDL GB LTD						DATES: 23/06/22		Scale		
								1:30		
								Logged	Checked	
								MS	JMJ	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20-0.40	ES		0.10			MADE GROUND: Tarmacadam.	1.0	
		0.60-0.80	ES		0.60			MADE GROUND: Greyish brown and orange sand and gravel with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, limestone, sandstone and mudstone. Cobbles are angular of brick up to 100mm in diameter.		
		0.70	D					Medium desne brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.		
		1.20	SPT	N=10 (1,1/2,2,3,3)	1.40			Firm brown slightly sandy CLAY. Sand is fine to coarse.	2.0	
		1.60	D		1.50			Medium dense orangish brown fine to coarse SAND. <i>Becoming grey from 0.70m bgl.</i>		
		2.00	SPT	N=16 (2,3/4,4,4,4)				Firm brown slightly sandy CLAY. Sand is fine to coarse.		
		3.00	D SPT	N=8 (1,1/2,2,2,2)	3.00			Firm brown slightly sandy CLAY. Sand is fine to coarse.	3.0	
		4.00	D SPT	N=12 (2,2/2,3,3,4)						
		5.00	SPT	N=11 (2,2/2,3,3,3)						
					5.45			End of Borehole at 5.45m	5.0	
										6.0
		Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 3.00m bgl. 3. Terminated at required depth. 4. Installation down to 5.00m bgl. 1.00m plain, 4.00m slotted.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane

Borehole Log						Window Sampler No.			
PROJECT NO: C5061						WS08			
						Sheet 1 of 1			
						Hole Type			
PROJECT NAME: LOWRY HOUSE, CHORLTON						WS			
						Scale			
						1:30			
CLIENT: LIDL GB LTD						DATES: 23/06/22			
						Logged	Checked		
						MS	JMJ		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.07			0.07			MADE GROUND: Tarmacadam.	
		0.30-0.60	ES					MADE GROUND: Brown and grey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, limestone, concrete and sandstone. Cobbles are angular of brick up to 120mm in diameter.	
		0.60-0.80	ES		0.60			Medium desne brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone.	1.0
		0.70	D						
		1.20	SPT	N=17 (3,3/4,4,4,5)				Medium dense grey medium to coarse SAND.	2.0
		1.40	D		1.40				
		2.00	SPT	N=12 (2,2/3,3,3,3)				Firm brown slightly sandy CLAY. Sand is fine to coarse.	3.0
		2.90	D		2.90				
		3.00	SPT	N=10 (1,2/2,2,3,3)	3.00			Medium dense brownish grey medium to coarse SAND.	
		3.60	D		3.60				
		4.00	SPT	N=26 (4,5/5,6,7,8)	4.00			Firm brown slightly sandy CLAY. Sand is fine to coarse.	4.0
		5.00	SPT	N=11 (3,3/2,3,3,3)				Medium dense brownish grey medium to coarse SAND.	
				5.45			End of Borehole at 5.45m	5.0	
								6.0	
Remarks		1. Hand dug inspection pit down to 1.20m bgl. 2. Groundwater encountered at 2.900m bgl. 3. Terminated at required depth. 4. Hole backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

APPENDIX C

Chemical Testing Results

Human Health Assessment Summary			Soil Type: Location: Depth:			WS07 0.20-0.40	WS02 0.50-0.70	WS01 0.40-0.50	WS02 0.20-0.40	WS03 0.40-0.60	WS08 0.30-0.60
Contaminant	GAC (mg/kg)	No. Samples	Min. Value	Max. Value	No. Samples ≥GAC						
Moisture Content	-	6	1.80	9.80	-	2	3	4	5	10	3
Soil Organic Matter	-	6	1.30	9.30	-	1.3	7.0	9.3	2.6	2.5	3.6
pH	-	6	8.00	9.00	-	8.0	8.3	9.0	8.1	8.1	8.4
Water Soluble Sulphate (2:1 Leachate Equivalent)	-	0	0.00	<LOD	-						
Arsenic	640	6	3.00	12.00	0	9.8	5	3	11	12	3
Cadmium	190	6	< LOD	0.30	0	< 0.2	0.20	0.20	< 0.2	< 0.2	0.30
Chromium (III)	8600	6	13.00	21.00	0	16.0	21	18	13	14	13
Hexavalent Chromium (VI)	33	6	< LOD	<LOD	0	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Copper	68000	6	9.60	65.00	0	18.0	21	25	29	65	10
Lead	2300	6	17.00	120.00	0	68.0	25	17	120	110	18
Mercury	58.0	6	< LOD	0.50	0	< 0.3	< 0.3	< 0.3	0.4	0.5	< 0.3
Nickel	980	6	12.00	45.00	0	14.0	35	45	13	12	15
Selenium	12000	6	< LOD	<LOD	0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	730000	6	31.00	120.00	0	51.0	38	41	73	120	31
Naphthalene	1100.0	6	< LOD	1.80	0	< 0.05	1.80	0.26	0.31	< 0.05	0.30
Acenaphthylene	100000	6	< LOD	1.80	0	< 0.05	1.10	< 0.05	< 0.05	< 0.05	1.80
Acenaphthene	100000	6	< LOD	37.00	0	< 0.05	11.00	< 0.05	0.75	0.90	37.00
Fluorene	71000	6	< LOD	37.00	0	< 0.05	13.00	< 0.05	0.49	0.66	37.00
Phenanthrene	23000	6	0.51	160.00	0	0.72	70.0	0.5	4.5	6.2	160.0
Anthracene	540000	6	0.27	81.00	0	0.34	23.00	0.27	1.50	1.90	81.00
Fluoranthene	23000	6	1.10	160.00	0	1.70	73.0	1.1	6.5	9.1	160.0
Pyrene	54000	6	1.40	170.00	0	1.70	63.0	1.4	6.2	8.7	170.0
Benzo(a)anthracene	180.0	6	0.74	120.00	0	0.74	41.0	0.8	2.9	3.8	120.0
Chrysene	350	6	0.72	79.00	0	0.72	28.0	1.0	3.1	3.8	79.0
Benzo(b)fluoranthene	45.0	6	0.64	96.00	1	0.64	36.0	1.1	3.5	4.3	96.0
Benzo(k)fluoranthene	1200	6	0.48	36.00	0	0.48	16.00	0.55	1.10	1.30	36.00
Benzo(a)pyrene	36.0	6	0.72	84.00	1	0.72	33.0	0.8	2.6	3.3	84.0
Indeno(1,2,3-cd)pyrene	510	6	0.36	38.00	0	0.36	16.00	0.48	1.50	1.70	38.00
Dibenz(a,h)anthracene	3.60	6	< LOD	10.00	2	< 0.05	4.80	< 0.05	0.36	0.49	10.00
Benzo(ghi)perylene	4000	6	0.48	40.00	0	0.48	18.00	0.84	1.70	2.00	40.00
Asbestos Detected (Detected or Not-Detected)	Y	6	-	0.00	0	N	N	N	N	N	N
Asbestos Quantification (% w/w)	0	0	0.48	<LOD	0						
Petroleum Hydrocarbons Aliphatic >EC5-EC6	12000	2	0.00	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aliphatic >EC6-EC8	40000	2	0.00	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aliphatic >EC8-EC10	11000	2	< LOD	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aliphatic >EC10-EC12	47000	2	< LOD	<LOD	0	< 1.0	< 1.0				
Petroleum Hydrocarbons Aliphatic >EC12-EC16	90000	2	< LOD	8.20	0	< 2.0	8.20				
Petroleum Hydrocarbons Aliphatic >EC16-EC35	1800000	2	< LOD	1360.00	0	184.00	1360.00				
Petroleum Hydrocarbons Aromatic >EC5-EC7	86000	2	< LOD	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aromatic >EC7-EC8	180000	2	184.00	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aromatic >EC8-EC10	17000	2	< LOD	<LOD	0	< 0.001	< 0.001				
Petroleum Hydrocarbons Aromatic >EC10-EC12	34000	2	< LOD	1.50	0	< 1.0	1.50				
Petroleum Hydrocarbons Aromatic >EC12-EC16	38000	2	< LOD	66.00	0	< 2.0	66.00				
Petroleum Hydrocarbons Aromatic >EC16-EC21	28000	2	< LOD	400.00	0	< 10	400.00				
Petroleum Hydrocarbons Aromatic >EC21-EC35	28200	2	< LOD	2000.00	0	120.00	2000.00				
Benzene	90.000	2	< LOD	<LOD	0	< 0.001	< 0.001				
Toluene	180000	2	120.00	<LOD	0	< 0.001	< 0.001				
Ethyl benzene	27000	2	< LOD	<LOD	0	< 0.001	< 0.001				
o-Xylene	14000	2	< LOD	<LOD	0	< 0.001	< 0.001				
m- & p-Xylene	61000	2	< LOD	<LOD	0	< 0.001	< 0.001				
MTBE	24000	2	< LOD	<LOD	0	< 0.001	< 0.001				
Mean Average SOM 4.4											
Mean Average pH 8.3											
Commercial 6% SOM						Values in RED are > the relevant GAC (Generic Assessment Criteria).					
Job Number: C5061											
Client: Lidl GB Ltd											
Site: Lowry House, Chorlton											
Soil Group Type Made Ground											

Matthew Shore
Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

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

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

e: m.shore@brownfield-solutions.co.uk

Analytical Report Number : 22-67987

Replaces Analytical Report Number: 22-67987, issue no. 1
Additional analysis undertaken.

Project / Site name:	Lowry House Chortlton	Samples received on:	28/06/2022
Your job number:	C5061	Samples instructed on/ Analysis started on:	28/06/2022
Your order number:		Analysis completed by:	12/07/2022
Report Issue Number:	2	Report issued on:	14/07/2022
Samples Analysed:	8 soil samples		


Signed:

Adam Fenwick
Technical Reviewer
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

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

Analytical Report Number: 22-67987

Project / Site name: Lowry House Chortilton

Lab Sample Number				2330829	2330830	2330831	2330832	2330833
Sample Reference				WS07	WS02	WS01	WS02	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20-0.40	0.50-0.70	0.40-0.50	0.20-0.40	0.40-0.60
Date Sampled				23/06/2022	24/06/2022	24/06/2022	24/06/2022	24/06/2022
Time taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content				37	51	31	< 0.1	< 0.1
Moisture Content				1.8	2.7	3.9	4.7	9.8
Total mass of sample received				0.3	0.3	0.5	0.5	0.5

Asbestos in Soil				Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID				SCA	SCA	SCA	SCA	SCA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	8.3	9	8.1	8.1
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	340	210	130	25	37
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.17	0.11	0.065	0.012	0.019
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	172	106	64.9	12.4	18.6
Organic Matter (automated)	%	0.1	MCERTS	1.3	7	9.3	2.6	2.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	1.8	0.26	0.31	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	1.1	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	11	< 0.05	0.75	0.9
Fluorene	mg/kg	0.05	MCERTS	< 0.05	13	< 0.05	0.49	0.66
Phenanthrene	mg/kg	0.05	MCERTS	0.72	70	0.51	4.5	6.2
Anthracene	mg/kg	0.05	MCERTS	0.34	23	0.27	1.5	1.9
Fluoranthene	mg/kg	0.05	MCERTS	1.7	73	1.1	6.5	9.1
Pyrene	mg/kg	0.05	MCERTS	1.7	63	1.4	6.2	8.7
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.74	41	0.83	2.9	3.8
Chrysene	mg/kg	0.05	MCERTS	0.72	28	0.95	3.1	3.8
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.64	36	1.1	3.5	4.3
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.48	16	0.55	1.1	1.3
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.72	33	0.83	2.6	3.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.36	16	0.48	1.5	1.7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	4.8	< 0.05	0.36	0.49
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.48	18	0.84	1.7	2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	8.64	450	9.01	36.8	48.3
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Analytical Report Number: 22-67987

Project / Site name: Lowry House Chortilton

Lab Sample Number	2330829	2330830	2330831	2330832	2330833
Sample Reference	WS07	WS02	WS01	WS02	WS03
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.20-0.40	0.50-0.70	0.40-0.50	0.20-0.40	0.40-0.60
Date Sampled	23/06/2022	24/06/2022	24/06/2022	24/06/2022	24/06/2022
Time taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.8	4.8	3	11	12
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	16	21	18	13	14
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	21	18	14	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	21	25	29	65
Lead (aqua regia extractable)	mg/kg	1	MCERTS	68	25	17	120	110
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.4	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	35	45	13	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	51	38	41	73	120

Monoaromatics & Oxygenates

Benzene	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
Toluene	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
p & m-xylene	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
o-xylene	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	8.2	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	44	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	92	660	-	-	-
TPH-CWG - Aliphatic >EC16 - EC35 EH_CU_1D_AL	mg/kg	10	MCERTS	92	700	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	MCERTS	99	710	-	-	-

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	1.5	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	66	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	400	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	120	2000	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	MCERTS	120	2400	-	-	-

Miscellaneous Organics

Coal Tar		N/A	NONE	-	-	-	-	-
Total Residue	mg/kg	10	NONE	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-67987

Project / Site name: Lowry House Chortilton

Lab Sample Number				2330834	2330835	2330836
Sample Reference				WS08	LWD03	LWD04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.60	0.00-0.10	0.00-0.05
Date Sampled				23/06/2022	21/06/2022	21/06/2022
Time taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content				24	< 0.1	< 0.1
Moisture Content				3.1	0.09	0.04
Total mass of sample received				0.5	0.5	0.5

Asbestos in Soil				Not-detected	-	-
Asbestos Analyst ID				SCA	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	78	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.039	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	39.1	-	-
Organic Matter (automated)	%	0.1	MCERTS	3.6	11	5.8

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.3	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	1.8	< 0.05	0.42
Acenaphthene	mg/kg	0.05	MCERTS	37	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	37	0.32	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	160	1.1	0.61
Anthracene	mg/kg	0.05	MCERTS	81	0.42	0.5
Fluoranthene	mg/kg	0.05	MCERTS	160	1.5	1.2
Pyrene	mg/kg	0.05	MCERTS	170	1.5	2.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	120	0.71	0.35
Chrysene	mg/kg	0.05	MCERTS	79	0.63	0.45
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	96	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	36	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	84	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	38	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	10	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	40	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	1150	6.13	6.04
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Analytical Report Number: 22-67987

Project / Site name: Lowry House Chortilton

Lab Sample Number				2330834	2330835	2330836
Sample Reference				WS08	LWD03	LWD04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.60	0.00-0.10	0.00-0.05
Date Sampled				23/06/2022	21/06/2022	21/06/2022
Time taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	-	-
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	-	-
Chromium (III)	mg/kg	1	NONE	13	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	9.6	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	31	-	-

Monoaromatics & Oxygenates

Benzene	mg/kg	0.001	MCERTS	-	-	-
Toluene	mg/kg	0.001	MCERTS	-	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	-	-	-
p & m-xylene	mg/kg	0.001	MCERTS	-	-	-
o-xylene	mg/kg	0.001	MCERTS	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS,1D,AL}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 _{HS,1D,AL}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 _{HS,1D,AL}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 _{EH,CU,1D,AL}	mg/kg	1	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 _{EH,CU,1D,AL}	mg/kg	2	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	-	-	-
TPH-CWG - Aliphatic >EC16 - EC35 _{EH,CU,1D,AL}	mg/kg	10	MCERTS	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) _{EH,CU+HS,1D,AL}	mg/kg	10	MCERTS	-	-	-

TPH-CWG - Aromatic >EC5 - EC7 _{HS,1D,AR}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 _{HS,1D,AR}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 _{HS,1D,AR}	mg/kg	0.001	MCERTS	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 _{EH,CU,1D,AR}	mg/kg	1	MCERTS	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 _{EH,CU,1D,AR}	mg/kg	2	MCERTS	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) _{EH,CU+HS,1D,AR}	mg/kg	10	MCERTS	-	-	-

Miscellaneous Organics

Coal Tar		N/A	NONE	-	Not Identified	Not Identified
Total Residue	mg/kg	10	NONE	-	6900	7400

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report number : 22-67987

Project / Site name: Lowry House Chortilton

* 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 *
Z330829	WS07	None Supplied	0.20-0.40	Brown sand with rubble.
Z330830	WS02	None Supplied	0.50-0.70	Brown loam and sand with rubble.
Z330831	WS01	None Supplied	0.40-0.50	Brown loam and sand with stones and plastic.
Z330832	WS02	None Supplied	0.20-0.40	Brown loam and sand with gravel and vegetation.
Z330833	WS03	None Supplied	0.40-0.60	Brown loam and clay with gravel and vegetation.
Z330834	WS08	None Supplied	0.30-0.60	Brown sand with rubble.
Z330835	LWD03	None Supplied	0.00-0.10	Black tar with gravel.**
Z330836	LWD04	None Supplied	0.00-0.05	Black gravel with tar.**

**Non MCERTS Matrix

Analytical Report Number : 22-67987
Project / Site name: Lowry House Chortilton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
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.	L038-PL	D	MCERTS
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	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	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
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.	L019-UK/PL	D	NONE
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Coal Tar in Soil	DCM Extraction with qualitative interpretation via GC/MS	In-house method	L064-PL	D	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L0738-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' 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.

Information in Support of Analytical Results

Analytical Report number : 22-67987
Project / Site name: Lowry House Chortilton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX D

Geotechnical Testing Results

4041

Client: Brownfield Solutions Ltd
 Client Address: William Smith House, 173 - 183 Witton Street,
 Northwich, Cheshire,
 CW9 5LP
 Contact: Matthew Shore
 Site Address: Lowry House, Chorlton

Client Reference: C5061
 Job Number: 22-67821
 Date Sampled: 24/06/2022
 Date Received: 28/06/2022
 Date Tested: 07/07/2022
 Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

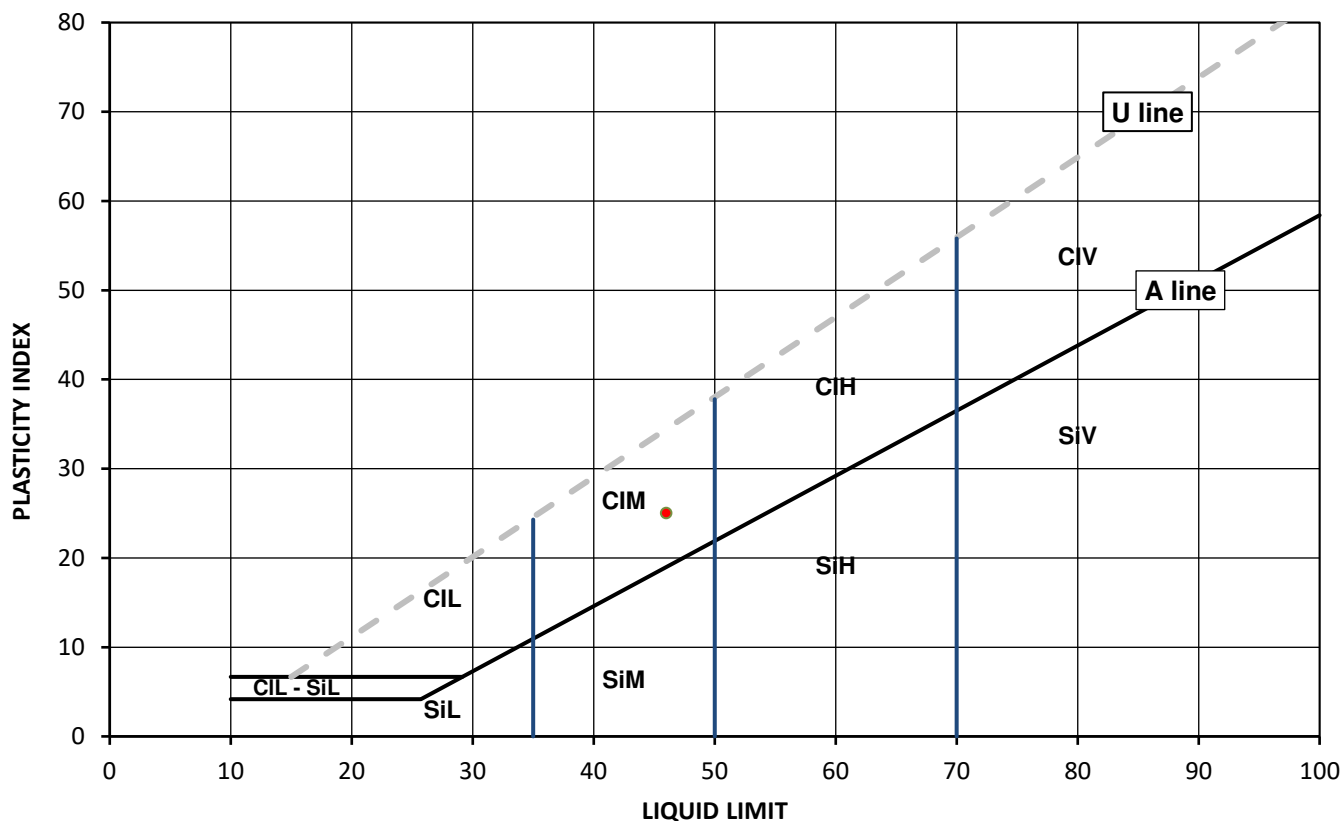
Test Results:

Laboratory Reference: 2329825
 Hole No.: WS03
 Sample Reference: Not Given
 Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 2.90
 Depth Base [m]: Not Given
 Sample Type: D

Sample Preparation: Tested in natural condition;
 Cone Type: 80g/30deg

As Received Water Content [W] %	Corrected Liquid Limit [WL] %	Correlation Factor	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
25.4	46	1.020	21	25	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

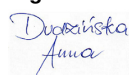
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS EN 17892-1: 2014; Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Remarks:

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Signed:



Anna Dudzinska
 PL Deputy Head of Reporting Team
 for and on behalf of i2 Analytical Ltd

4041

Client: Brownfield Solutions Ltd
 Client Address: William Smith House, 173 - 183 Witton Street,
 Northwich, Cheshire,
 CW9 5LP
 Contact: Matthew Shore
 Site Address: Lowry House, Chorlton

Client Reference: C5061
 Job Number: 22-67821
 Date Sampled: 23/06/2022
 Date Received: 28/06/2022
 Date Tested: 07/07/2022
 Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

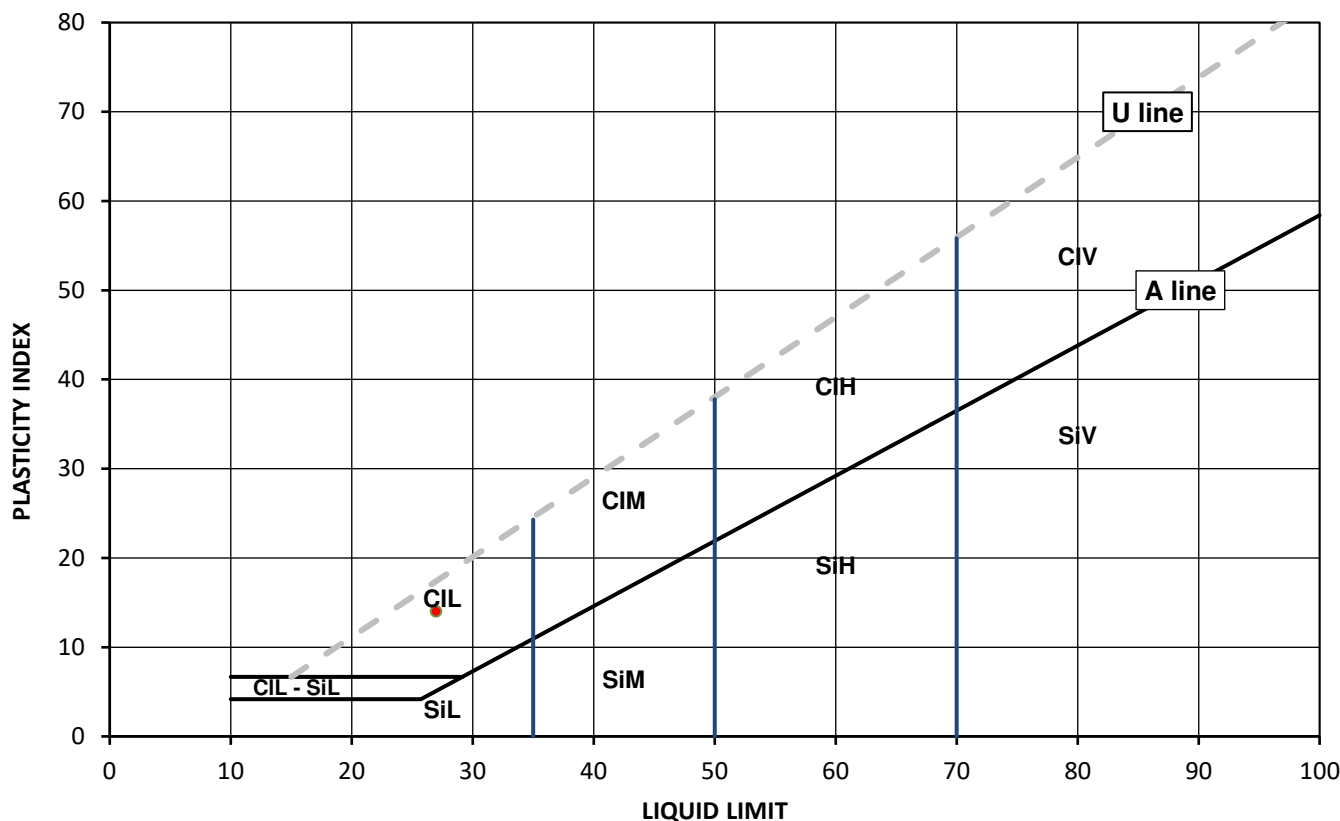
Test Results:

Laboratory Reference: 2329826
 Hole No.: WS05
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 0.80
 Depth Base [m]: Not Given
 Sample Type: D

Sample Preparation: Tested after >0.425mm removed by hand;
 Cone Type: 80g/30deg

As Received Water Content [W] %	Corrected Liquid Limit [WL] %	Correlation Factor	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
21.2	27	1.000	13	14	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

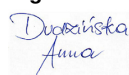
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS EN 17892-1: 2014; Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

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Client: Brownfield Solutions Ltd
 Client Address: William Smith House, 173 - 183 Witton Street,
 Northwich, Cheshire,
 CW9 5LP
 Contact: Matthew Shore
 Site Address: Lowry House, Chorlton

Client Reference: C5061
 Job Number: 22-67821
 Date Sampled: 23/06/2022
 Date Received: 28/06/2022
 Date Tested: 07/07/2022
 Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

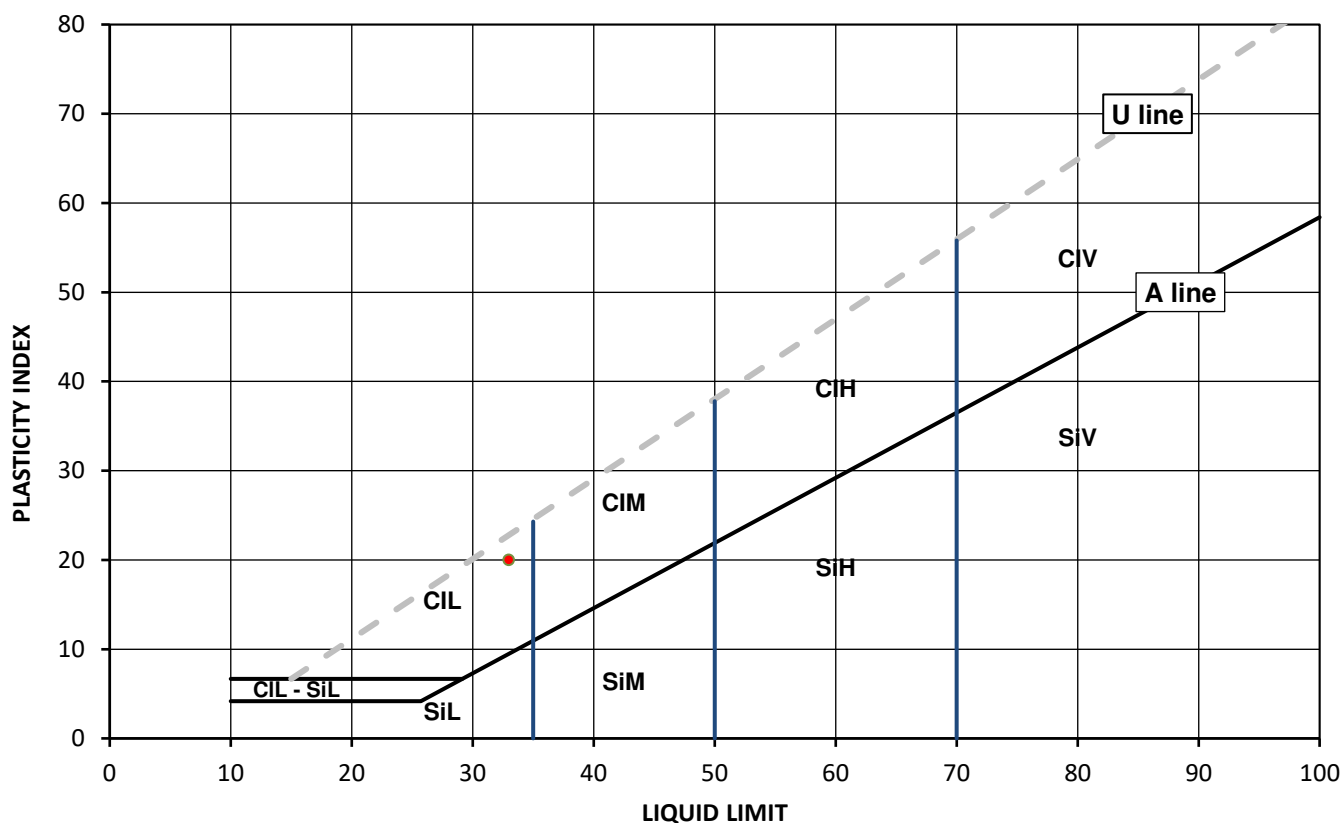
Test Results:

Laboratory Reference: 2329827
 Hole No.: BH02
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 3.10
 Depth Base [m]: 3.55
 Sample Type: D

Sample Preparation: Tested after >0.425mm removed by hand;
 Cone Type: 80g/30deg

As Received Water Content [W] %	Corrected Liquid Limit [WL] %	Correlation Factor	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18.4	33	1.015	13	20	99



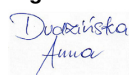
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS EN 17892-1: 2014; Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Remarks:

Signed:



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4041

Client: Brownfield Solutions Ltd
 Client Address: William Smith House, 173 - 183 Witton Street,
 Northwich, Cheshire,
 CW9 5LP
 Contact: Matthew Shore
 Site Address: Lowry House, Chorlton

Client Reference: C5061
 Job Number: 22-67821
 Date Sampled: 24/06/2022
 Date Received: 28/06/2022
 Date Tested: 07/07/2022
 Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

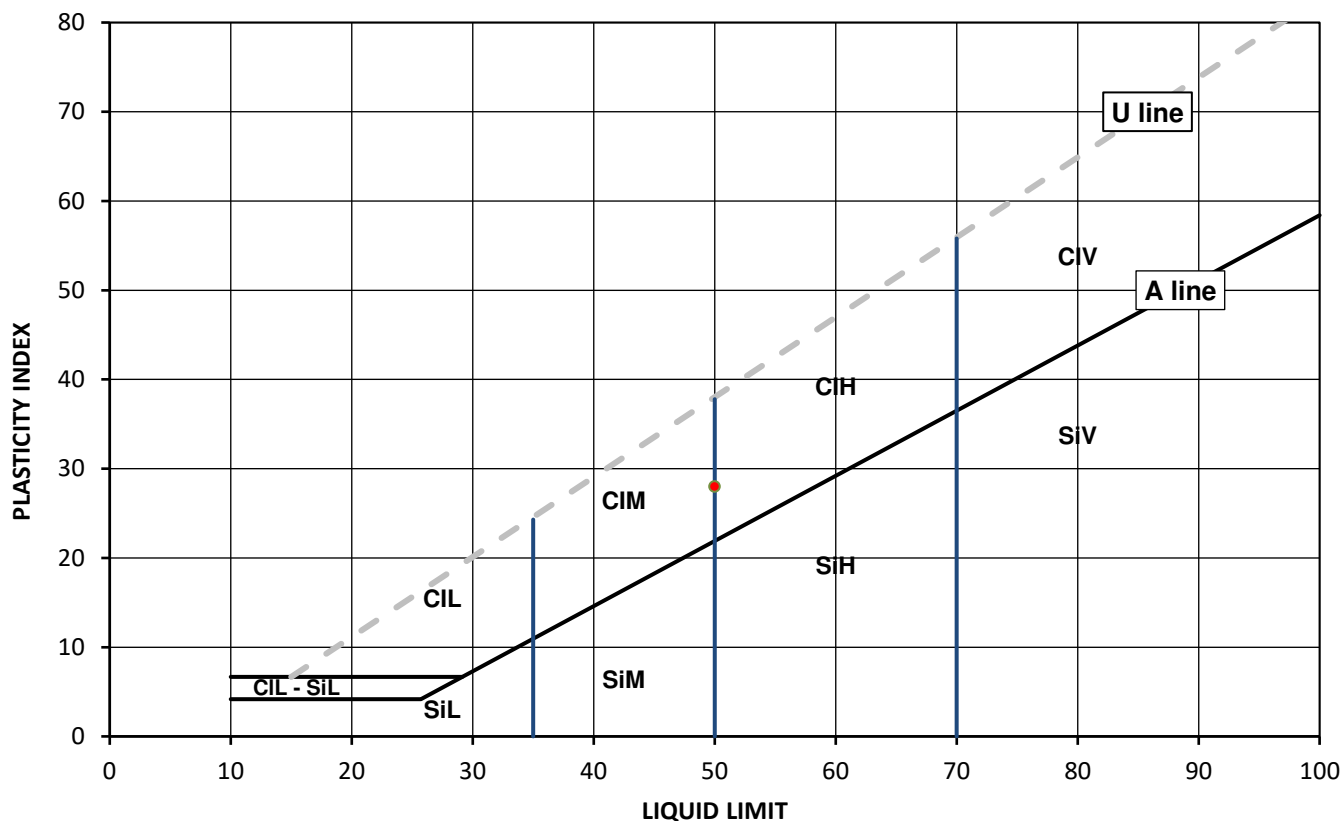
Test Results:

Laboratory Reference: 2329828
 Hole No.: WS01
 Sample Reference: Not Given
 Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 2.70
 Depth Base [m]: Not Given
 Sample Type: D

Sample Preparation: Tested in natural condition;
 Cone Type: 80g/30deg

As Received Water Content [W] %	Corrected Liquid Limit [WL] %	Correlation Factor	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29.0	50	1.020	22	28	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

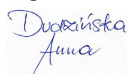
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS EN 17892-1: 2014; Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Remarks:

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Client: Brownfield Solutions Ltd
 Client Address: William Smith House, 173 - 183 Witton Street,
 Northwich, Cheshire,
 CW9 5LP
 Contact: Matthew Shore
 Site Address: Lowry House, Chorlton

Client Reference: C5061
 Job Number: 22-67821
 Date Sampled: 23/06/2022
 Date Received: 28/06/2022
 Date Tested: 07/07/2022
 Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

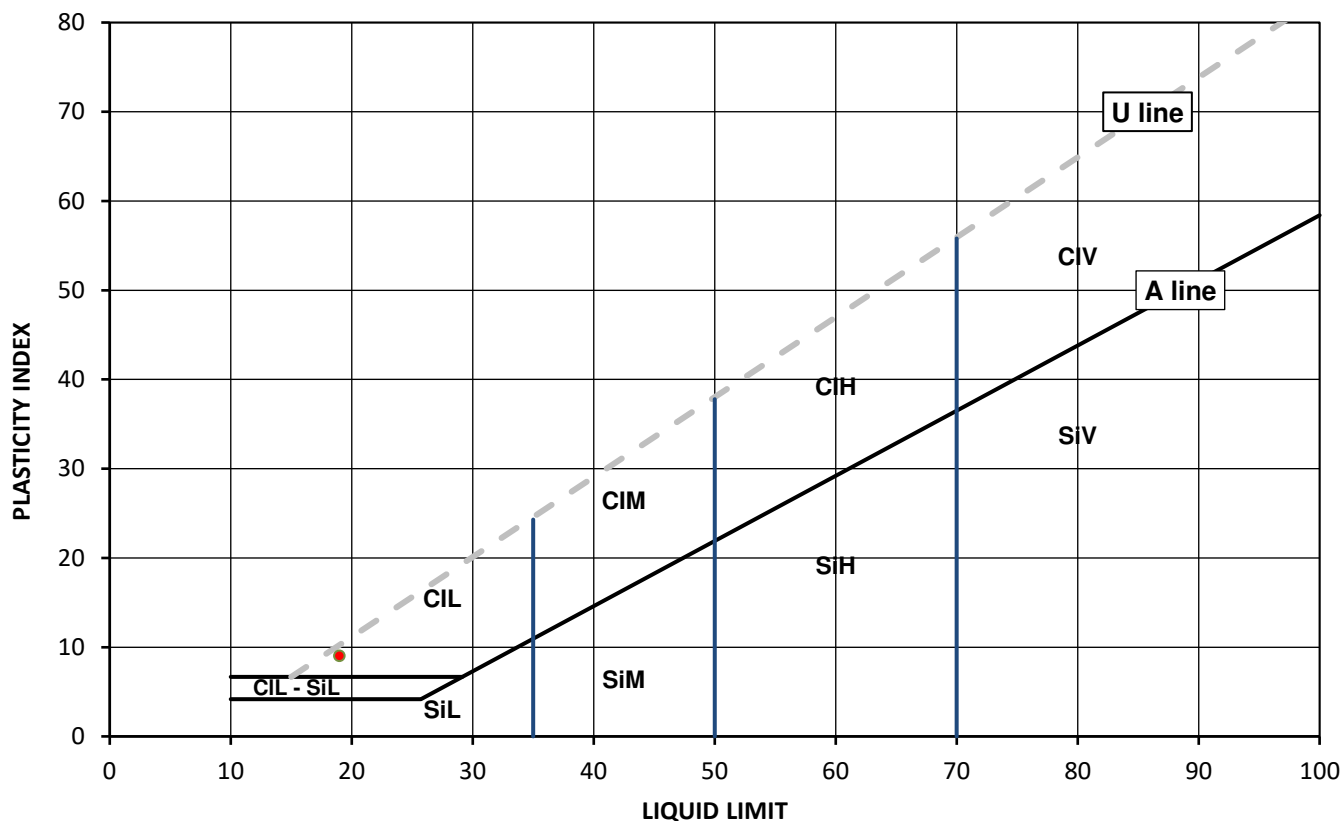
Test Results:

Laboratory Reference: 2329829
 Hole No.: WS08
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly SAND

Depth Top [m]: 2.90
 Depth Base [m]: Not Given
 Sample Type: D

Sample Preparation: Tested after >0.425mm removed by hand;
 Cone Type: 80g/30deg

As Received Water Content [W] %	Corrected Liquid Limit [WL] %	Correlation Factor	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
14.1	19	1.000	10	9	92



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

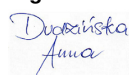
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS EN 17892-1: 2014; Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Remarks:

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Signed:



Anna Dudzinska
 PL Deputy Head of Reporting Team
 for and on behalf of i2 Analytical Ltd



SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Brownfield Solutions Ltd
Client Address: William Smith House, 173 - 183 Witton Street,
Northwich, Cheshire,
CW9 5LP
Contact: Matthew Shore
Site Address: Lowry House, Chorlton

W by BS EN 17892-1: 2014; Liquid and Plastic Limit by BS EN ISO 17892-12:2018+A1:2021: Clause 5.3 (4 Point Test), Clause 5.3.14 (1 Point Test) and 5.5; Correlation Factor by Clayton C.R.I and Jukes A.W (1978); PD by BS 1377-2: 1990: Clause 8.2

Client Reference: C5061
Job Number: 22-67821
Date Sampled: 23/06 - 24/06/2022
Date Received: 28/06/2022
Date Tested: 07/07/2022
Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	W	Liquid & Plastic Limit							Density		
		Reference	Depth Top	Depth Base	Type				% Passing 425um	WL*	Correlation Factor	Wp	Ip	Cone type	Sample Preparation	bulk	dry	PD
			m	m														
2329827	BH02	Not Given	3.10	3.55	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	18.4	99	33	1.015	13	20	80g/30 deg	N/A			
2329828	WS01	Not Given	2.70	Not Given	D	Brown slightly sandy CLAY	Atterberg 1 Point	29.0	100	50	1.020	22	28	80g/30 deg	N/A			
2329825	WS03	Not Given	2.90	Not Given	D	Brown slightly sandy CLAY	Atterberg 1 Point	25.4	100	46	1.020	21	25	80g/30 deg	N/A			
2329826	WS05	Not Given	0.80	Not Given	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	21.2	99	27	1.000	13	14	80g/30 deg	N/A			
2329829	WS08	Not Given	2.90	Not Given	D	Brown slightly gravelly SAND	Atterberg 1 Point	14.1	92	19	1.000	10	9	80g/30 deg	N/A			

Note: # Non accredited; NP - Non plastic; I - The water content in the sample was increased ; D - The water content in the sample was decreased; * - One point liquid limit corrected as per the report Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Comments:

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Signed:

Dudzińska Anna

Anna Dudzińska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

DETERMINATION OF THE UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Tested in Accordance with: BS 1377-7: 1990: Clause 8

Client: Brownfield Solutions Ltd
Client Address: William Smith House, 173 - 183 Witton Street,
Northwich, Cheshire,
CW9 5LP
Contact: Matthew Shore
Site Address: Lowry House, Chorlton

Client Reference: C5061
Job Number: 22-67821
Date Sampled: 24/06/2022
Date Received: 28/06/2022
Date Tested: 12/07/2022
Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2329823

Hole No.: BH01

Sample Reference: Not Given

Sample Description: Brown CLAY

Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

Depth Top [m]: 4.20

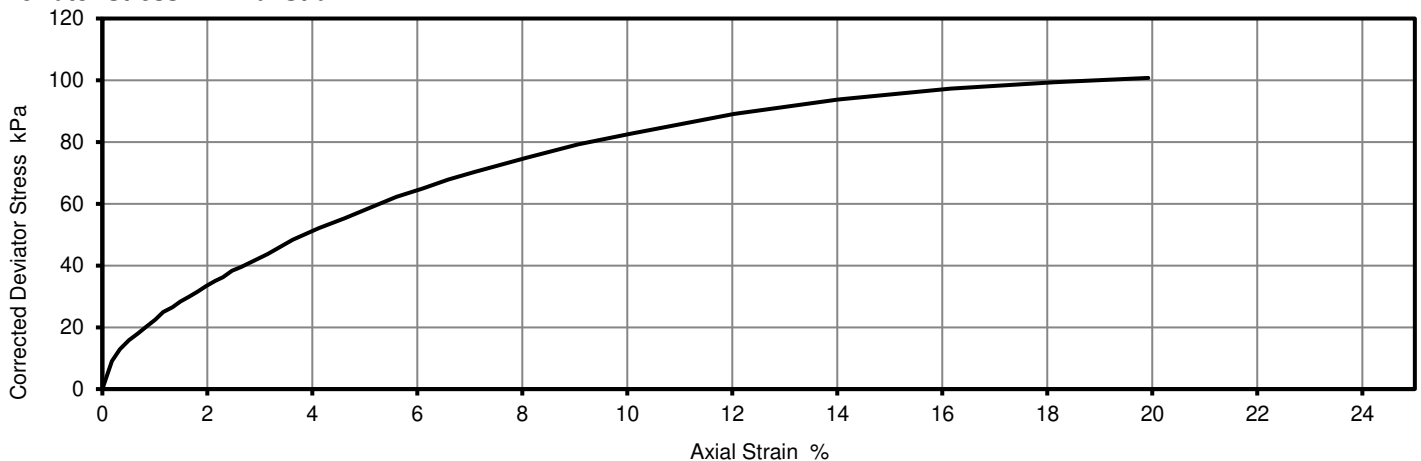
Depth Base [m]: 4.65

Sample Type: U

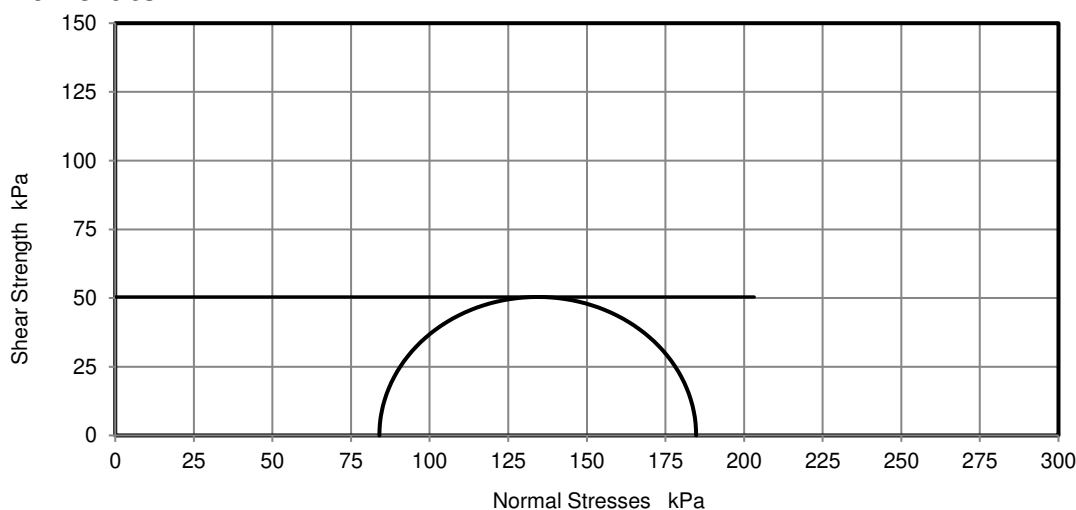
Test Number	1
Length	204.45 mm
Diameter	100.89 mm
Bulk Density	2.09 Mg/m ³
Moisture Content	26 %
Dry Density	1.66 Mg/m ³
Membrane Correction	0.91 kPa

Rate of Strain	1.96 %/min
Cell Pressure	84 kPa
Axial Strain at failure	19.9 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	101 kPa
Undrained Shear Strength, c_u	50 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.24 mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Anna Dudzinska

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

DETERMINATION OF THE UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Tested in Accordance with: BS 1377-7: 1990: Clause 8

Client: Brownfield Solutions Ltd
Client Address: William Smith House, 173 - 183 Witton Street,
Northwich, Cheshire,
CW9 5LP
Contact: Matthew Shore
Site Address: Lowry House, Chorlton

Client Reference: C5061
Job Number: 22-67821
Date Sampled: 23/06/2022
Date Received: 28/06/2022
Date Tested: 12/07/2022
Sampled By: Client - MS

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2329824

Hole No.: BH02

Sample Reference: Not Given

Sample Description: Brown CLAY

Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

Depth Top [m]: 5.50

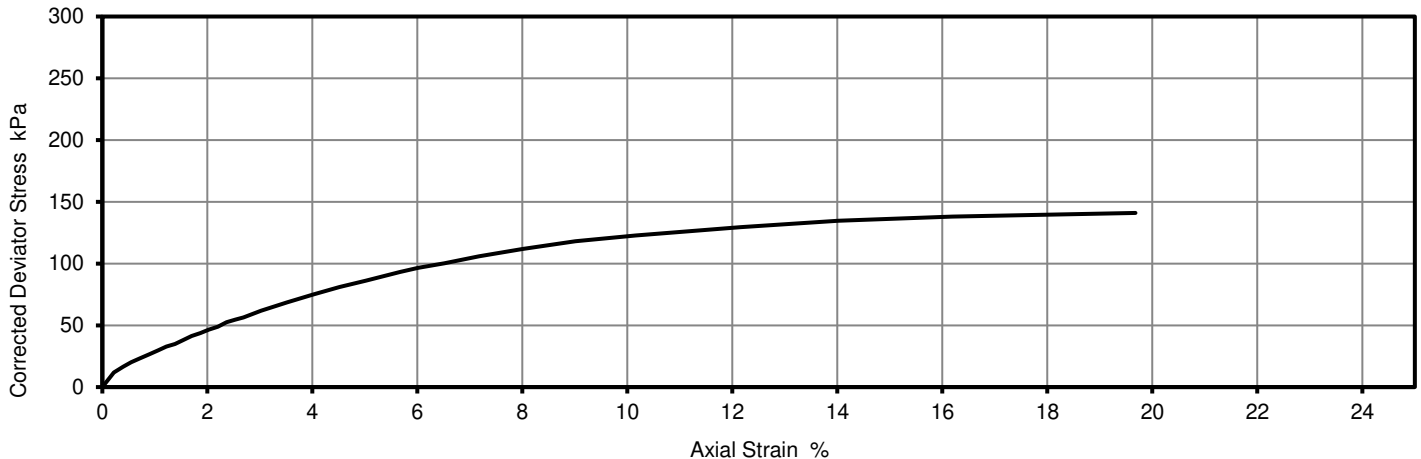
Depth Base [m]: 5.95

Sample Type: U

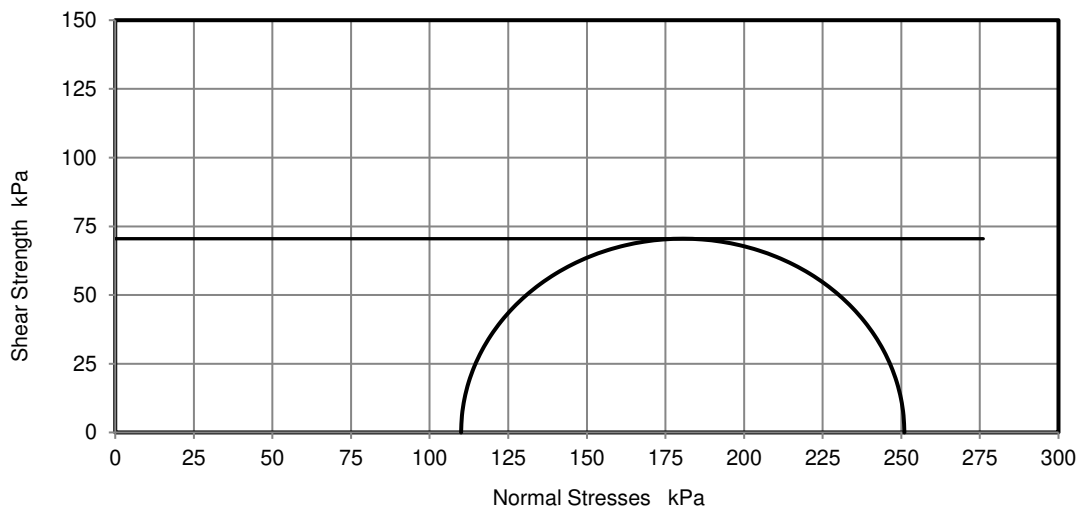
Test Number	1
Length	140.36 mm
Diameter	69.04 mm
Bulk Density	2.08 Mg/m ³
Moisture Content	23 %
Dry Density	1.69 Mg/m ³
Membrane Correction	1.48 kPa

Rate of Strain	2.00 %/min
Cell Pressure	110 kPa
Axial Strain at failure	19.7 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	141 kPa
Undrained Shear Strength, c_u	70 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.27 mm

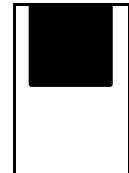
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks:

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Signed:

Anna Dudzinska

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Matthew Shore

Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: m.shore@brownfield-solutions.co.uk

Analytical Report Number : 22-67827

Project / Site name:	Lowry House, Chortlton	Samples received on:	28/06/2022
Your job number:	C5061	Samples instructed on/ Analysis started on:	28/06/2022
Your order number:		Analysis completed by:	11/07/2022
Report Issue Number:	1	Report issued on:	12/07/2022
Samples Analysed:	4 soil samples		

Signed:

Izabela Wójcik

Izabela Wójcik
Reporting Specialist
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

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: 22-67827
Project / Site name: Lowry House, Chortilton

Lab Sample Number				2329844	2329845	2329846	2329847
Sample Reference				WS03	WS05	WS04	WS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.90	0.80	0.70	0.70
Date Sampled				24/06/2022	23/06/2022	23/06/2022	23/06/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	12	7.5	8.9
Total mass of sample received	kg	0.001	NONE	0.4	0.4	0.4	0.4

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	8.9	8.7	7.7
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	80	130	54	120
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.04	0.064	0.027	0.062
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	39.8	63.6	27	62.3

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-67827

Project / Site name: Lowry House, Chortlton

* 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 *
2329844	WS03	None Supplied	2.9	Brown clay.
2329845	WS05	None Supplied	0.8	Brown clay.
2329846	WS04	None Supplied	0.7	Brown clay and sand.
2329847	WS07	None Supplied	0.7	Brown sand.

Analytical Report Number : 22-67827

Project / Site name: Lowry House, Chortlton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
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
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.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' 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.

Determination of Indicative CBR Value by Lightweight Deflectometer (LWD)

IAN 73/06 (2009 amendment), LWD Manufacturer's Manual and Barounis, N. & Smith, T. (2017)



**BROWNFIELD
SOLUTIONS LTD**

Client: LIDL GB LTD
Site Name: Lowry House, Chorlton
Job Number: C5061
Date(s) Tested: 21/06/2022

www.brownfield-solutions.com
(+44) 0800 044 8025
info@brownfield-solutions.co.uk

Equipment:	Terratest 4000 STREAM
Plate Size:	300mm
Drop Weight Mass:	10kg

[illegible]

Compiled By: Matthew Shore

Signature:

Checked By: Aaron Stokoe

Signature: 

Date: 07/07/2022

WS04

Test 1

LIDL GB LTD

LOWRY HOUSE, CHORLTON

C5061


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Falling Head Permeability Test

(a) bottom of borehole:	3.55	m
(b) bottom of casing:		m
(c) top of filter material:	1.00	m
(d) initial groundwater level or base of hole:	2.05	m
(e) centre of piezometer tip:		m
Height of casing/standpipe above surface	0.00	m
Diameter of casing/standpipe	100	mm
Length of filter (above GW table or base of hole)	1.05	m

Date of Test:

25/07/2022

Logged By:

PG

Checked By:

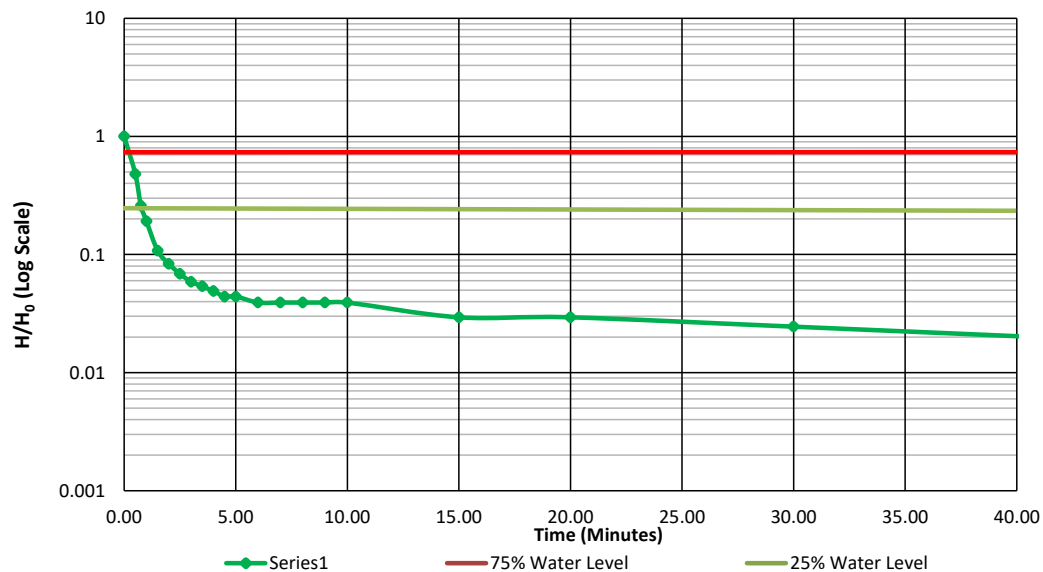
MS

Site Recorded Data

Time (mm:ss.0)	Depth to water (m)	Head of water (m)	Head Ratio H/H_0	Time (mm:ss.0)	Depth to water (mm)	Head of water (m)	Head Ratio H/H_0
00:00.0	0.01	2.04	1.000	15:00.0	1.99	0.06	0.029
00:30.0	1.07	0.98	0.480	20:00.0	1.99	0.06	0.029
00:45.0	1.52	0.53	0.260	30:00.0	2.00	0.05	0.025
01:00.0	1.66	0.39	0.191	40:00.0	2.01	0.04	0.020
01:30.0	1.83	0.22	0.108				
02:00.0	1.88	0.17	0.083				
02:30.0	1.91	0.14	0.069				
03:00.0	1.93	0.12	0.059				
03:30.0	1.94	0.11	0.054				
04:00.0	1.95	0.10	0.049				
04:30.0	1.96	0.09	0.044				
05:00.0	1.96	0.09	0.044				
05:30.0	1.97	0.08	0.039				
06:00.0	1.97	0.08	0.039				
06:30.0	1.97	0.08	0.039				
07:00.0	1.97	0.08	0.039				
07:30.0	1.97	0.08	0.039				
08:00.0	1.99	0.06	0.029				
08:30.0	1.99	0.06	0.029				
09:00.0	2.00	0.05	0.025				
10:00.0	2.01	0.04	0.020				

Data Analysis

Head Ratio Vs Time



WS04
Test 1

LIDL GB LTD

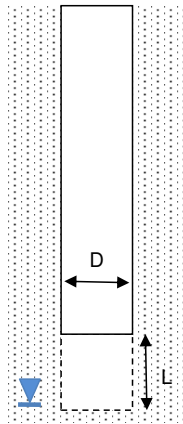
LOWRY HOUSE, CHORLTON

C5061



**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Calculation of Intake Factor (F)



X-sectional area of base

$$A = 0.007853982 \text{ m}^2$$

Diameter

$$D = 0.1 \text{ m}$$

Length

$$L = 1.05 \text{ m}$$

$$\text{Cylindrical Cavity with } \frac{L}{D} > 10 \quad F = \frac{2\pi L}{\ln\left(2\frac{L}{D}\right)}$$

$$F = \frac{6.597}{3.045}$$

$$F = 2.167$$

Calculation

	Head (m)	Depth (m bgl)	Time (s)
75% effective level	1.530	0.520	15.0
25% effective level	0.510	1.540	47.0

At time (t_1) Depth to water = 0.520 $t_1 = 15.0$ sec

Initial groundwater level = 2.05

Depth of Water (H_1) = 1.530

At time (t_2) Depth to water = 1.540 $t_2 = 47.0$ sec

Initial groundwater level = 2.05

Depth of Water (H_2) = 0.510

$$\text{Permeability} = k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

$$k = \frac{0.0079}{69.34} \ln \frac{1.530}{0.510}$$

$$k = 1.24\text{E-}04 \text{ m/s}$$

WS07

Test 1

LIDL GB LTD

LOWRY HOUSE, CHORLTON

C5061


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Falling Head Permeability Test

(a) bottom of borehole:	4.90	m
(b) bottom of casing:		m
(c) top of filter material:	1.00	m
(d) initial groundwater level or base of hole:	3.26	m
(e) centre of piezometer tip:		m
Height of casing/standpipe above surface	0.00	m
Diameter of casing/standpipe	100	mm
Length of filter (above GW table or base of hole)	2.26	m

Date of Test:

25/07/2022

Logged By:

PG

Checked By:

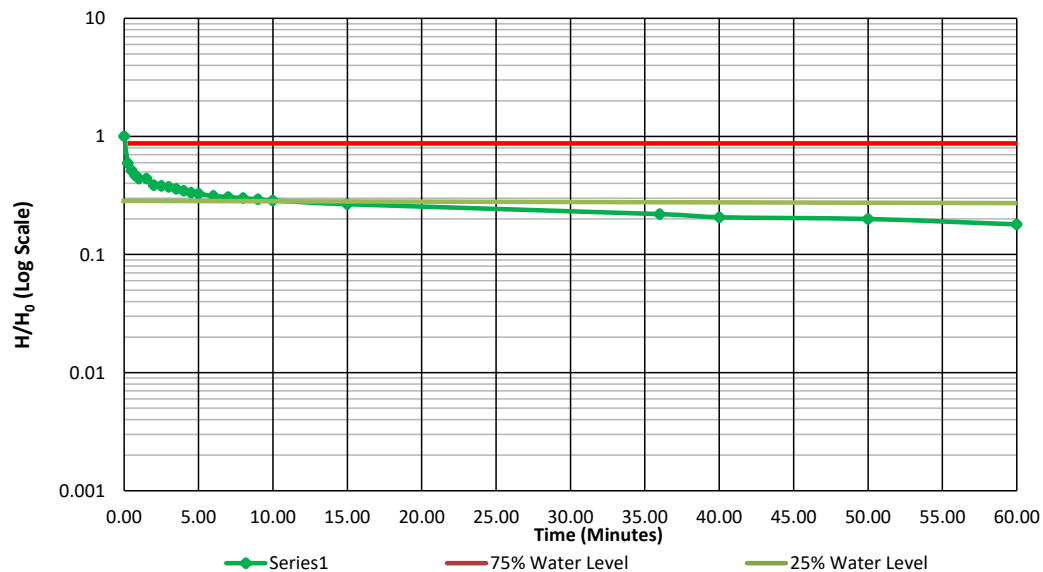
MS

Site Recorded Data

Time (mm:ss.0)	Depth to water (m)	Head of water (m)	Head Ratio H/H_0	Time (mm:ss.0)	Depth to water (mm)	Head of water (m)	Head Ratio H/H_0
00:00.0	1.76	1.50	1.000	10:00.0	2.83	0.43	0.287
00:15.0	2.37	0.89	0.593	15:00.0	2.86	0.40	0.267
00:30.0	2.49	0.77	0.513	36:00.0	2.93	0.33	0.220
00:45.0	2.56	0.70	0.467	40:00.0	2.95	0.31	0.207
01:00.0	2.60	0.66	0.440	50:00.0	2.96	0.30	0.200
01:30.0	2.60	0.66	0.440	00:00.0	2.99	0.27	0.180
02:00.0	2.68	0.58	0.387				
02:30.0	2.69	0.57	0.380				
03:00.0	2.70	0.56	0.373				
03:30.0	2.72	0.54	0.360				
04:00.0	2.74	0.52	0.347				
04:30.0	2.76	0.50	0.333				
05:00.0	2.77	0.49	0.327				
05:30.0	2.79	0.47	0.313				
06:00.0	2.80	0.46	0.307				
06:30.0	2.81	0.45	0.300				
07:00.0	2.82	0.44	0.293				
07:30.0	2.83	0.43	0.287				
08:00.0	2.86	0.40	0.267				
08:30.0	2.93	0.33	0.220				
09:00.0	2.95	0.31	0.207				

Data Analysis

Head Ratio Vs Time



WS07
Test 1

LIDL GB LTD

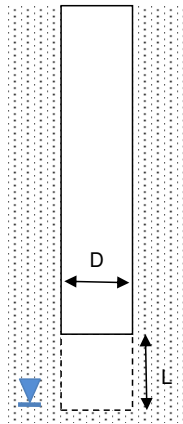
LOWRY HOUSE, CHORLTON

C5061



**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Calculation of Intake Factor (F)



X-sectional area of base

$$A = 0.007853982 \text{ m}^2$$

Diameter

$$D = 0.1 \text{ m}$$

Length

$$L = 2.26 \text{ m}$$

$$\text{Cylindrical Cavity with } \frac{L}{D} > 10 \quad F = \frac{2\pi L}{\ln\left(2\frac{L}{D}\right)}$$

$$F = \frac{14.200}{3.811}$$

$$F = 3.726$$

Calculation

	Head (m)	Depth (m bgl)	Time (s)
75% effective level	1.125	2.135	15.0
25% effective level	0.375	2.885	900.0

At time (t_1) Depth to water = 2.135 $t_1 = 15.0$ sec

Initial groundwater level = 3.26

Depth of Water (H_1) = 1.125

At time (t_2) Depth to water = 2.885 $t_2 = 900.0$ sec

Initial groundwater level = 3.26

Depth of Water (H_2) = 0.375

$$\text{Permeability} = k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

$$k = \frac{0.0079}{3297.48} \ln \frac{1.125}{0.375}$$

$$k = 2.62\text{E-}06 \text{ m/s}$$

APPENDIX E

Monitoring Results

Ground Gas Monitoring Results



CLIENT:	Date	Operator	Analysar	Weather Observations		Temp (°C)	Pressure Trend	Min Barometric Pressure (mb)	Notes
LIDL BG LTD	07/07/2022	PG	GFM436	Sunny	Light breeze	Warm	18	Rising	1024
JOB NO.	25/07/2022	PG	GFM436	Light rain	Light breeze	Cool	15	Falling	998
C5061	16/08/2022	AN	GFM436	Overcast	Light breeze	Warm	21	Rising	1002
SITE:									
LOWRY HOUSE, CHORLTON									

Notes: mb = milibars; CH₄ = methane; LEL = lower explosive limit = 5%v/v; CO₂ = carbon dioxide; O₂ = oxygen; CO=carbon monoxide; H₂S = hydrogen sulphide; TVOC= Total volatile organic compounds; PPM = parts per million. Where the flow is less than the limit of detection of the instrument, the detection limit is reported (Highlighted in green). Gas Screening Values (GSVs) are rounded to 3 decimal places. Calibration Records for analysers used available on request.

Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)					
				Summary Statistics																			
Max. values:				1026	0.0	0.1	0.1	0.1	0.1	2.0	2.0	9.0	8.2	21.0	20.6	0.0	0.0	0.0	3.6	4.9	0.000	0.009	
Min. values:				998	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.2	11.6	12.2	0.0	0.0	0.0	2.1	2.1	0.000	0.001	
				Worst-case GSVs based on maximum recorded steady flow and maximum individual peak concentrations:																		0.000	
07/07/2022	AM	Ambient		1026				0.1		2.0		0.1		21.0		0.0	0.0	NA					
		WS02	0.60 - 2.60		0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.6	0.5	19.6	20.4	0.0	0.0	NA	NGW	2.61	0.000	0.002	
		WS03	1.00 - 2.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	3.0	2.8	14.8	14.8	0.0	0.0	NA	NGW	2.06	0.000	0.003	
		WS04	1.00 - 4.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	4.7	4.5	16.8	17.2	0.0	0.0	NA	2.07	3.57	0.000	0.005	
		WS07	1.00 - 5.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	7.0	7.0	13.3	13.0	0.0	0.0	NA	3.59	4.92	0.000	0.007	
		LK Install	?..? - ?..?		0.0	0.1	0.1	0.1	0.1	2.0	2.0	4.6	4.1	16.1	17.0	0.0	0.0	NA	NGW	2.17	0.000	0.005	
07/07/2022	AM	Ambient		1024				0.1		2.0		0.1		21.0		0.0	0.0	NA					
25/07/2022	AM	Ambient		998				0.1		2.0		0.1		20.7		0.0	0.0	NA					
		WS02	0.60 - 2.60			0.1	0.1	0.1	0.1	2.0	2.0	1.4	0.8	19.3	20.2	0.0	0.0	NA	NGW	2.60	0.000	0.001	
		WS03	1.00 - 2.00			0.1	0.1	0.1	0.1	2.0	2.0	1.0	0.6	19.6	20.4	0.0	0.0	NA	NGW	2.06	0.000	0.001	
		WS04	1.00 - 4.00			0.1	0.1	0.1	0.1	2.0	2.0	4.3	4.1	17.3	17.5	0.0	0.0	NA	2.05	3.55	0.000	0.004	
		WS07	1.00 - 5.00			0.1	0.1	0.1	0.1	2.0	2.0	8.5	8.2	11.9	12.2	0.0	0.0	NA	3.26	4.90	0.000	0.009	
25/07/2022	AM	Ambient		998				0.1		2.0		0.1		20.7		0.0	0.0	NA					
16/08/2022	AM	Ambient		1002				0.1		2.0		0.1		20.5		0.0	0.0	NA					
		WS02	0.60 - 2.60			0.1	0.1	0.1	0.1	2.0	2.0	1.0	0.2	18.6	20.6	0.0	0.0	NA	NGW	2.60	0.000	0.001	
		WS03	1.00 - 2.00			0.1	0.1	0.1	0.1	2.0	2.0	2.9	0.7	17.6	18.6	0.0	0.0	NA	NGW	2.06	0.000	0.003	
		WS04	1.00 - 4.00			0.1	0.1	0.1	0.1	2.0	2.0	5.1	1.0	17.7	18.5	0.0	0.0	NA	2.10	3.55	0.000	0.005	
		WS07	1.00 - 5.00			0.1	0.1	0.1	0.1	2.0	2.0	9.0	2.1	11.6	17.1	0.0	0.0	NA	3.16	4.90	0.000	0.009	
16/08/2022	AM	Ambient		1002				0.1		2.0		0.1		20.5		0.0	0.0	NA					

APPENDIX F

Waste Assessment Report

**Matthew Shore**

Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

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

t: 01923 225404**f:** 01923 237404**e:** reception@i2analytical.com**e:** m.shore@brownfield-solutions.co.uk

Analytical Report Number : 22-67992

Project / Site name:	Lowry House Chortlton	Samples received on:	28/06/2022
Your job number:	C5061	Samples instructed on/ Analysis started on:	28/06/2022
Your order number:		Analysis completed by:	07/07/2022
Report Issue Number:	1	Report issued on:	07/07/2022
Samples Analysed:	2 10:1 WAC samples		

Signed:

Joanna Wawrzeczko
Reporting Specialist
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

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.

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	22-67992						
					Client: BSL		
Location	Lowry House Chorlton						
Lab Reference (Sample Number)	2330871 / 2330872				Landfill Waste Acceptance Criteria		
					Limits		
Sampling Date	23/06/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS07						
Depth (m)	0.20-0.40						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	1.9				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) ^{EH, ID, CU, AL}	100				500	--	--
Total PAH (WAC-17) (mg/kg)	8.92				100	--	--
pH (units)**	8.3				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	8.0				--	To be evaluated	To be evaluated
Eluate Analysis		10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)		mg/l		mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0104			0.0989	0.5	2	25
Barium *	0.0308			0.295	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0019			0.019	0.5	10	70
Copper *	0.019			0.18	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0074			0.0710	0.5	10	30
Nickel *	0.0041			0.039	0.4	10	40
Lead *	0.012			0.11	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.013			0.13	4	50	200
Chloride *	3.8			36	800	15000	25000
Fluoride	0.62			5.9	10	150	500
Sulphate *	16			150	1000	20000	50000
TDS*	64			610	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	10.9			104	500	800	1000
Leach Test Information							
Stone Content (%)	37						
Sample Mass (kg)	0.30						
Dry Matter (%)	98						
Moisture (%)	1.8						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.					** = UKAS accredited (liquid eluate analysis only)		
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation					** = MCERTS accredited		

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



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Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.

This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



Analytical Report Number : 22-67992
Project / Site name: Lowry House Chortlton

* 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 *
2330871	WS07	None Supplied	0.20-0.40	Brown sand with rubble.
2330873	WS02	None Supplied	0.50-0.70	Brown loam and sand with rubble.

Analytical Report Number : 22-67992

Project / Site name: Lowry House Chortlton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
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.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025

Analytical Report Number : 22-67992

Project / Site name: Lowry House Chortlton

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' 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.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total



Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



OXDSH-1V8A3-6HQ32

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

Lowry House, Chorlton

Description/Comments

Project

C5061

Site

Lowry House, Chorlton

Classified by

Name:
Matthew Shore
Date:
11 Jul 2022 13:03 GMT
Telephone:
01606334844

Company:
Brownfield Solutions Limited
Brownfield Solutions Ltd
173-183 Witton Street
Northwich
CW9 5LP

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course
Hazardous Waste Classification

Date
07 Oct 2021

Next 3 year Refresher due by Oct 2024

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS07	0.20-0.40	Non Hazardous		2
2	WS02	0.50-0.70	Hazardous	HP 7, HP 11	4
3	WS01	0.40-0.50	Non Hazardous		7
4	WS02[2]	0.20-0.40	Non Hazardous		9
5	WS03	0.40-0.60	Non Hazardous		11
6	WS08	0.30-0.60	Non Hazardous		13

Related documents

#	Name	Description
1	BSL Suite	waste stream template used to create this Job

Report

Created by: Matthew Shore

Created date: 11 Jul 2022 13:03 GMT

Appendices

	Page
Appendix A: Classifier defined and non GB MCL determinands	15
Appendix B: Rationale for selection of metal species	16
Appendix C: Version	16



Classification of sample: WS07

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS07	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.20-0.40 m	
Moisture content:	
1.8%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 1.8% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				8 pH		8 pH	8pH		
2	arsenic { arsenic trioxide }				9.8 mg/kg	1.32	12.706 mg/kg	0.00127 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				16 mg/kg	1.462	22.964 mg/kg	0.0023 %	✓	
		215-160-9	1308-38-9							
6	copper { dicopper oxide; copper (I) oxide }				18 mg/kg	1.126	19.901 mg/kg	0.00199 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	68 mg/kg	1.56	104.158 mg/kg	0.00668 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel dihydroxide }				14 mg/kg	1.579	21.715 mg/kg	0.00217 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	selenium { selenium compounds with the exception of cadmium selenosulfide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	zinc { zinc chromate }				51 mg/kg	2.774	138.935 mg/kg	0.0139 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	naphthalene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9							
15	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		0.72 mg/kg		0.707 mg/kg	0.0000707 %	✓	
17	anthracene	204-371-1	120-12-7		0.34 mg/kg		0.334 mg/kg	0.0000334 %	✓	
18	fluoranthene	205-912-4	206-44-0		1.7 mg/kg		1.669 mg/kg	0.000167 %	✓	
19	pyrene	204-927-3	129-00-0		1.7 mg/kg		1.669 mg/kg	0.000167 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		0.74 mg/kg		0.727 mg/kg	0.0000727 %	✓	
21	chrysene	601-048-00-0	205-923-4		0.72 mg/kg		0.707 mg/kg	0.0000707 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.64 mg/kg		0.628 mg/kg	0.0000628 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.48 mg/kg		0.471 mg/kg	0.0000471 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.72 mg/kg		0.707 mg/kg	0.0000707 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.36 mg/kg		0.354 mg/kg	0.0000354 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		0.48 mg/kg		0.471 mg/kg	0.0000471 %	✓	
28	TPH (C6 to C40) petroleum group		TPH		304 mg/kg		298.528 mg/kg	0.0299 %	✓	
29	benzene	601-020-00-8	200-753-7		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
30	toluene	601-021-00-3	203-625-9		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
31	ethylbenzene	601-023-00-4	202-849-4		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
Total:								0.0595 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1 Only the metal concentration has been used for classification	

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous property to non hazardous because The absence of a free draining liquid and the relatively low concentrations of short-chain hydrocarbons reported indicates that this hazard property is not applicable to this waste.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0299%)



Classification of sample: WS02

 **Hazardous Waste**
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50-0.70 m	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
2.7%	
(wet weight correction)	

Hazard properties

HP 7: Carcinogenic "waste which induces cancer or increases its incidence"

Hazard Statements hit:

Carc. 1B; H350 "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.373%)

HP 11: Mutagenic "waste which may cause a mutation, that is a permanent change in the amount or structure of the genetic material in a cell"

Hazard Statements hit:

Muta. 1B; H340 "May cause genetic defects [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.373%)

Determinands

Moisture content: 2.7% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	pH				8.3	pH		8.3	pH	8.3 pH		
2	arsenic { arsenic trioxide }				4.8	mg/kg	1.32	6.166	mg/kg	0.000617 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	0.2	mg/kg	1.285	0.25	mg/kg	0.0000195 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				21	mg/kg	1.462	29.864	mg/kg	0.00299 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				21	mg/kg	1.126	23.005	mg/kg	0.0023 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead chromate }			1	25	mg/kg	1.56	37.943	mg/kg	0.00243 %	✓	
	082-004-00-2	231-846-0	7758-97-6									
8	mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									



#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number								
9		nickel { nickel dihydroxide }				35 mg/kg	1.579	53.79 mg/kg	0.00538 %			
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD	
	034-002-00-8											
11		zinc { zinc chromate }				38 mg/kg	2.774	102.571 mg/kg	0.0103 %			
	024-007-00-3	236-878-9	13530-65-9									
12		naphthalene				1.8 mg/kg		1.751 mg/kg	0.000175 %			
	601-052-00-2	202-049-5	91-20-3									
13		acenaphthylene				1.1 mg/kg		1.07 mg/kg	0.000107 %			
		205-917-1	208-96-8									
14		acenaphthene				11 mg/kg		10.703 mg/kg	0.00107 %			
		201-469-6	83-32-9									
15		fluorene				13 mg/kg		12.649 mg/kg	0.00126 %			
		201-695-5	86-73-7									
16		phenanthrene				70 mg/kg		68.11 mg/kg	0.00681 %			
		201-581-5	85-01-8									
17		anthracene				23 mg/kg		22.379 mg/kg	0.00224 %			
		204-371-1	120-12-7									
18		fluoranthene				73 mg/kg		71.029 mg/kg	0.0071 %			
		205-912-4	206-44-0									
19		pyrene				63 mg/kg		61.299 mg/kg	0.00613 %			
		204-927-3	129-00-0									
20		benzo[a]anthracene				41 mg/kg		39.893 mg/kg	0.00399 %			
	601-033-00-9	200-280-6	56-55-3									
21		chrysene				28 mg/kg		27.244 mg/kg	0.00272 %			
	601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				36 mg/kg		35.028 mg/kg	0.0035 %			
	601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				16 mg/kg		15.568 mg/kg	0.00156 %			
	601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				33 mg/kg		32.109 mg/kg	0.00321 %			
	601-032-00-3	200-028-5	50-32-8									
25		indeno[123-cd]pyrene				16 mg/kg		15.568 mg/kg	0.00156 %			
		205-893-2	193-39-5									
26		dibenz[a,h]anthracene				4.8 mg/kg		4.67 mg/kg	0.000467 %			
	601-041-00-2	200-181-8	53-70-3									
27		benzo[ghi]perylene				18 mg/kg		17.514 mg/kg	0.00175 %			
		205-883-8	191-24-2									
28		TPH (C6 to C40) petroleum group				3835 mg/kg		3731.455 mg/kg	0.373 %			
			TPH									
29		benzene				<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
	601-020-00-8	200-753-7	71-43-2									
30		toluene				<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
	601-021-00-3	203-625-9	108-88-3									
31		ethylbenzene				<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
	601-023-00-4	202-849-4	100-41-4									
Total:									0.441 %			



Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because The absence of a free draining liquid and the relatively low concentrations of short-chain hydrocarbons reported indicates that this hazard property is not applicable to this waste.

Hazard Statements hit:

Fam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.373%)



Classification of sample: WS01

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS01	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.40-0.50 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
3.9%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 3.9% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				9 pH		9 pH	9pH		
2	arsenic { arsenic trioxide }				3 mg/kg	1.32	3.806 mg/kg	0.000381 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	cadmium { cadmium sulfide }			1	0.2 mg/kg	1.285	0.247 mg/kg	0.0000192 %	✓	
	048-010-00-4	215-147-8	1306-23-6							
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				18 mg/kg	1.462	25.282 mg/kg	0.00253 %	✓	
		215-160-9	1308-38-9							
6	copper { dicopper oxide; copper (I) oxide }				25 mg/kg	1.126	27.049 mg/kg	0.0027 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	17 mg/kg	1.56	25.483 mg/kg	0.00163 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel dihydroxide }				45 mg/kg	1.579	68.305 mg/kg	0.00683 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	zinc { zinc chromate }				41 mg/kg	2.774	109.304 mg/kg	0.0109 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	naphthalene				0.26 mg/kg		0.25 mg/kg	0.000025 %	✓	
	601-052-00-2	202-049-5	91-20-3							
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9							
15	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		0.51 mg/kg		0.49 mg/kg	0.000049 %	✓	
17	anthracene	204-371-1	120-12-7		0.27 mg/kg		0.259 mg/kg	0.0000259 %	✓	
18	fluoranthene	205-912-4	206-44-0		1.1 mg/kg		1.057 mg/kg	0.000106 %	✓	
19	pyrene	204-927-3	129-00-0		1.4 mg/kg		1.345 mg/kg	0.000135 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		0.83 mg/kg		0.798 mg/kg	0.0000798 %	✓	
21	chrysene	601-048-00-0	205-923-4		0.95 mg/kg		0.913 mg/kg	0.0000913 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1.1 mg/kg		1.057 mg/kg	0.000106 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.55 mg/kg		0.529 mg/kg	0.0000529 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.83 mg/kg		0.798 mg/kg	0.0000798 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.48 mg/kg		0.461 mg/kg	0.0000461 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		0.84 mg/kg		0.807 mg/kg	0.0000807 %	✓	
Total:								0.0263 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Classification of sample: WS02[2]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02[2]	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.20-0.40 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
4.7%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 4.7% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				8.1 pH		8.1 pH	8.1 pH		
2	arsenic { arsenic trioxide }				11 mg/kg	1.32	13.841 mg/kg	0.00138 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				13 mg/kg	1.462	18.107 mg/kg	0.00181 %	✓	
		215-160-9	1308-38-9							
6	copper { dicopper oxide; copper (I) oxide }				29 mg/kg	1.126	31.116 mg/kg	0.00311 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	120 mg/kg	1.56	178.38 mg/kg	0.0114 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				0.4 mg/kg	1.353	0.516 mg/kg	0.0000516 %	✓	
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel dihydroxide }				13 mg/kg	1.579	19.568 mg/kg	0.00196 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	zinc { zinc chromate }				73 mg/kg	2.774	192.995 mg/kg	0.0193 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	naphthalene				0.31 mg/kg		0.295 mg/kg	0.0000295 %	✓	
	601-052-00-2	202-049-5	91-20-3							
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	acenaphthene				0.75 mg/kg		0.715 mg/kg	0.0000715 %	✓	
		201-469-6	83-32-9							
15	fluorene				0.49 mg/kg		0.467 mg/kg	0.0000467 %	✓	
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		4.5 mg/kg		4.289 mg/kg	0.000429 %	✓	
17	anthracene	204-371-1	120-12-7		1.5 mg/kg		1.43 mg/kg	0.000143 %	✓	
18	fluoranthene	205-912-4	206-44-0		6.5 mg/kg		6.195 mg/kg	0.000619 %	✓	
19	pyrene	204-927-3	129-00-0		6.2 mg/kg		5.909 mg/kg	0.000591 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	2.9 mg/kg		2.764 mg/kg	0.000276 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	3.1 mg/kg		2.954 mg/kg	0.000295 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	3.5 mg/kg		3.336 mg/kg	0.000334 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	1.1 mg/kg		1.048 mg/kg	0.000105 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	2.6 mg/kg		2.478 mg/kg	0.000248 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.5 mg/kg		1.43 mg/kg	0.000143 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.36 mg/kg		0.343 mg/kg	0.0000343 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		1.7 mg/kg		1.62 mg/kg	0.000162 %	✓	
Total:								0.043 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
•	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification



Classification of sample: WS03

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS03	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.40-0.60 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
9.8%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 9.8% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	• pH				8.1 pH		8.1 pH	8.1 pH		
2	• arsenic { arsenic trioxide }				12 mg/kg	1.32	14.291 mg/kg	0.00143 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	• cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
4	• chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	• chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				14 mg/kg	1.462	18.457 mg/kg	0.00185 %	✓	
		215-160-9	1308-38-9							
6	• copper { dicopper oxide; copper (I) oxide }				65 mg/kg	1.126	66.011 mg/kg	0.0066 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	• lead { lead chromate }			1	110 mg/kg	1.56	154.765 mg/kg	0.00992 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	• mercury { mercury dichloride }				0.5 mg/kg	1.353	0.61 mg/kg	0.000061 %	✓	
	080-010-00-X	231-299-8	7487-94-7							
9	• nickel { nickel dihydroxide }				12 mg/kg	1.579	17.097 mg/kg	0.00171 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	• selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	• zinc { zinc chromate }				120 mg/kg	2.774	300.274 mg/kg	0.03 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	• naphthalene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
13	• acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	• acenaphthene				0.9 mg/kg		0.812 mg/kg	0.0000812 %	✓	
		201-469-6	83-32-9							
15	• fluorene				0.66 mg/kg		0.595 mg/kg	0.0000595 %	✓	
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		6.2 mg/kg		5.592 mg/kg	0.000559 %	✓	
17	anthracene	204-371-1	120-12-7		1.9 mg/kg		1.714 mg/kg	0.000171 %	✓	
18	fluoranthene	205-912-4	206-44-0		9.1 mg/kg		8.208 mg/kg	0.000821 %	✓	
19	pyrene	204-927-3	129-00-0		8.7 mg/kg		7.847 mg/kg	0.000785 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	3.8 mg/kg		3.428 mg/kg	0.000343 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	3.8 mg/kg		3.428 mg/kg	0.000343 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	4.3 mg/kg		3.879 mg/kg	0.000388 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	1.3 mg/kg		1.173 mg/kg	0.000117 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	3.3 mg/kg		2.977 mg/kg	0.000298 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.7 mg/kg		1.533 mg/kg	0.000153 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.49 mg/kg		0.442 mg/kg	0.0000442 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		2 mg/kg		1.804 mg/kg	0.00018 %	✓	
Total:								0.0563 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Classification of sample: WS08

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS08	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.30-0.60 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
3.1%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 3.1% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	• pH		PH		8.4 pH		8.4 pH	8.4 pH		
2	• arsenic { arsenic trioxide }				3 mg/kg	1.32	3.838 mg/kg	0.000384 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	• cadmium { cadmium sulfide }			1	0.3 mg/kg	1.285	0.374 mg/kg	0.0000291 %	✓	
	048-010-00-4	215-147-8	1306-23-6							
4	• chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	• chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				13 mg/kg	1.462	18.411 mg/kg	0.00184 %	✓	
		215-160-9	1308-38-9							
6	• copper { dicopper oxide; copper (I) oxide }				9.6 mg/kg	1.126	10.473 mg/kg	0.00105 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	• lead { lead chromate }			1	18 mg/kg	1.56	27.206 mg/kg	0.00174 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	• mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	• nickel { nickel dihydroxide }				15 mg/kg	1.579	22.958 mg/kg	0.0023 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	• selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	• zinc { zinc chromate }				31 mg/kg	2.774	83.333 mg/kg	0.00833 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	• naphthalene				0.3 mg/kg		0.291 mg/kg	0.0000291 %	✓	
	601-052-00-2	202-049-5	91-20-3							
13	• acenaphthylene				1.8 mg/kg		1.744 mg/kg	0.000174 %	✓	
		205-917-1	208-96-8							
14	• acenaphthene				37 mg/kg		35.853 mg/kg	0.00359 %	✓	
		201-469-6	83-32-9							
15	• fluorene				37 mg/kg		35.853 mg/kg	0.00359 %	✓	
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
16	phenanthrene	201-581-5	85-01-8		160 mg/kg		155.04 mg/kg	0.0155 %		✓	
17	anthracene	204-371-1	120-12-7		81 mg/kg		78.489 mg/kg	0.00785 %		✓	
18	fluoranthene	205-912-4	206-44-0		160 mg/kg		155.04 mg/kg	0.0155 %		✓	
19	pyrene	204-927-3	129-00-0		170 mg/kg		164.73 mg/kg	0.0165 %		✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	120 mg/kg		116.28 mg/kg	0.0116 %		✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	79 mg/kg		76.551 mg/kg	0.00766 %		✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	96 mg/kg		93.024 mg/kg	0.0093 %		✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	36 mg/kg		34.884 mg/kg	0.00349 %		✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	84 mg/kg		81.396 mg/kg	0.00814 %		✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		38 mg/kg		36.822 mg/kg	0.00368 %		✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	10 mg/kg		9.69 mg/kg	0.000969 %		✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		40 mg/kg		38.76 mg/kg	0.00388 %		✓	
Total:									0.128 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

• pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

• chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

• acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

• fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

• anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

■ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

■ **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case species based on hazard statements

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead chromate}

Worst case species based on hazard statements

mercury {mercury dichloride}

Worst case species based on hazard statements

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium sulposelenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements

zinc {zinc chromate}

Worst case species based on hazard statements

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2022.189.5236.9830 (08 Jul 2022)
HazWasteOnline Database: 2022.189.5236.9830 (08 Jul 2022)



This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK:
2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021

APPENDIX G

Detailed UXO Desk Study



BRIMSTONE
SITE INVESTIGATION

**DETAILED
UXO RISK ASSESSMENT**

INTEGRITY



PROFESSIONALISM



KNOWLEDGE



STAGE 2 DETAILED UXO RISK ASSESSMENT

Client: Brownfield Solutions Ltd.
Project Ref: BROW69R
Site: Lowry House, Chorlton
Report Ref: DRA-22-1423-BROW69R-LowryHouse,Chorlton
Revision: 0
Status: Final
Release Date: 17th August 2022

Written By:	Chris Birch	Project Researcher	chris.birch@brimstoneuxo.com
Reviewed By:	Will Hunnisett	Research Supervisor	will.hunnisett@brimstoneuxo.com
Authorised By:	Aaron Florence	Managing Director	

EXECUTIVE SUMMARY

RESULT: Brimstone Site Investigation concludes that UXO poses a **LOW-MODERATE RISK** to the proposed works.

THE SITE: The Site (approximately centred on the National Grid Ref: SJ 82518 93243) is located in the Chorlton-Cum-Hardy district of Manchester, approximately 300m north-east of Barlow Moor Road tram station.

The Site comprises the large multi-storey office building, Lowry House, surrounded by areas of hardstanding car park and footpaths. There are small areas of open ground with mature vegetation interspersed throughout the Site.

It is bound to the north by Chorlton High School, to the east by Mauldeth Road West, to the south by Nell Lane and to the west by areas of hard surfaced car park, and Hough End Hall.

THE PROPOSED WORKS: A GI is proposed, comprising window sample drilling to 5.45m bgl, and cable percussive drilling to 12m bgl.

At the time of writing, BSI was not made aware of any proposed future developments on Site.

UXO RISK ASSESSMENT:

German UXO:

- During WWII, the Site was situated within the County Borough of Manchester, which experienced a low-to-moderate density bombing campaign according to Home Office statistics. Although Greater Manchester was the 11th most heavily bombed British conurbation during WWII, the Site was situated >3km to the south of the main Luftwaffe target areas (Manchester city centre, Trafford Park, Salford Docks) and therefore likely experienced a lower localised bombing density.
- However, a local bomb plot map confirms at least three raids occurred within a 500m radius of the Site, resulting in eight HE bomb strikes and one incendiary bombing incident. None appear to have affected the Site itself; however, two incidents are recorded in the Site's immediate surrounds, approximately 40m and 100m to the north-east respectively.
- Post-WWII aerial photography displays evidence of two areas of ground disturbance in the approximate locations of both the abovementioned bomb strikes. Anecdotal evidence refers to a bomb strike occurring 'to the rear left corner of the plot of the Hall itself' – the hall being Hough End Hall, situated to the immediate north-east of the Site. It is considered likely that the incident referred to in the anecdotal source is that recorded 100m to the north-east in the abovementioned mapping.
- Analysis of the local bomb plot map has identified two potential linear bomb-sticks (individual aircraft bombloads) in the local area and therefore the flightpath orientations of the aircraft involved. Note, although unconfirmed, given the recorded date of the incidents and their close proximity to one another, it is feasible that the two bomb-sticks were in fact one. This analysis confirms at least one potential occasion during which a UXB (unobserved and unplotted) could have been released over and landed on / adjacent to the Site.
- At the outset of WWII, the Site was occupied by a combination of structures and undeveloped land; anecdotal evidence suggests that the Site area was encompassed by a farm. It is anticipated that the Site experienced at least an intermittent level of access throughout WWII, owing to the lack of damage occurring to the structures, although this will have depended on the landowner. Additionally, the structures could have been temporarily evacuated for a period.
- Whilst any UXB strike to the structures on Site would have caused incontrovertible evidence of its incidence and have been removed at the time, it is feasible that a UXB could have fallen unnoticed within the open areas of the Site. Even if access levels had been frequent and regular, the diameter of the smallest German HE bomb (which was also the most commonly deployed over Britain) was just 200mm, creating a small entry hole which could be easily obscured in vegetation.

- Furthermore, had such a scenario occurred and the UXB fell within a certain impact angle window, the bomb could have penetrated to several meters depth and come to rest under the structures present within the Site boundary, due to the J-Curve (lateral offset) Effect. However, given the lack of evidence suggesting such strikes occurred, this is not considered a likely occurrence.
- To summarise, although a potential occasion during which an unrecorded UXB was released over / adjacent to the Site has been identified, the risk of encountering UXBs on Site is not significantly elevated above the background risk for this area of the country given the evidence to suggest the Site was not subject to bombing / bomb damage. As such, the risk of encountering UXBs on Site has been assessed as **Low-Moderate**. Note, the risk of encountering UXBs can be considered mitigated in the specific locations and to the specific depths of previous post-WWII intrusive works.

British / Allied UXO:

- 28 permanent HAA batteries were active within range of the Site during WWII. Luftwaffe activity was on occasion frequent and intense over the wider area and therefore these guns may have expended a vast quantity of ammunition. Consequently, it is quite possible that an unexploded AA shell struck the Site. However, for the same reason as above, depending on where it occurred, any such UXO may have been reported and removed at the time.
- No evidence of historic military activity within the Site boundary has been found and it is highly unlikely that any has occurred historically. Consequently, the risk from associated UXO is low.

Likelihood of UXO Remaining and UXO Encounter:

- Post-WWII, all structures present on Site identified in pre- and post-WWII OS mapping have been cleared. Lowry House has been constructed in the northern extent of the Site, whilst hardstanding has been laid throughout in the form of car parking areas and accessways. Areas of soft landscaping and vegetation are also present in peripheral areas.
- The risk associated with any deep buried German UXBs (>2m bgl) will have only been mitigated at the locations and down to the maximum depths of the foundations associated with Lowry House. The clearance of the WWII-era structures i.e. grubbing out of foundations will have mitigated the risk of encountering UXO to shallow depths (1-2m bgl) in these locations only. The laying of hardstanding and the soft landscaping will have disturbed WWII-era soil to very shallow depths (<1m bgl).
- As deep intrusions are planned, a risk pathway exists between these works and deep buried (large) German UXBs in areas not previously exposed to such works. It is also conceivable that a UXB could be encountered during any shallow mechanical excavations beneath the existing ground level in this location, or in between / beneath previous post-WWII excavations. However, as aforementioned, it should be noted that the risk of encountering UXBs is not considered significantly elevated above the background level for this area of the country.

RECOMMENDED RISK MITIGATION MEASURES: The measures detailed below are recommended to mitigate the risk to ALARP level.

Risk Mitigation Measure	Recommendation
UXO Safety Awareness Briefings	Prior to all intrusive works commencing.

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- FIGURE 6:** Manchester Bomb and Damage Map
- FIGURE 7:** Manchester Blitz Map (22nd-24th December 1940) – Civilian Deaths

APPENDICES

- APPENDIX 1:** Recent UXO Incidents and Historical Analysis
- APPENDIX 2:** Data Sheets - German WWII Air-Delivered Munitions
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- APPENDIX 4:** Glossary
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QUALITY MANAGEMENT

Brimstone Site Investigation is committed to the provision of UXO risk mitigation services, including the safe removal and disposal, in the UK and overseas. Since our inception in 2016 it has been our goal to provide unsurpassed UXO risk mitigation services. Brimstone is a client-driven organisation, we aim to provide the client the services they need, to the agreed requirement, in accordance with national and international standards.

We are committed to providing a safe, cost-effective and quality service, underpinned by our three core values;

- Integrity in advice, information and the manner in which we conduct ourselves and our operations,
- Professionalism in the way we handle our operations, people and processes, and
- Knowledge in new skills and information, to ensure we remain at the forefront of innovation and strategy.

We are committed to the applicable requirements of the ISO 9001 standards. We set and review quality monitoring objectives to measure the performance of our quality management system. Brimstone wholly endorses the ethos of 'continual improvement efforts' and allocates resources to meet this requirement.

This policy applies to the whole of the Brimstone Site Investigation Ltd services and affects roles from the managing director down. All staff are responsible for helping manage quality, seeking improvement through constant review, and by encouraging supplier and subcontractor involvement. We are committed to achieving customer satisfaction using quality procedures, which will be operated to meet or exceed the applicable requirements of ISO 9001.



Aaron Florence

Founder and Managing Director

Brimstone Site Investigation Ltd.

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The contents of this report are confidential. This report has been prepared for the use of the client and shall not be distributed or made available to any other company or person without the knowledge and written consent of either the client or Brimstone Site Investigation.



1 INTRODUCTION

1.1 Background

Brownfield Solutions Ltd. (the Client) has commissioned BSI to carry out a Stage 2 Detailed Unexploded Ordnance Risk Assessment (DRA) of the proposed redevelopment works at the Lowry House, Chorlton site (the Site).

1.2 Legislation

There are no regulations that specifically govern the UXO risk mitigation industry in the UK. There are however two pieces of legislation that require consideration. It is industry best practice (and common sense) to frame your site in the context of UXO, and to put in place measures to protect people from risks. In 2009, CIRIA published Unexploded Ordnance (UXO) - A Guide for the Construction Industry C681. This publication, though not legally binding, provides the gold-standard framework to which UXO and construction companies operate.

1.2.1 Construction Design and Management Regulations (CDM) 2015

The regulations identify the client, the CDM coordinator, the designer, and the principal contractor as responsible parties. Under the regulations, responsible parties are held accountable for the way a construction project is managed and for the health and safety of workers. Responsible parties must:

- Provide an appropriate assessment of potential UXO risks, or ensure an assessment is completed by another party.
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks.
- Ensure the preparation of an emergency response plan.

1.2.2 The Health and Safety at Work Act 1974

The Health and Safety at Work Act 1974 had a transformative impact on health and safety, saving thousands of lives since its enactment. Employers must consider their employees, workers not in their employment, and members of the public. The act places a duty on every employer 'as far as is reasonably practicable' to protect workers from risks. It also says that information must be provided about aspects of health and safety that affect their role.

1.3 Commercial Contractor and the Authorities

1.3.1 Commercial Contractors

If your site has been given a moderate or high-risk rating, then control measures will be recommended. The measures will be specific to the scope of works on site, usually in relation to the depth and extent of excavations, piling and similar activities. There are a range of different methods at BSI's disposal, including:

- Non-intrusive surveying (including drone surveying)
- Intrusive surveying
- Search and clear
- Watching brief
- Support to geotechnical investigations
- Target investigation
- Site-specific training packages
- Site safety briefings

Our UXO Engineers can assess suspicious items on site when they are found. This will avoid unnecessary site evacuations. If our engineer(s) decide the item is UXO, they will coordinate with the authorities, manage disruptions, and advise on control measures, such as evacuations and a cordon.

1.3.2 UK Authorities

If BSI is not on site and a suspicious item is found, the local police must be immediately called on the non-emergency number. Police will visit the site. They will then inform the Joint Services Explosive Ordnance Disposal (JSEOD) office, which will coordinate the callout of an army or navy response team.

A precautionary cordon will initially be put into effect, with possible evacuation of homes and businesses, road and rail closures. The cordon may be extended following the advice from JSEOD's response team.

To manage their resources, JSEOD triages incidents. A consideration of the type, size and location of the UXO is made. If an incident is not given a high priority rating, a team may not be available for up to two days following the initial report.

The use of JSEOD is under the Military Aid to Civil Authorities (MACA) framework, therefore the budget and personnel is limited, and there are no statutory obligations made of the MOD. Often the MOD will recommend involvement of a commercial UXO contractor to manage the ongoing risk – this is especially true of former airfields and training areas where contact with land service ammunition can be frequent.

1.4 UXO Risk in the UK

Fortunately, to the best of our knowledge, there has not been a single post-war incident in the UK where a construction worker has been killed or injured because of an item of UXO exploding. There have been cases in mainland Europe where UXO had been struck and then exploded, killing workers. In 2019 a WWII general purpose bomb spontaneously detonating in a field north of Frankfurt, Germany.

However, the incident in Frankfurt is not comparable to the UK, due to the way different countries manufactured ordnance. Bombs made in different countries have different associated hazards. British WWII bombs, for example, have a fuzing system which uses chemicals which makes them very unsafe. Please see **APPENDIX 1** for recent examples of UK UXO incidents.

Between 2013 and 2016 JSEOD responded to 7,500 callouts. These callouts range from falsely identified objects, inert objects, small items of UXO and large WWII German unexploded bombs (UXBs). Each year the construction industry inadvertently unearths UXO; often this goes unreported. UXO contamination comes from three main sources:

- **Enemy action:** during WWI and WWII the air forces of Germany, and to a lesser extent Italy, bombed targets throughout the UK. The German navy bombarded several coastal targets in eastern England during WWI and then in WWII German long-range artillery on the French coast bombarded parts of Kent.
- **Allied military activity:** during WWI and WWII several Allied nations used the UK as a staging area for military action in the European Theatre; predominantly the US and Canada.
- **UK military activity:** domestic British Army, Royal Air Force (RAF) and Royal Navy (RN) training activities during peacetime and conflict as well as anti-aircraft gun and rocket batteries during WWI and WWII.

1.5 UXO Detonations

A detonation is a violent chemical reaction which creates a huge volume of gas. This reaction appears to happen instantaneously – the velocity of the shockwave moving is up to 9000m per second. This chemical reaction is started using a small amount of very sensitive explosives called primary explosives. These types of explosives are highly sensitive to shock, friction, heat, and spark. As the explosive charge undergoes high order decomposition (detonation), the brisance, or shattering effect, causes the casing to splinter, projecting razor-sharp shrapnel across long distances.

The blast wave effect and the shrapnel effect can cause significant damage. Calculating safety distances is a complex process. As a rule of thumb, in open ground, a 250kg explosive charge (as would be found inside a typical 500kg bomb) would require an omnidirectional safety distance of at least 1.6km.

Bombs work by amplifying the explosive charge from the sensitive primary explosive through to the main charge or fill of the item. This process is called an explosive train, if any link in that chain is broken, the item will fail to

function as intended. This can be due to mechanical, electrical, or manufacturing tolerances or faults. Amongst other reasons, detonation of UXO could occur under the following circumstances:

- **UXO body impact:** A substantial impact onto the main body of a UXO; borehole rigs, piling rigs, jack hammers and mechanical excavator buckets.
- **Fuse impact:** Environmental conditions during decades of burial can result in the primary explosives located in the fuse pocket to crystallise and become shock sensitive. It would then take a relatively small impact or friction impact to cause the fuse to function and detonate the UXO.
- **Re-starting a timer:** A small proportion of German WWII bombs used clockwork fuses. In 2002 an Army EOD Engineer reported that the clockwork fuse in a UXB re-started. Decades of burial cause substantial corrosion in WWII German UXBs and therefore an incident such as this is extremely rare.

2 ASSESSMENT METHODOLOGY

2.1 Introduction

This assessment has been produced in accordance with the relevant CIRIA guidelines; *Unexploded Ordnance (UXO) - A Guide for the Construction Industry C681* (published in 2009). CIRIA C681 is a publication which originated from round table best practice discussions from industry leaders.

2.2 SPRC Risk Model

The Source, Pathway, Receptor, Consequence (SPRC) risk model can be applied to buried UXO as follows:

- **Sources:** UK and allied UXO sources include military firing ranges, bases, storage depots, munitions factories, anti-aircraft batteries, amongst others. There are many wartime causes of UXO contamination. The source for enemy contamination is overwhelmingly from WWII German air raids.
- **Pathways:** the pathway describes how the UXO reaches receptors. Usually UXO is buried and therefore pathways can be any activity which involve breaking ground. Examples include ground investigation works, site enabling works and excavations.
- **Receptors:** receptors are the people, assets and infrastructure that can be adversely affected by UXO exposure. This includes site personnel, plant, equipment, buildings, the general public, , and the environment.
- **Consequence:** the consequences of an inadvertent UXO detonation are catastrophic. They include injury and loss of life, as well as damage to property. Fortunately, the likelihood of UXO detonating is low, even when it is uncovered during works. Another consequence to consider however is delays to works, which itself can be a risk.

2.3 Assessment Structure

In accordance with CIRIA C681 this assessment addresses the following considerations in the appropriate order:

- The likelihood that the site was contaminated with UXO.
- The type of UXO that could have contaminated the site, and their associated hazards.
- The likelihood that UXO remains on the site.
- Theoretical bomb penetration depths.
- The likelihood that UXO will be uncovered during the proposed works.
- Risk rating and risk mapping (as appropriate).
- Risk mitigation recommendations.

2.4 Information Sources

To complete this risk assessment BSI has gathered information from a wide range of sources. BSI's research team has completed detailed historical research, including access of original archived records. The following is a general list of information sources that are consulted during the research process:

- The National Archives,
- Local archive centres,
- Ministry of Defence,
- The Council for British Archaeology,
- Groundsure mapping services,
- Historical aerial photography (Historic England, Britain From Above, Bluesky),
- Google open source mapping,
- The British Geological Society,
- Open sources; published book, articles, web resources,
- Site specific information supplied by the Client,
- BSI's library and historical database, and
- BSI's former armed forces employees.

2.5 ALARP Principle

The ALARP (as low as reasonably practicable) principle corresponds to the actions that should be taken to reduce risks. The term 'ALARP' is in the Health and Safety at Work Act 1974, which says that risks must be controlled in a reasonable way.

Infinite time, effort and money could be spent trying to eliminate risk entirely. HSE uses the example that spending £1m to prevent five employees bruising their knees is disproportionate, whereas spending the same amount to prevent an explosion which could kill 150 people is proportionate.

Using this principle, BSI aims to reduce client costs by recommending strategies that are proportionate to the assessed risks, if any elevated risk is found at all.

2.6 Risk Tolerances

The BSI risk assessment process divides UXO risk into two tolerances:

- **Tolerable:** negligible risk or low risk ratings are tolerable. Where the risk cannot be completely discounted, it may be a useful strategy to opt for a low-cost measure, such as a UXO safety briefing from a qualified UXO engineer.
- **Intolerable:** moderate risk or high-risk ratings are intolerable. Proactive risk mitigation measures should be put in place. Various strategies are at BSI's disposal to meet your project-specific needs.

2.7 Reliance and Limitations

This report has been prepared using published information and information provided by the Client. BSI is not liable for any information which has become available following the publication of this report. No third-party liability or duty of care is extended. Any third-party using information contained in this assessment do so at their own risk.

3 THE PROJECT

3.1 The Site

The Site (approximately centred on the National Grid Ref: SJ 82518 93243) is located in the Chorlton-Cum-Hardy district of Manchester, approximately 300m north-east of Barlow Moor Road tram station.

The Site comprises the large multi-storey office building, Lowry House, surrounded by areas of hardstanding car park and footpaths. There are small areas of open ground with mature vegetation interspersed throughout the Site.

It is bound to the north by Chorlton High School, to the east by Mauldeth Road West, to the south by Nell Lane and to the west by areas of hard surfaced car park, and Hough End Hall.

FIGURE 1: Site Location Maps **FIGURE 2:** Recent Aerial Photograph

3.2 The Proposed Works

A GI is proposed, comprising window sample drilling to 5.45m bgl, and cable percussive drilling to 12m bgl.

At the time of writing, BSI was not made aware of any proposed future developments on Site.

FIGURE 3: Existing Site Plan

4 SITE HISTORY

4.1 Introduction

Site-specific history can be assessed by reviewing historical mapping, historical aerial photography and by carrying out additional Site-specific research where appropriate. Below are descriptions of a selection of records relevant to the Site:

4.2 Mapping

Period	Map Date	Map Scale	Review
Pre-WWI	1904-1905	1:10,560	The Site is occupied by a combination of structures and open ground, comprising the Hough End Hall Estate. Anecdotal evidence suggests that these structures were associated with a farm on the estate. Hough End Hall itself is situated to the immediate north-west. An accessway intersects the Site in the north-east. An orchard is encompassed by the north-west border. A pond is partially encompassed by the south-east border.
WWI	1916	1:10,560	Although this map is of small scale and lacks detail, it can be said that no significant changes have occurred on Site.
Pre-WWII	1933	1:2,500	FIGURE 4.1: A small structure has been constructed in the southern extent of the boundary. No further changes are noted.
Post-WWII	1952	1:2,500	FIGURE 4.2: The orchard in the north-west appears to have been cleared. The pond in the south-east has been filled in. The structures in the south have been amalgamated into one structure. Widespread residential development has occurred to the east and south.

4.3 Aerial Photography

Period	Photo Date	Review
Post-WWII	22 nd July 1955	FIGURE 5: Note, the date of this image (approximately ten years post-WWII) means that evidence of bomb damage occurring may not be visible. The structures on Site and immediately adjacent (Houghend Hall) appear externally structurally intact. The open ground within the boundary does not display any evidence of ground disturbance occurring i.e. craters. However, two areas of potential ground disturbance have been highlighted to the north-west of the Site. The closest of these is approximately 40m north-west.

4.4 Additional Site-Specific History

Some sites will have been occupied by landmarks or significant buildings historically and in such cases specific written histories including significant wartime details are occasionally available in the public domain. In 1917, some of the land within the Hough End estate was requisitioned by the War Department for use as Alexandra Park aerodrome; the aerodrome was closed in 1924.¹ The aerodrome's location was approximately 300m east of the Site.

5 UXO RISK - GERMAN BOMBING

5.1 WWII Bombing History of the Site

5.1.1 Greater Manchester

Greater Manchester was home to a number of vital wartime industries during WWII, many of which were located in Trafford Park. Infrastructure of strategic importance was also present in the form of Manchester Docks and the Manchester Ship Canal.

Between 29th July 1940 and 30th July 1942, Greater Manchester experienced 41 air raids, most of which were small in scale, often executed by a solitary bomber. At least nine relatively insignificant raids were carried out during the autumn of 1940, with the first medium scale raid affecting a wide area, occurring on 28th August. On 1st October, a medium to heavy raid was executed.

The Luftwaffe mounted consecutive major attacks on the nights of 22nd/23rd and 23rd/24th December 1940 (the 'Christmas Blitz'); a major attack was a Luftwaffe designation for a raid delivering >100 tonnes of HE (in addition to incendiaries) to a target area. These left large areas of Manchester, Salford and Stretford devastated.

In total, these two attacks involved 441 German bombers dropping 272 tonnes of HE on the first night and 195 tonnes of HE on the second night. Seven conflagrations and 600 smaller fires were reported, the result of tens of thousands of small incendiary bombs (IBs). The Christmas Blitz caused the total destruction of >4,000 houses as well as serious damage to a further 12,000. 805 HE bombs were reported across Manchester, Salford, Stretford and Manchester Docks, including 134 UXBs.

During 1941, two additional major* raids was launched on 9th January and 1st June. Although each involved half as many aircraft as the 22nd December 1940 raid, they still delivered a further 208 tonnes of HE bombs and numerous IBs onto the city and surrounding area. Three medium scale raids were also mounted in 1941, during the spring.

*The fourth and final major raid actually only delivered 97 tonnes of HE. However, it is close enough to 100 tonnes to be considered 'major'.

¹ <https://www.forgottenairfields.com/airfield-alexandra-park-1024.html>

5.1.2 Site Specific

The Site is located approximately 3.5km south-east of Trafford Park, 3.75km south-east of Salford Docks and 5km south of Manchester city centre, the Luftwaffe's primary aiming points for indiscriminate air raids in the area. Therefore, in terms of individual targets, their proximity is more relevant than in other parts of the borough because the study area experienced less large-scale raids indiscriminate raids in comparison. No identified Luftwaffe bombing targets were located in close proximity to the Site area.

5.1.3 Bombing Decoy Sites

In mid-1940 bombing decoys were introduced. The decoys used either;

- A system of lighting to simulate an urban area or a military airfield's runway
- Deliberately started fires to simulate a previously bombed target
- Dummy buildings and vehicles to simulate a military facility

792 static decoy sites were built at 593 locations in Britain. They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. No decoys were operational within a significant radius of the Site during WWII. The closest was approximately 7.3km to the south-west.

5.2 WWII Bombing Records

5.2.1 Introduction

The bomb census recorded the location and type of bomb strikes to help with intelligence gathering and planning. It was compiled using information recorded by ARP wardens. These records were gathered by the Ministry of Home Security to calculate bombing density within administrative areas.

The bomb census was unreliable in the early stages of the war, though by 1941 procedures had been standardised. The quality of the census records also depended on where in the UK the records were produced. Some records are held at the National Archives and some are held at local borough archives.

Relevant records held at the National Archives and Manchester Library were obtained for this risk assessment.

5.2.2 Bombing Density Statistics

The table below records the Ministry of Home Security's bombing density calculation for the County Borough of Manchester. It gives a breakdown of the types of large German bombs reported and is understood to not include UXBs.

	County Borough of Manchester
Area Acreage	27,255
High Explosive Bombs (all types/weights)	712
High Explosive Parachute Mines	18
Flam (Oil) Bombs	7
40kg Phosphorus Incendiary Bombs (IBs)	0
40kg 'Fire Pot' IBs	0
V1 Flying Bomb	1
V2 Long Range Rocket	0
Total (excluding V-Weapons and 1kg / 2kg IBs)	738
Bombs Per 1,000 Acres	27.1

1kg / 2kg incendiary bombs (IBs) and 2kg anti-personnel (AP) bombs were often too numerous to record accurately and therefore are not included in the above figures.

5.2.3 Manchester Bomb and Damage Map – 1940-1941

BSI has reviewed an original bomb plot and damage map for the wider study area. This map was produced by Manchester City Council's Architect's Department (Building Surveyor's Division) during the war and was updated throughout the conflict to reflect all raids on the city. No original legend / key accompanies this map; however, a contemporary description does confirm some symbols. No symbol for UXBs was identified and any IB strike symbol with a number written within it represents the number of individual IBs falling at that location. Three categories of damage are illustrated on this map: solid red, hatched red and red outline. These are likely to represent 'total destruction or severe damage', 'moderate damage' and 'minor blast damage' respectively.

A relevant section of the map covering the study area is presented in **FIGURE 6** and described below.

- Eight HE bombing incidents are plotted within a 500m radius of the Site.
- The closest of these incidents is approximately 40m north-east of the Site.
- The afore mentioned incident and another approximately 100m to the north-east are in the rough locations of the ground disturbances identified in post-WWII aerial photography.
- The closest recorded incendiary incident is approximately 300m south-east of the Site.
- Two structures approximately 50m south are outlined in red, suggesting minor blast damage occurred. This damage can be attributed to a HE bombing incident recorded between the two structures.

5.2.4 Manchester Civilian Fatalities Map

A contemporary digital map of Greater Manchester recording the locations of every Christmas Blitz bombing incident that resulted in at least one fatality was reviewed. This map (published by the Manchester Evening News) was compiled using data from the Commonwealth War Graves Commission; however, it only covers the two heaviest air raids on the city. Although a potentially significant source of bombing incident locations, many bombs did not cause a fatality and therefore this map should not be viewed as comprehensive.

A relevant section of the map covering the study area is presented in **FIGURE 7**. No fatalities were recorded on Site or in the immediate vicinity. The closest recorded fatalities were plotted approximately 590m north-west of the Site.

5.2.5 Abandoned Bomb Register

Due to the overstretched bomb disposal units during WWII, many bombs were intentionally left undisturbed. UXBs were triaged based on where they were and how big they were. If they didn't pose a significant risk, they were 'abandoned'. The locations of these bombs were recorded on the abandoned bomb register.

The abandoned bomb register is a public record document held at the Parliamentary Archives of the House of Commons, from which BSI has obtained a copy. The register should not be relied on for completeness or accuracy. The closest abandoned bomb is recorded approximately 4.2km north-west of the Site, in the vicinity of Salford Docks.

5.2.6 Secondary Source / Anecdotal Evidence

A search of online resources, as well as a review of local history publications was carried out with the intention of locating any eyewitness accounts of local bombing incidents. An anecdotal account refers to a crater being left by a bomb strike occurring within the Hough End Estate.² This incident is reported as occurring 'in the field near the rear left hand corner of the plot of the Hall itself'; it is possible that this incident is that recorded in the consulted mapping and identified in the consulted post-WWII photography.

² <https://chorltonhistory.blogspot.com/2017/04/hough-end-hall-still-working-farm-in.html>

The source also reports that Hough End Hall was a working farm in the 1950s; should the farm have been in use during WWII, then it can be anticipated that access levels will have been relatively frequent on Site.

5.3 Likelihood of UXB Contamination

Where detailed bombing records exist, it is possible to predict whether any UXBs could be found on a site. This likelihood is discussed in the following table:

Density of Bombing	
Number of Air Raids in the Vicinity:	A comparison of the bombing incident records confirms that at least three air raids affected a 500m radius of the Site.
Intensity of these Air Raids:	Small scale raids, likely carried out at night.
Bomb Strike Positions	
Closest Bomb Strikes	HE bombs: 40m north-east. 1kg / 2kg IBs: 300m south-east.
Alignment of recorded Bomb Strikes:	It has been possible to identify two potential bomb-sticks (individual aircraft bombloads) in the local area. These are linear and therefore the flightpath can be deduced. Of these, one is generally aligned with the Site. However, it is possible that as all incidents thought to be part of bomb-sticks were recorded on the same date, they all may have been dropped by the same aircraft. Although complete analysis is not possible, it is possible that a UXB (unobserved and unplotted) could have been released over and landed within the Site boundary.
Bomb Failure Rate	
Evidence to suggest that the generally accepted failure rate of 10% differs in the vicinity of the site:	The records of exploded and unexploded HE bombs dropped during the Manchester Blitz give a failure rate of 16.6%. Note, this does not account for all HE bombs dropped on the borough throughout WWII.
UXBs recorded in close proximity to the site:	n/a

5.4 Likelihood of Subsequent UXB Detection

A range of circumstances determine whether a UXB strike location would have been identified, during and after the war. This is discussed in the following table.

Historic Access
A UXB falling on a site which was frequently accessed would have had a better chance of being found. ARP Wardens actively searched for UXBs in heavily bombed residential areas. The importance of a site or nearby buildings and infrastructure was also a factor. Many industrial facilities had fire watchers tasked with extinguishing incendiary bombs and reporting UXBs.
As local air raids are anticipated to have occurred during the hours of darkness, when residents and workers would have been indoors and / or sheltering, there is generally a lower probability of anyone witnessing any UXB strike to the Site as it fell / occurred. Additionally, no evidence of fire watchers providing night-time observation being active in the vicinity was found. As aforementioned, the Site encompassed part of the Hough End Estate; anecdotal evidence suggests that Hough End House was part of a working farm, which likely encompassed the Site area. Should the farm have been active during WWII, it is anticipated that access levels will have been relatively frequent and regular throughout, although the estate could have been temporarily evacuated for a time. Even without agricultural usage, the presence of infrastructure on and immediately adjacent to the Site suggests at least an intermittent level of access, although this will have depended on the landowner.

Bomb Damage
As the bombing campaign continued, damaged areas became vulnerable to unreported UXBs. Bombsite wreckage or soil disturbance at a bomb crater could obscure evidence of a subsequent UXB strike.
No immediately obvious visual evidence of bomb damage occurring within the Site footprint has been noted. Post-WWII aerial photography indicates the structures to have survived WWII externally structurally intact, whilst no ground disturbance consisted with bombing is noted. However, two areas of ground disturbance with the appearance of bomb craters are noted in the Site's surrounds. Bomb strikes are plotted in both of these locations in consulted local bomb mapping, whilst an anecdotal account refers to a crater being present 'to the rear left corner of the plot of the Hall itself'.

Ground Cover Type
A UXB which falls on open field could easily go unnoticed, whereas a UXB dropped on a hard-surfaced car park would have been easily observed.
Any UXB strike to the structures on Site would have caused incontrovertible evidence of its incidence as it passed through the structure and into the ground beneath. The same can be said for neighbouring structures and the road surfaces, where (assuming no cratering) a HE UXB entry hole would have been persistent and easily recognisable. However, the open ground within and immediately surrounding the Site likely provided conditions for which a UXB could fall unnoticed and go unreported, although it is anticipated that evidence of such an occurrence may have been noticed within the Site footprint.

5.5 Bombing During WWI

During WWI, an estimated 9,000 German bombs were dropped on London, Eastern England and South-Eastern England during some 51 Zeppelin airship raids and 52 fixed-wing aircraft raids. London suffered the worst of the bombing with an estimated 250 tonnes of HE and incendiary bombs recorded across the Capital, over half of which fell on the City of London district.

The WWI bombing campaign waged by Germany was on a far smaller scale than the WWII campaign, in terms of the number of raids, the weight of ordnance dropped during each attack and the size of the bombs used. When coupled with the fact that most WWI bombed locations have since been redeveloped, German WWI UXB finds

are extremely rare. Furthermore, most air raids took place during daylight hours and as it was the first time Britain had experienced strategic aerial bombardment, the raids often attracted public interest and even spectators, increasing the chances of any UXBs being reported.

However, Manchester was not subject to any bombing raids during WWI. Consequently, there is no risk associated with WWI-era German UXO and will not be discussed further.

6 WWII GERMAN BOMBS

6.1 Bombs Dropped on the UK

Nazi Germany used different types of ordnance against the UK for different effects. Some types were designed to cause fires, others for their destructive blast effect and other for their penetration capability. Each type of ordnance was fitted with at least one fuze. For some bombs multiple fuzes were used. Many different types of fuzes were available for use – each with its own set of associated hazards.

Data sheets on those bombs most likely to be encountered today are included at **APPENDIX 2**.

- **HE bombs – moderate NEQ (net explosive quantity):** the most common types of HE bombs dropped were the SC (general purpose - GP) and SD (semi-armour piercing - SAP) series of bombs. The NEQ is between 30-50%. SAP bombs are engineered to attack light fortifications, whereas GP bombs are used in a mixed destructive blast and anti-personnel fragmentation role. 70% of bombs dropped on the UK were the 50kg type.
- **HE bombs – high NEQ:** blast bombs and parachute mines have bodies made of thin steel, allowing for larger HE charges. These were designed to detonate above ground, maximising the blast effect. Parachute mines were weapons slowed by parachutes and designed to detonate without penetrating the ground. Although, in some marshland areas, partially buried parachute mines have been observed. Consequently, it is highly unlikely that any unexploded blast bombs remain buried in the UK today.
- **HE bombs – low NEQ:** The PC series were armour piercing bombs used against heavy fortifications and reinforced bunkers. They were not commonly used over the UK.
- **Small incendiary bombs:** The 1kg and 2kg incendiaries were the most dropped bomb. Up to 620 x 1kg incendiaries could be packed into the largest container unit, which opened at a pre-determined height scattering its payload over a wide area. These small bombs could fully penetrate soft ground due to their small diameter. Variants of the 1kg and 2kg incendiary bombs contained a small HE charge designed for an anti-personnel role, and to increase its incendiary effect.
- **Large incendiary bombs - Thick skinned:** The C50 has a thick body and contained a mixture of incendiary liquids and white phosphorus. Another version of the C50 had a white phosphorus fill. The C50 'firepot' contained thermite incendiary containers (aka firepots) and a small HE charge.
- **Large incendiary bombs - Thin skinned:** The Flam 250 and Flam 500 models had thin steel bodies designed to break up on impact, spreading their oil-incendiary mixture, which was ignited by a small HE charge. Consequently, it is highly unlikely that any unexploded Flam bombs remain buried in the UK today. Their unreliability meant withdrawal from frontline use by January 1941.
- **Submunitions:** The SD2 'butterfly' bomb was a 2kg submunition dropped on several British cities and towns. It contained a 225gram HE charge. SD2s had no ground penetration ability so the vast majority were recovered at the time. However, SD2s are still found across Britain today.
- **V1 flying bombs and V2 rockets:** In the final year of WWII Germany began using pilotless weapons against England. Both V Weapons had 1,000kg HE warheads. Due to their light-body construction, they had no penetration ability and any impact left a noticeable debris field. As such, there is negligible risk from unexploded V weapons today.

6.2 Bomb Failures

Records from September 1940 to July 1941 show that an average of 84 UXBs were dropped on civilian targets each day. Around 8% of these were time delay bombs – designed to strike the ground and start a predetermined countdown which could last days.

There is a generally accepted 10% failure rate for WWII German HE bombs. This is estimated from records gathered by bomb disposal units. These statistics do not account for UXBs that went by unnoticed.

Failures can happen for different reasons, including:

- Equipment or human error in arming the bombs before release,
- Failure of a mechanism within the fuze (out of tolerance),
- Jettisoning payloads if the bomber was under attack or crashing, or
- Partially functioned bombs (e.g. cracks in the cast TNT)

6.3 Bomb Ground Penetration

6.3.1 Introduction

Using data gathered during WWII by the Ministry of Home Security, estimations can be made about how deep a bomb is likely to penetrate the ground. Over one thousand incidents were reported by the bomb disposal units to support this research. Further tests were carried out, dropping bombs of different sizes into chalk and measuring the depths they reached. This research is held at the National Archives. The estimates are:

Bomb weight (kg)	Ground Type (m)							
	Sand		Gravel		Chalk		Clay	
	Average	Max.	Average	Max.	Average	Max.	Average	Max.
50	2.8	7.8	2.8	7.8	3.5	7.7	4.0	9.1
250	4.8	13.7	4.8	13.7	6.0	13.1	6.8	15.8
500	6.0	17.3	6.0	17.3	7.6	16.4	8.7	19.8
1,000	7.6	21.9	7.6	21.9	9.6	20.7	10.9	24.9

Different layers of geology affect penetration depths. For example, 1m of made ground, then 1m of gravel before reaching clay – as is many areas of London – is not easily calculated from the data above.

When calculating how deep a bomb could have reached, we must make three assumptions:

- **Impact velocity:** German bombing raids were carried out at altitudes in excess of 5,000m. The velocity of impact is roughly 313ms^{-1} (not accounting for resistance). It is the same velocity regardless of mass.
- **Impact angle:** strike angles of 10 to 15 degrees to the vertical. It must be assumed that the bomb was stable at the moment of ground penetration.
- **Bomb design:** Some larger German bombs were occasionally fitted with 'kopfrings' - a metal ring, triangular in cross section, fitted around the nose of the bomb to help prevent penetration. It must be assumed that no 'kopfrings' were fitted.

6.3.2 The J-Curve Effect

During WWII BDUs reported that most buried UXBs were found horizontal or upturned. This observation confirmed the 'J-curve effect'. As an HE bomb penetrates the ground, slightly offset from the vertical, its passage underground creates a 'J' shape.

This is relevant because the J-curve effect results in a horizontal offset between the buried UXB and its point of entry. This distance is estimated to be one third of the theoretical penetration depth. A low altitude attack, meaning a low impact angle, could produce an even greater offset, of up to 15m.

6.3.3 Site Specific Geology

BGS Mapping	Superficial Deposits: Glaciofluvial Sheet Deposits, Devensian - sand and gravel	Bedrock Deposits: Wilmslow Sandstone Formation - sandstone
SI Data	Site-specific SI data was not provided by the Client. However, local BGS borehole logs were available. The closest BGS SI through the same mapped geology is located immediately south-east of the Site (BGS ID: 19329396). This SI (June 2010) encountered the following ground conditions: - 0.30m of topsoil - 0.20m of made ground - 0.25m of brown slightly silty slightly gravelly fine to medium sand - 0.10m of brown mottled orange clayey fine to coarse sand - 2.60m of medium dense light brown silty slightly gravelly to gravelly fine to coarse sand - 6.20m of firm to stiff brown slightly sandy slightly gravelly clay - 0.40m of dense brown clayey fine to coarse sand	

6.3.4 Site Specific Maximum Bomb Penetration Depth

During WWII the Luftwaffe dropped many different types of HE bomb. The SC (general purpose) series was by far the most numerous and of this series, the SC 500 model (weighing 500kg) was the largest of the most commonly deployed and therefore this will be used as the benchmark weapon for the Site-specific bomb penetration depth calculations.

The presence of made ground and a superficial deposit at shallow depths means that accurate bomb penetration depths cannot be calculated. The empirical 1940s evidence appears to record UXBs travelling through uniform geology of only one type. Different lithologies will have had a differing decelerating effect on a HE UXB, both individually and in combination, thereby complicating the estimation of burial depth.

To calculate an approximate maximum bomb penetration depth, BSI has taken the average of the averages of the two figures for the predominant Site-specific geologies (sand and clay), in the table above. This gives a maximum bomb penetration depth of 12.95m below WWII ground level for a 500kg HE bomb.

Theoretically, penetration depths could be greater if the UXB was larger; however, War Office statistics confirm that between October 1940 and May 1941 the majority of HE UXBs (>90%) were either 50kg or 250kg, with the 500kg bombs making up most of the remaining 10%.

7 UXO RISK - BRITISH/ALLIED ACTIVITY

7.1 Introduction

The table below lists potential sources of UXO (excluding enemy action). Those which are potentially relevant to the Site are discussed in the subsequent section(s).

Potential UXO Source	Potentially Significant
Army or RAF training areas / ranges	✗
Military bases and other installations	✗
Munitions and explosives factories	✗
Military storage depots	✗
Defensive fortifications	✗
Wartime site requisitions	✗
WWII defensive mining (landmines)	✗
WWII Home Guard activity	✗
Wartime anti-aircraft fire	✓

7.2 Potential Sources of UXO

7.2.1 Introduction

Research has not located any evidence of significant British or Allied army, RAF or Royal Navy activity specifically on Site and none is likely to have occurred historically. The only likely potential source of British UXO contamination is therefore WWII AA artillery fire.

7.2.2 WWII Anti-Aircraft Fire

Anti-Aircraft (AA) Command was a British Army command established in 1939 to defend the UK during the anticipated German bombing campaign. It controlled the Territorial Army AA artillery and searchlight units. From 1940 to 1945 BDUs dealt with 7,000 unexploded AA shells in Britain. There were three main types of AA battery used for home defence (see below). Data sheets on these AA defences are included at **APPENDIX 3**.

- **Heavy Anti-Aircraft (HAA):** large calibre guns (3.7" and 4.5") for engaging high altitude bomber formations. Hundreds of permanent batteries were constructed in and around major cities and military bases during the 1930s. Some 2,000 of these guns were available during the Blitz. Each gun could fire between 10 and 20 rounds per minute and consequently HAA batteries could expend large quantities of shells during each engagement.

British time fuses were poorly manufactured during WWII and this led to high failure rate for HAA shells, up to 30%. Unexploded HAA shells had the potential to land up to 27km from their battery, although more typically landed within a 15km radius.

- **Light Anti-Aircraft (LAA):** smaller calibre guns for engaging dive bombers and low altitude intruders. As such they were mostly used to defend specific industrial and military targets which were subject to precision bomber attack. LAA guns were either .303" calibre machine guns or 20mm and 40mm calibre cannon. The latter were fitted with simply impact fuses and small incendiary or HE bursting charges.

The 40mm Bofors gun could fire 120 x HE shells / minute to a ceiling of 1,800m. Each shell was designed to self-destruct if it didn't strike an aircraft, however, inevitably some failed and fell back to earth.

- **Z (Rocket) Batteries:** a Z-Battery comprised a grid formation of 64 rocket projectors which fired 2" and later 3" Unrotated Projectile (UP) rockets to a maximum altitude of 5,800m; a ground range of some

9,000m. They were deployed in cities all around the UK from 1941 and proved to be an effective addition to the existing AA guns.

The rockets measured 0.9m (2") and 1.8m (3") in length with four stabilising fins at the base and were fitted with 3.5kg or 8.2kg HE warheads. The larger warhead had an effective airborne blast radius of up to 20m. Some variants deployed a form of aerial mine described as a "small yellow bomb" which was designed to detach from the rocket at height and descend on a parachute with the objective of becoming snagged on target aircraft and then detonating.

Unlike bombs which were designed to strike the ground, AA projectiles and rockets were designed to function in the air. Due to their shape, and centre of gravity they would often not strike the ground nose first. This coupled with the lower mass of AA UXO resulted in shallower ground penetration depths, compared to UXBs. Although, in very soft conditions, unexploded AA projectiles have been found deeper than 1.5m bgl.

28 permanent HAA batteries were active within range of the Site during WWII. No evidence of permanent LAA gun batteries defending vulnerable points within range of the Site was found. Luftwaffe activity was often frequent and intense over the wider area and therefore these guns may have expended a vast quantity of ammunition. Consequently, there is an elevated likelihood of unexploded AA shells striking the Site and penetrating to a shallow depth in the open areas of the Site. However, such an incident may have been observed.

8 UXO RISK MITIGATING CIRCUMSTANCES

8.1 Introduction

Works on a UXO contaminated site could result in the partial or complete removal of UXO risk. Construction or earthworks may have uncovered any UXO contamination, which would then have been reported and removed by the authorities. A site may have been subject to an explosive ordnance clearance (EOC) task conducted by the armed forces. EOC tasks involve surveying, subsequent target investigation and removal of UXO. Although the effectiveness of historic EOC tasks will have often been unsatisfactory.

8.2 Explosive Ordnance Clearance Tasks

The division of EOD tasks has been complex throughout British military history. It used to be the case that anything under the water level would be dealt with by navy units, and anything on land would be dealt with by army units. In recent years RAF EOD capability has been discontinued, and now only the Royal Navy and the British Army have EOD units. In the army, the Royal Logistics Corps and Royal Engineer EOD units have been amalgamated to form 29 EOD & Search Group. Often taskings are assigned to either the naval or army elements based on where in the country the threat is and the nature of the threat.

BSI has access to a database of historic EOC tasks. This database is only complete up until the early 2000s and therefore does not include recent EOC tasks. No such database for the RAF and Royal Navy EOD units is easily accessible. A search of this database has not resulted in any Army EOC tasks in the vicinity of the Site.

UXO encounters on civilian land are often reported in the media and therefore a web search of local media outlets was also carried out. No recent incidents within close proximity to the Site were identified.

8.3 Ground Works

Post-WWII, all structures present on Site identified in pre- and post-WWII OS mapping have been cleared. Lowry House has been constructed in the northern extent of the Site, whilst hardstanding has been laid throughout in the form of car parking areas and accessways. Areas of soft landscaping and vegetation are also present in peripheral areas.

8.4 Deductions

The risk associated with any deep buried German UXBs (>2m bgl) will have only been mitigated at the locations and down to the maximum depths of the foundations associated with Lowry House. The clearance of the WWII-era structures i.e. grubbing out of foundations will have mitigated the risk of encountering UXO to shallow depths (1-2m bgl) in these locations only. The laying of hardstanding and the soft landscaping will have disturbed WWII-

era soil to very shallow depths (<1m bgl). It is conceivable that a deep buried German UXB could remain on Site, beneath or in between previous post-WWII excavations.

9 CONCLUSION

9.1 Accuracy of Historical Records

Occasionally, the accuracy of some historical records can prove to be poor when compared with other sources of information. One significant consequence of this can be the possibility of unrecorded German bomb strikes in the study area. With regard to this Site, no comprehensive written records for the Manchester County Borough are known to exist; however, the available consulted sources are largely corroborative of one another (local bomb plot mapping and aerial photography), with no significant inconsistencies identified. Subsequently, the conclusions of this assessment can be confidently drawn without the need for additional resources.

9.2 The Risk of UXO Contamination on Site

9.2.1 Key Findings - German UXO Risk

- During WWII, the Site was situated within the County Borough of Manchester, which experienced a low-to-moderate density bombing campaign according to Home Office statistics. Although Greater Manchester was the 11th most heavily bombed British conurbation during WWII, the Site was situated >3km to the south of the main Luftwaffe target areas (Manchester city centre, Trafford Park, Salford Docks) and therefore likely experienced a lower localised bombing density.
- However, a local bomb plot map confirms at least three raids occurred within a 500m radius of the Site, resulting in eight HE bomb strikes and one incendiary bombing incident. None appear to have affected the Site itself; however, two incidents are recorded in the Site's immediate surrounds, approximately 40m and 100m to the north-east respectively.
- Post-WWII aerial photography displays evidence of two areas of ground disturbance in the approximate locations of both the abovementioned bomb strikes. Anecdotal evidence refers to a bomb strike occurring 'to the rear left corner of the plot of the Hall itself' – the hall being Hough End Hall, situated to the immediate north-east of the Site. It is considered likely that the incident referred to in the anecdotal source is that recorded 100m to the north-east in the abovementioned mapping.
- Analysis of the local bomb plot map has identified two potential linear bomb-sticks (individual aircraft bombloads) in the local area and therefore the flightpath orientations of the aircraft involved. Note, although unconfirmed, given the recorded date of the incidents and their close proximity to one another, it is feasible that the two bomb-sticks were in fact one. This analysis confirms at least one potential occasion during which a UXB (unobserved and unplotted) could have been released over and landed on / adjacent to the Site.
- At the outset of WWII, the Site was occupied by a combination of structures and undeveloped land; anecdotal evidence suggests that the Site area was encompassed by a farm. It is anticipated that the Site experienced at least an intermittent level of access throughout WWII, owing to the lack of damage occurring to the structures, although this will have depended on the landowner. Additionally, the structures could have been temporarily evacuated for a period.
- Whilst any UXB strike to the structures on Site would have caused incontrovertible evidence of its incidence and have been removed at the time, it is feasible that a UXB could have fallen unnoticed within the open areas of the Site. Even if access levels had been frequent and regular, the diameter of the smallest German HE bomb (which was also the most commonly deployed over Britain) was just 200mm, creating a small entry hole which could be easily obscured in vegetation.
- Furthermore, had such a scenario occurred and the UXB fell within a certain impact angle window, the bomb could have penetrated to several meters depth and come to rest under the structures present within the Site boundary, due to the J-Curve (lateral offset) Effect. However, given the lack of evidence suggesting such strikes occurred, this is not considered a likely occurrence.

- To summarise, although a potential occasion during which an unrecorded UXB was released over / adjacent to the Site has been identified, the risk of encountering UXBs on Site is not significantly elevated above the background risk for this area of the country given the evidence to suggest the Site was not subject to bombing / bomb damage. As such, the risk of encountering UXBs on Site has been assessed as **Low-Moderate**. Note, the risk of encountering UXBs can be considered mitigated in the specific locations and to the specific depths of previous post-WWII intrusive works.

9.2.2 Key Findings - British UXO Risk

- 28 permanent HAA batteries were active within range of the Site during WWII. Luftwaffe activity was on occasion frequent and intense over the wider area and therefore these guns may have expended a vast quantity of ammunition. Consequently, it is quite possible that an unexploded AA shell struck the Site. However, for the same reason as above, depending on where it occurred, any such UXO may have been reported and removed at the time.
- No evidence of historic military activity within the Site boundary has been found and it is highly unlikely that any has occurred historically. Consequently, the risk from associated UXO is low.

9.3 Site-Specific UXO Hazards

Different types of UXO pose differing types of hazard, depending on their structural design, Net Explosive Quantity (NEQ), fill type and likely contamination depth. The table below lists the main types of UXO most often encountered on urban UK sites and their relative hazard levels.

UXO Type	NEQ (NEQ Range)	Likely Burial Depth	Hazard Posed
WWII German General Purpose HE Bombs	25kg - 220kg (most commonly deployed bomb weights)	Likely deep burial (>2m)	HIGH RISK
WWII British Heavy Anti-Aircraft Shells	1.1kg - 1.7kg	Shallow burial (1-2m)	MODERATE-HIGH RISK
WWII British Land Service Ammunition	<2kg	Shallow burial (1-2m)	
WWII German 2kg Incendiary / HE Bombs	680g incendiary hazard + ~500g explosive hazard	Shallow burial (1-2m)	
WWII German 1kg IBs	680g (incendiary, not explosive hazard)	Shallow burial (1-2m)	MODERATE RISK
WWII British Light Anti-Aircraft Shells	4g - 70g	Very shallow burial (<1m)	LOW-MODERATE RISK

9.4 The Likelihood of UXO Encounter

9.4.1 Introduction

This report assesses the risk of UXO in relation to the proposed works, not simply the risk that UXO remains buried on site. The likelihood of UXO encounter during intrusive ground works will vary depending on the type of UXO and the type of construction methods employed during the project. With increased soil disturbance i.e. more excavations, the likelihood of encountering UXO increases.

Within an area of elevated UXO contamination likelihood, the sub-surface volume of potential UXO contamination will comprise the natural soil / geology in between WWII ground level and the maximum bomb penetration depth. Therefore, any intrusions into this layer will be at risk of UXO encounter.

Any post-WWII fill material deposited on a site is unlikely to be contaminated with UXO and therefore the risk of encountering UXO on such a site could vary with depth.

In the wake of the initial nine-month Blitz, many cities and towns were left with vast quantities of bomb site rubble that required removal and relocation. This material was put to use for in a variety of ways, for example >750,000 tons of London's rubble was used to build runways for new RAF and USAAF airfields and much of Liverpool's rubble was used to create and maintain sea / flood defences throughout Merseyside.

It is quite possible that unexploded British AA projectiles and German 1kg incendiaries were overlooked during removal, resulting in UXO contaminated fill material ending up on otherwise low UXO risk sites, possibly many miles from any high bombing density areas.

9.4.2 German UXBs

Although most German UXBs came to rest several metres below WWII ground level, these weapons can be found at any level between just below WWII ground level and the maximum bomb penetration depth. There are a number of reasons why these heavy bombs might be found at surprisingly shallow depths.

- **Tip and run:** When enemy aircraft had to take evasive action to escape RAF fighter intercepts or AA defences, they often dropped their bomb loads from a reduced height, potentially resulting in extreme J-curve effect.
- **Deflection:** the shape of German bomb nose sections meant they were susceptible to deflection when striking surface or shallow sub-surface obstacles, occasionally resulting in shallow burial or even UXBs skidding across hardstanding.
- **Aircraft Crash Site:** if an aircraft was unable to dump its bomb load before impacting the ground, due to mechanical fault, any externally fitted bombs could have become buried on impact.

German 1kg / 2kg incendiaries were cylindrical and approximately 50mm in diameter. They had tail sections, and so landed nose first. Within soft ground this could result in full penetration of the bomb below the surface. Such UXBs are usually found close to the surface.

9.4.3 British / Allied UXO

The nature of British/Allied military activity involving LSA and SAA and the smaller size of these munitions (in relation to German HE bombs) indicates that any resulting UXO contamination on a site will be limited to shallow depths, usually within 1.5m of the surface, notwithstanding added material to raise the ground level.

Domestic military LSA and SAA contamination will either be the result of expending blinds (dud ammunition) which bury into the ground on impact or munitions purposefully buried, for a number of reasons. Either way, these types of UXO are all found at shallow depth.

9.4.4 Deductions

As deep intrusions are planned, a risk pathway exists between these works and deep buried (large) German UXBs. It is also conceivable that a UXB could be encountered during any shallow mechanical excavations beneath the existing ground level in this location. However, as aforementioned, it should be noted that the risk of encountering UXBs is not considered significantly elevated above the background level for this area of the country.

10 OVERALL RISK RATING

Ratings for the likelihood of UXO contaminating the Site, remaining within the Site up to the present day and being encountered during the proposed works, inform the overall risk rating. The UXO risk to the proposed works has been identified as **Low-Moderate**.

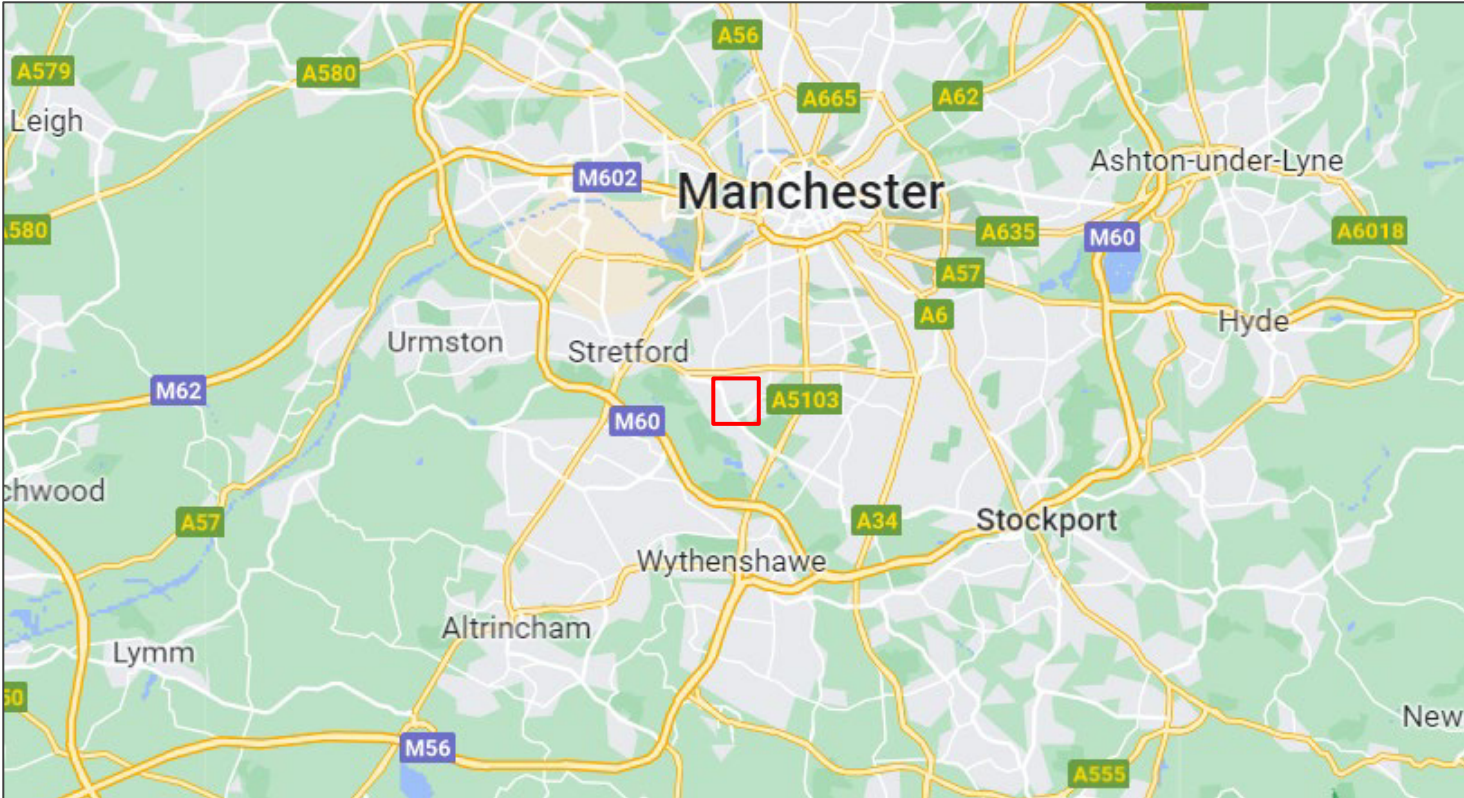
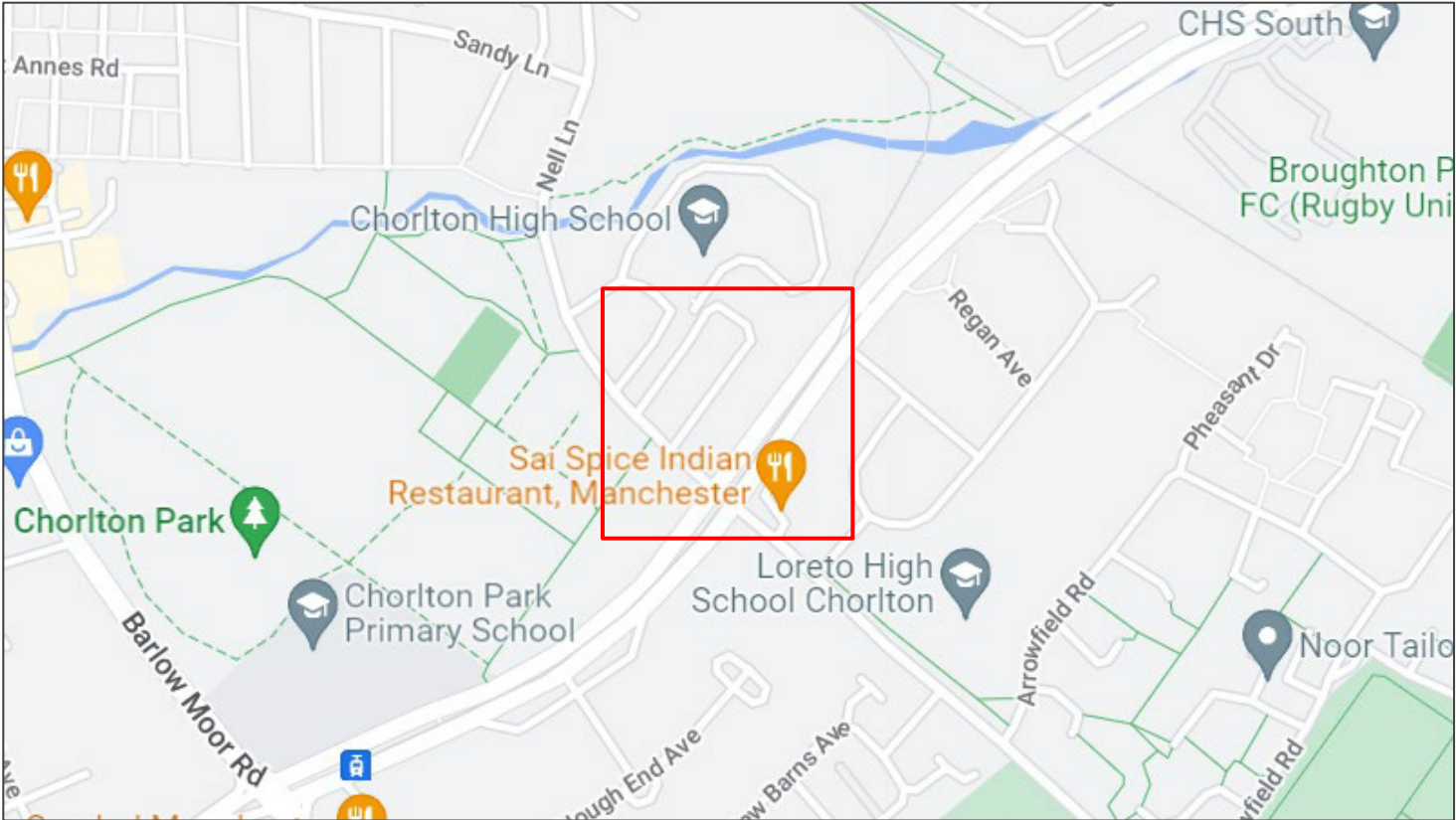
Risk Table: Low-Moderate Risk				
UXO TYPE (ASSOCIATED HAZARD)	LIKELIHOOD OF UXO CONTAMINATION	LIKELIHOOD OF UXO REMAINING	LIKELIHOOD OF ENCOUNTER	OVERALL RISK RATING
WWII German ‘Iron’ Bombs	Low-Moderate	Moderate-High	Moderate-High	Low-Moderate
WWII British Heavy Anti- Aircraft Shells	Low-Moderate	Moderate-High	Moderate-High	
WWII British Land Service Ammunition	Low	n/a		Low
WWII German 2kg Incendiary / HE Bombs	Low	n/a		
WWII German 1kg Incendiary Bombs	Low	n/a		
WWII British Light Anti- Aircraft Shells	Low	n/a		

11 RISK MITIGATION RECOMMENDATIONS

BSI has not identified a significantly elevated UXO risk to some of the proposed works. However, the measures detailed below are recommended to mitigate the risk to ALARP level.

Risk Mitigation Measure	Recommendation
UXO Safety Awareness Briefings: To all personnel conducting intrusive works on Site. An essential part of the Health & Safety Plan for a site. Conforms to the requirements of CDM2015.	Prior to all intrusive works commencing within both risk zones.

Figures: 1 - 7



	Project		Lowry House, Chorlton	 Suite 6, Delta House Laser Quay, Culpeper Close Rochester, Kent ME2 4HU +44 (0) 207 117 2492 www.brimstoneuxo.com enquire@brimstoneuxo.com
	Client:		Brownfield Solutions Ltd.	
	Report Ref:		DRA-22-1423	
	 General Site Location	Info Source:		

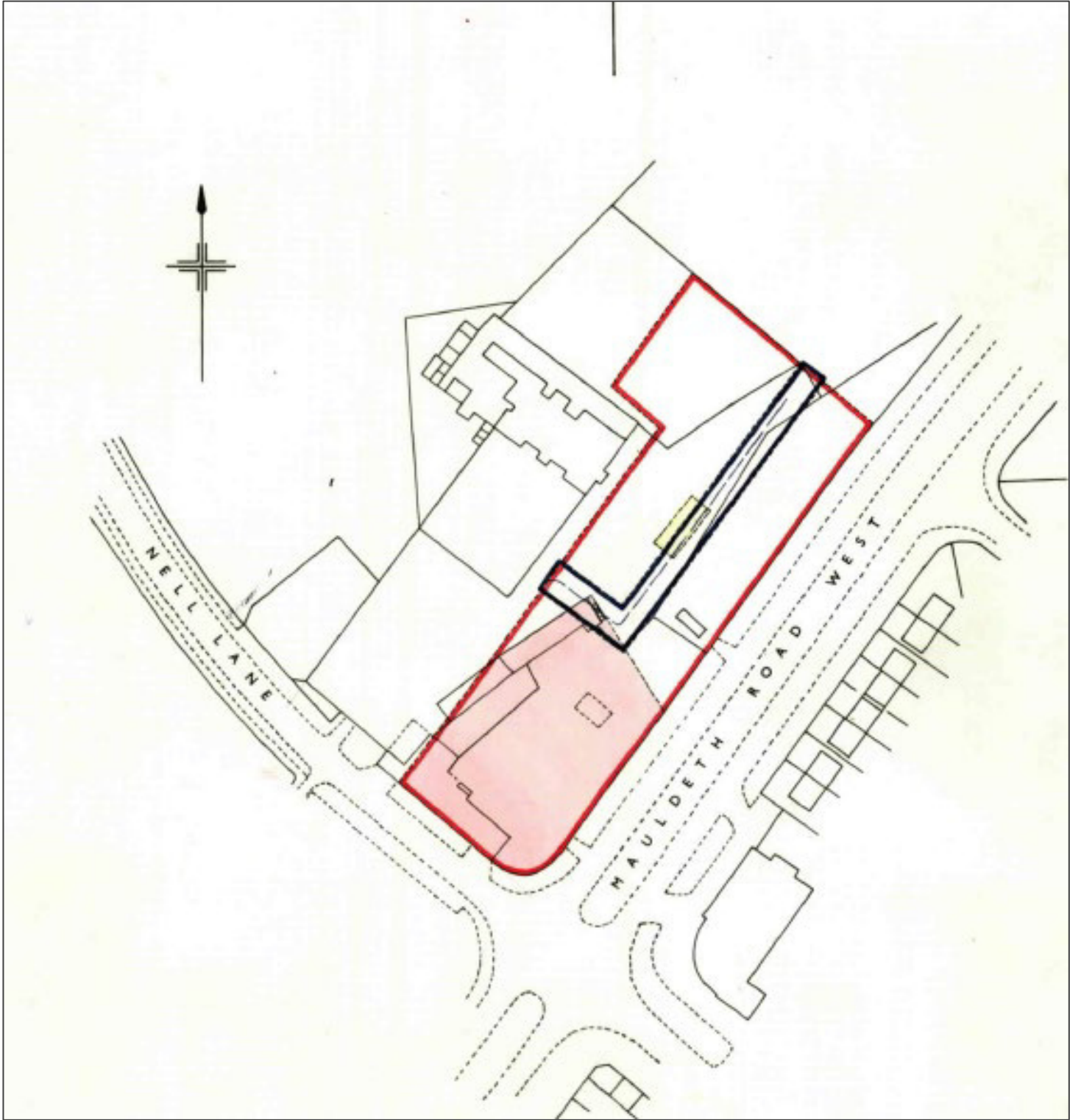


Project	Lowry House, Chorlton	
Client:	Brownfield Solutions Ltd.	
Report Ref:	DRA-22-1423	
 Approx. Site Boundary	Info Source:	Google (open-source)

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SITE INVESTIGATION

Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

 +44 (0) 207 117 2492
 www.brimstoneuxo.com
 enquire@brimstoneuxo.com

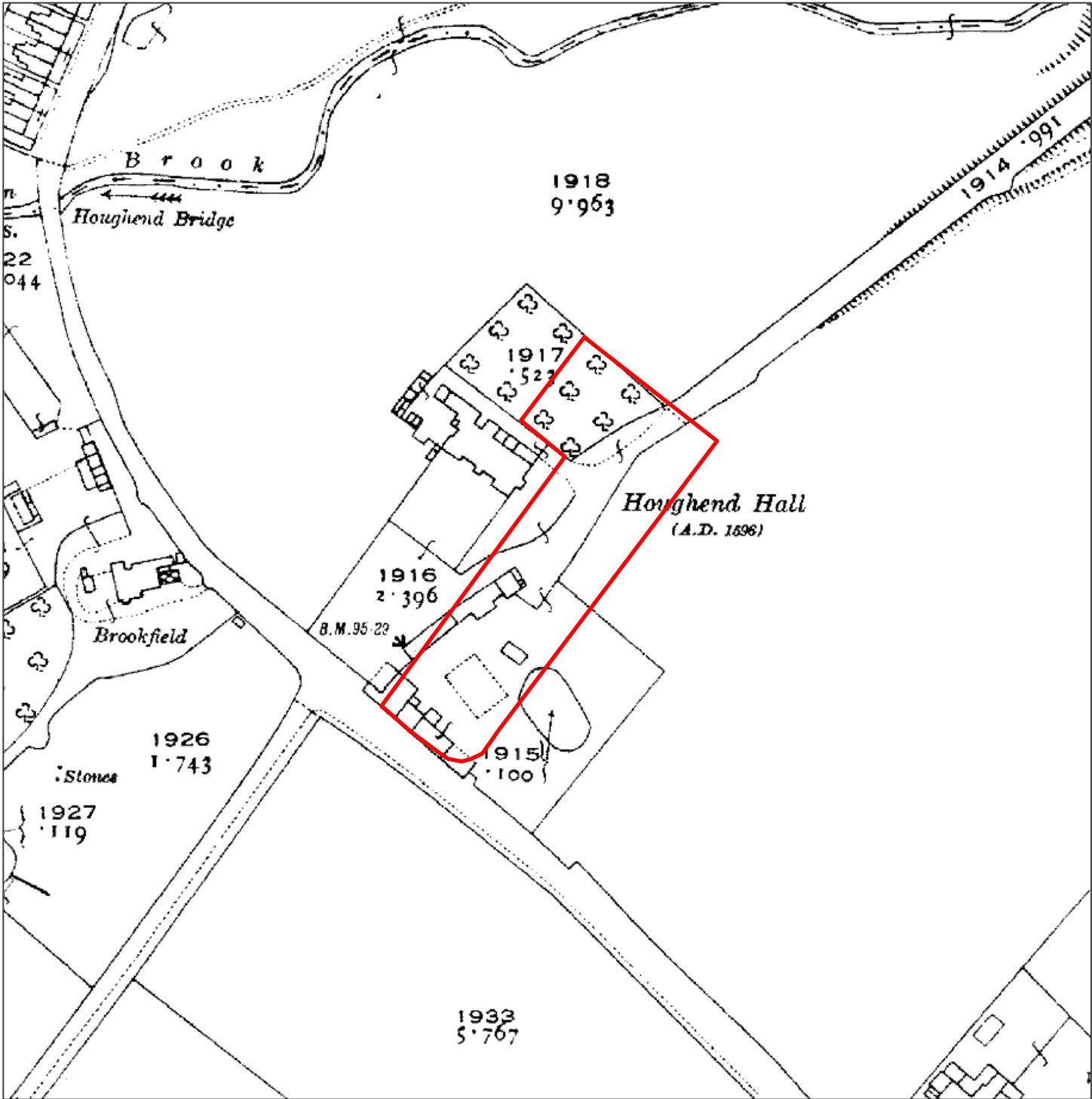


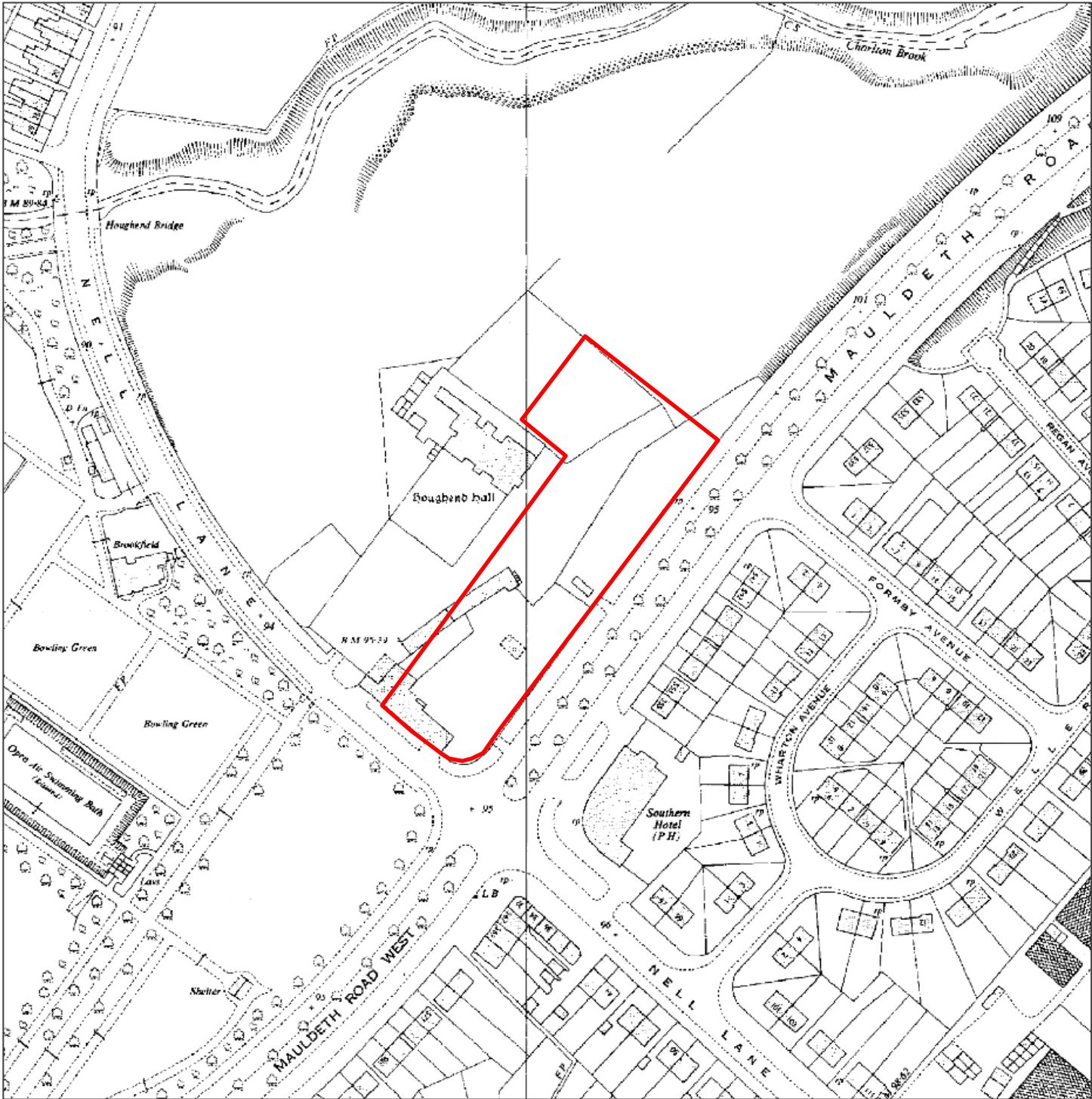
Project	Lowry House, Chorlton	
Client:	Brownfield Solutions Ltd.	
Report Ref:	DRA-22-1423	
 Site Boundary	Info Source:	Brownfield Solutions Ltd.



Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

+44 (0) 207 117 2492
www.brimstoneuxo.com
enquire@brimstoneuxo.com





Project

Lowry House, Chorlton

Client:

Brownfield Solutions Ltd.

Report Ref:

DRA-22-1423

 Approx. Site Boundary

Info Source:

Promaps

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Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
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+44 (0) 207 117 2492

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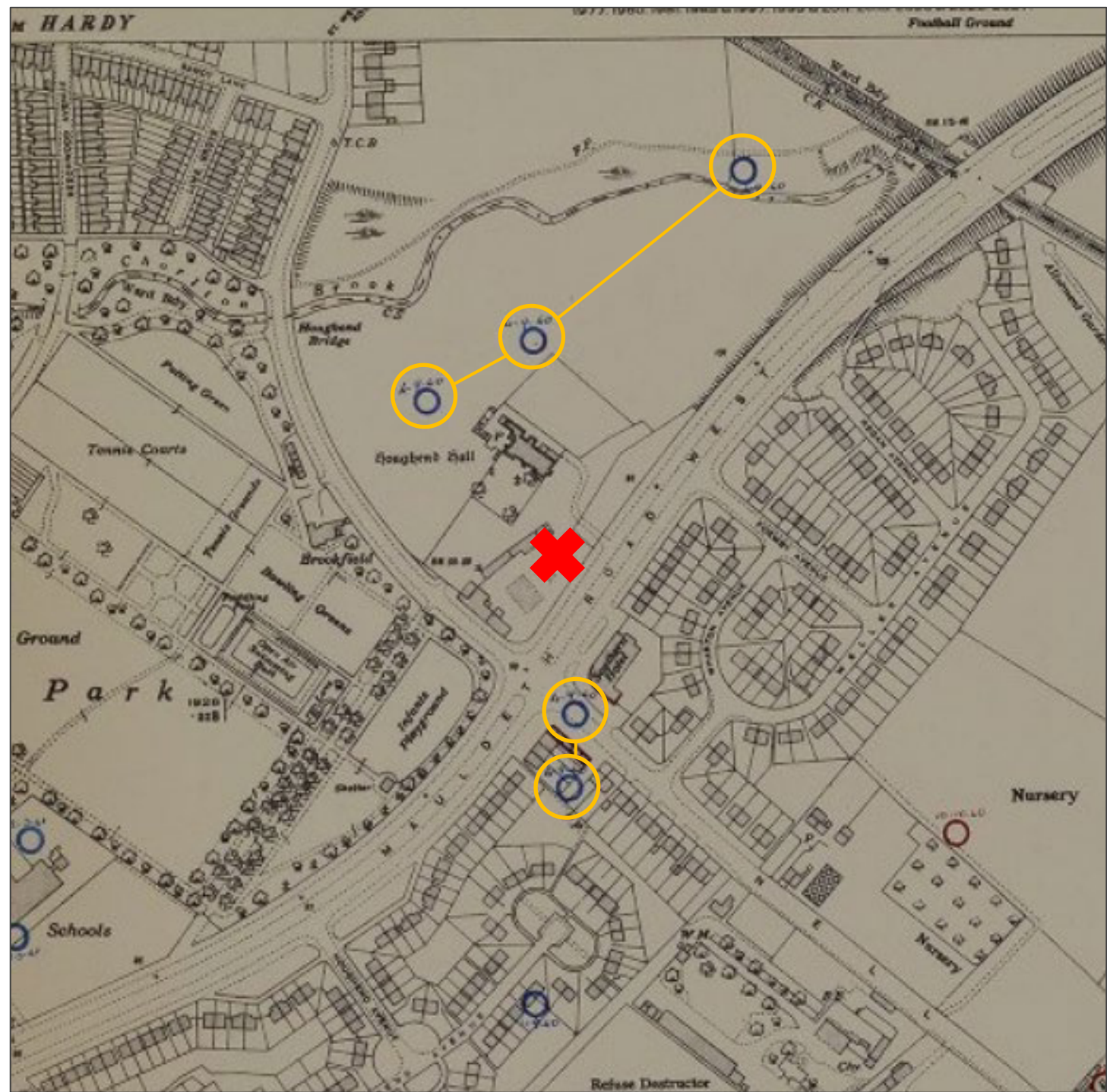


Project	Lowry House, Chorlton	
Client:	Brownfield Solutions Ltd.	
Report Ref:	DRA-22-1423	
 Approx. Site Boundary	Info Source:	Historic England

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SITE INVESTIGATION

Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

 +44 (0) 207 117 2492
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- HE Bomb Strike
- Incendiary Bombing
- Demolished buildings (does not apply to the Site boundary)
- Potential bomb-sticks

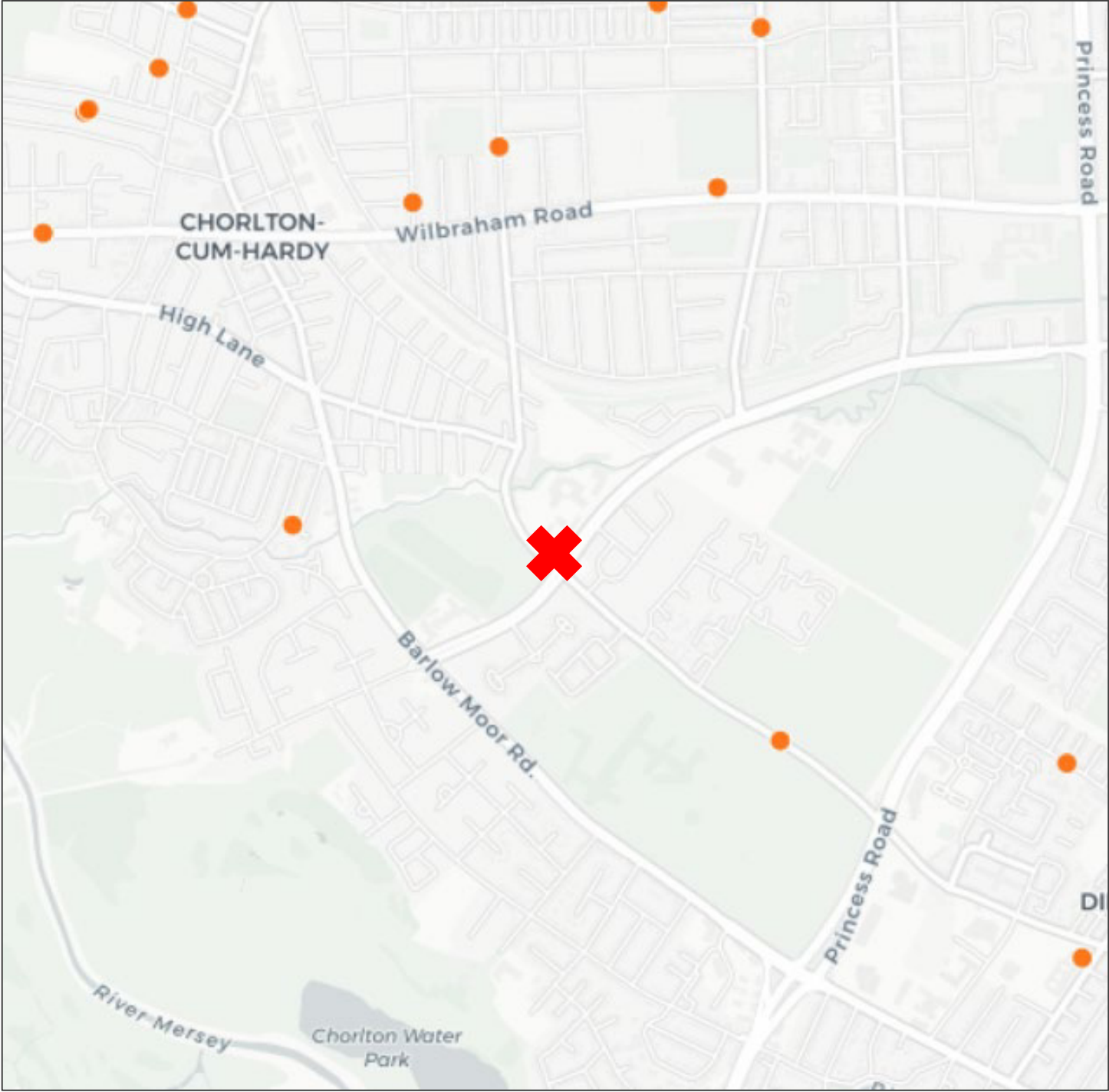


Project	Lowry House, Chorlton
Client:	Brownfield Solutions Ltd.
Report Ref:	DRA-22-1423
✖ Approx. Site Location	Info Source: Manchester Library

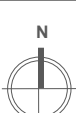
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Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

+44 (0) 207 117 2492
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● Fatalities caused by enemy action

	Project		Lowry House, Chorlton	
	Client:		Brownfield Solutions Ltd.	
	Report Ref:		DRA-22-1423	
	 Approx. Site Location	Info Source:	Manchester Evening News	



Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

+44 (0) 207 117 2492
www.brimstoneuxo.com
enquire@brimstoneuxo.com

Appendices: 1 - 5



Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

+44 (0) 207 117 2492
www.brimstoneuxo.com
enquire@brimstoneuxo.com

Recent German UXB Finds in the UK + Historical Analysis

- **23rd May 2019** - An SC250 (standard 250kg HE bomb) was found during shallow excavations at a building site in Kingston upon Thames, London. *Historical Analysis: The UXB landed in a small residential back garden belonging to an undamaged terraced house. It came to rest approximately 3 to 4m bgl.*
- **15th May 2017** - An SC250 (standard 250kg HE bomb) was found during shallow excavations at a building site in Aston, Birmingham. *Historical Analysis: The UXB landed in a small back garden belonging to a terraced house, part of a row. It J-Curved under a neighbouring garden and came to rest at just 1.4m bgl. NB: These houses had not sustained bomb damage.*
- **2nd March 2017** - A 250kg HE bomb was found during deep excavations at a building site in Brondesbury Park, London. *Historical Analysis: UXB landed in a large residential back garden. A single storey building was built on top of the UXB post-WWII.*
- **19th January 2017** - An SD50 (semi-armour piercing 50kg HE bomb) was dredged from the Thames during barge dredging works near Westminster Bridge, London.
- **12th May 2016** - A 500kg HE bomb was found buried just 1m below the playground of the former Royal High Junior School in Bath. *Historical Analysis: The UXB landed in a plot of neglected, unmaintained vegetation in between the school gym and main school building.*
- **23rd September 2015** - A 1,000kg HE bomb was encountered by a mechanical excavator on a building site in Paradise Street, Coventry. *Historical Analysis: the UXB landed in a large residential back garden occupied by dense vegetation. A two storey building was built on top of the UXB post-WWII.*
- **10th August 2015** - A 250kg HE bomb was found immediately beneath a basement floor during refurbishment works in Temple Street, Bethnal Green (London). *Historical Analysis: The UXB struck a house that had been damaged beyond repair during a previous air raid. The existing house was then built on top of UXB post-WWII.*
- **21st May 2015** - An SC50 (general purpose 50kg HE bomb) was found during deep excavations at a construction site in Wembley, London. *Historical Analysis: UXB landed in a large residential back garden.*
- **23rd March 2015** - A 250kg HE bomb was found during deep excavations at a building site in Grange Walk, Bermondsey (London). *Historical Analysis: inconclusive - reported UXB position is likely inaccurate.*

NB: Domestic UXO finds in the UK are too numerous to list. Between 2006 and 2009, over 15,000 items of British / Allied UXO (excluding small arms ammunition) were found on UK construction sites (CIRIA).

Initiation of WWII Allied Bombs

- **6th January 2014** - Mechanical excavator stuck a WWII bomb in Euskirchen (Germany) causing it to explode, killing the operator and injuring 13 more, two critically. The explosion was so large it damaged buildings 400m away.
- **1st March 2013** - During piling at a construction site in Ludwigshafen (Germany) a small buried WWII bomb exploded, injuring one worker.
- **2nd June 2010** - A British 500kg bomb detonated whilst being defused, killing three EOD engineers in Goettingen, Germany. The bomb was found as builders dug the foundations for a new sports hall. Several houses had their fronts blown off by the blast.
- **19th September 2008** - Seventeen people were injured and buildings were damaged when an excavator apparently drove over and set off a 250kg American bomb at a construction site in Hattingen, Germany.
- **23rd October 2006** - A construction worker breaking up tarmac at the side of a highway near the south-western German town of Aschaffenburg was killed when his machine struck and detonated a WWII bomb. In addition, the blast injured several motorists who were driving past.
- **2006** - A piling rig and dump truck were destroyed when a piling rig struck an Allied bomb on a construction site in Austria.
- **2003** - In the Austrian city of Salzburg, two people were killed while attempting to defuse a 250kg Allied bomb.
- **1994** - At a central Berlin construction site a piling rig struck a large WWII Allied bomb. 3 were killed and 14 more were injured. Dozens of cars in a 250m radius were wrecked, the top 10 floors of neighbouring office building collapsed and human remains were found 100m away.
- **1990** - In Wetzlar (Germany) two EOD engineers were blown up as they removed the detonator of an allied WWII UXB.

Project

Lowry House, Chorlton

Client:

Brownfield Solutions Ltd.

Report Ref:

DRA-22-1423

Info Source:

Various

BRIMSTONE
SITE INVESTIGATION

Suite 6, Delta House
Laser Quay, Culpeper Close
Rochester, Kent
ME2 4HU

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SC 50

Bomb Weight:

Explosive Weight:

Filling:

Charge/Weight Ratio:

Fuse Type:

Body Dimensions:

Appearance:

Variants:

40-54kg (110-119lb)

25kg (55lb)

TNT, Amatol or Trialen

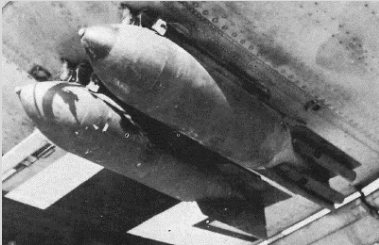
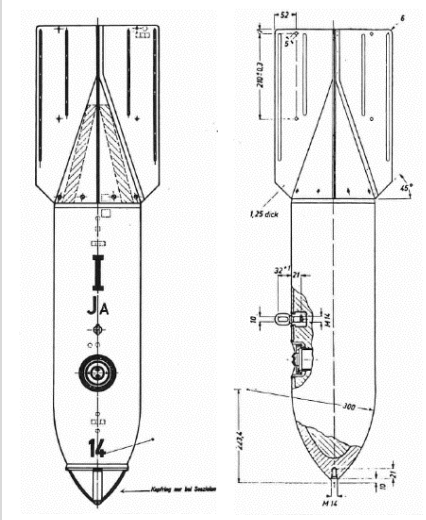
46%

Electrical impact fuse or mechanical delayed action fuse

1,100mm length x 200mm diameter

Bomb body and tail painted grey/green with a yellow stripe on the tail unit. Steel construction.

8 x variants. Additional fittings: Kopfring nose for limited penetration and Stabbo nose for dive-bombing.



SC 250

Bomb Weight:

Explosive Weight:

Filling:

Charge/Weight Ratio:

Fuse Type:

Body Dimensions:

Appearance:

Variants:

245-256kg (540-564lb)

125-130kg (276-287lb)

TNT, Amatol and Trialen mix

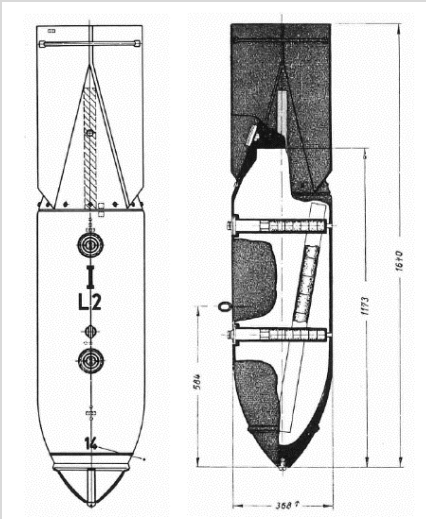
44%

1 or 2 electrical impact fuse(s) or mechanical delayed action fuse(s)

1,173mm length x 368mm diameter

Bomb body and tail painted grey/green with a yellow stripe on the tail unit. Steel construction.

8 x variants. Kopfring nose for limited penetration. Stabbo nose for dive-bombing.



SC 500

Bomb Weight:

Explosive Weight:

Filling:

Charge/Weight Ratio:

Fuse Type:

Body Dimensions:

Appearance:

Variants:

480-520kg (1,058-1,146lb)

220kg (485lb)

TNT, Amatol and Trialen mix

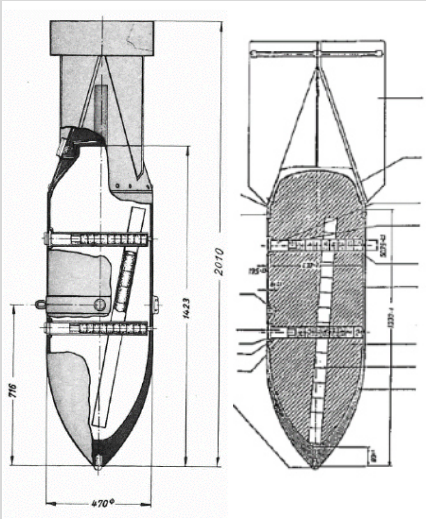
44%

2 electrical impact fuses or mechanical delayed action fuses

1,423mm length x 470mm diameter

Bomb body and tail painted grey/green or buff with a yellow stripe on the tail unit. Steel construction.

3 x variants. Kopfring nose for limited penetration.



Project	Lowry House, Chorlton
Client:	Brownfield Solutions Ltd.
Report Ref:	DRA-22-1423
Info Source:	W, Ramsey.1988 / various news sources

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Suite 6, Delta House

Laser Quay, Culpeper Close

Rochester, Kent

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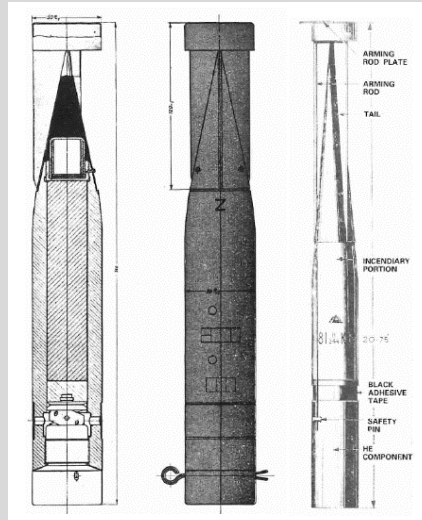
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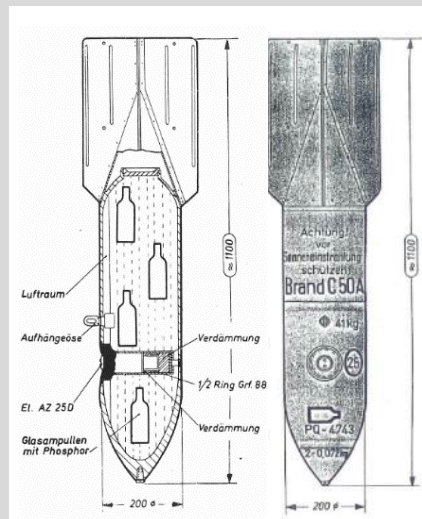
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B-1E Sub-Munition

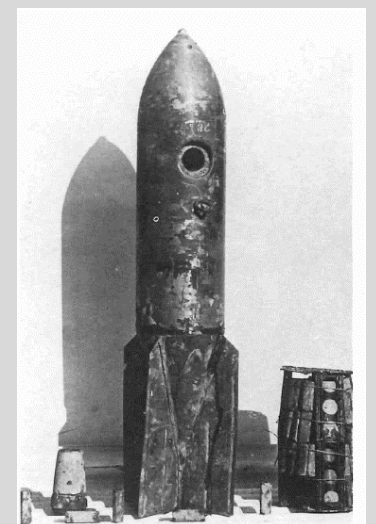
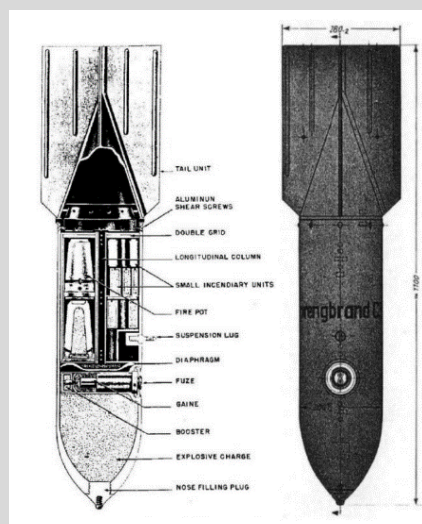
Bomb Weight: 1-1.3kg (2.2-2.87lb)
Incendiary Weight: 680g (1.4lb)
Filling: Thermite
Fuse Type: Simple impact fuse
Body Dimensions: 247mm length x 50mm diameter
Appearance: Grey body and dark green painted tail unit. Magnesium alloy case.
Operation: Small percussion charge ignites Thermite (>1,000°C burn).
Variants: Most common variant: B 2EZ (2kg) included a small HE charge
Remarks: Drop containers varied in size. The smallest cluster bomb held 36 x B-1Es and the largest 620 x B-1Es.

**Brand C50**

Bomb Weight: 41kg (90.4lb)
Incendiary Weight: 13kg (30lb)
Filling: Main fill (86% Benzine, 10% Rubber) plus 4% Phosphorus in glass bottles
Fuse Type: 1 x electrical impact fuse
Bomb Dimensions: 762mm length x 203mm diameter
Appearance: bomb body and tail painted grey or green with the rear of the bomb painted red and a red band around the centre of the body.
Variants: C 50 B: 77% White Phos fill
 C 250 A: 87.7% Petroleum, 11.7% Polystyrene, 0.5% White Phos (185kg version)

**Spreng-Brand C50 - Fire Pot**

Bomb Weight: 34kg (75lb)
Explosive Weight: 9kg (20lb)
Filling: TNT burster charge, 6 x Thermite containers (fire pots) and 67 x small triangular incendiary elements.
Fuse Type: 1 x electrical impact fuses or aerial burst fuse
Bomb Dimensions: 711mm length x 203mm diameter
Appearance: Bomb body and tail painted grey/green or pale blue with red base plug and red or green incendiary markings. Steel construction.
Operation: A charge blows off the base plate, firing a plume of incendiary mixture 100 yds. Approx 1 second later the HE charge detonates.



Project

Lowry House, Chorlton

Client:

Brownfield Solutions Ltd.

Report Ref:

DRA-22-1423

Info Source:

W, Ramsey.1988 / various news sources

BRIMSTONE
 SITE INVESTIGATION

 Suite 6, Delta House
 Laser Quay, Culpeper Close
 Rochester, Kent
 ME2 4HU

 +44 (0) 207 117 2492
 www.brimstoneuxo.com
 enquire@brimstoneuxo.com

HAA Battery - 3.7" QF Shell

Shell Weight: 12.7kg

Shell Dimensions: 94mm x 438mm

Fill Weight: 1.1kg

Fill Type: TNT

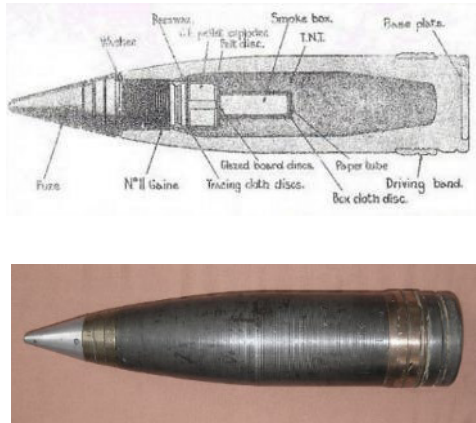
Fuse Type: Mechanical Time Delay fuse

Appearance: Grey body, copper driving bands, brass neck

Rate of Fire: 10 - 20 rpm

Ceiling: 9,000 - 18,000m

Variants: HE or shrapnel shells.
Note, the 4.5" gun was also used in an HAA role throughout the UK.



LAA Battery - 40mm Bofors Shell

Shell Weight: 0.84kg

Shell Dimensions: 40mm x 180mm

Fill Weight: 70g

Fill Type: TNT

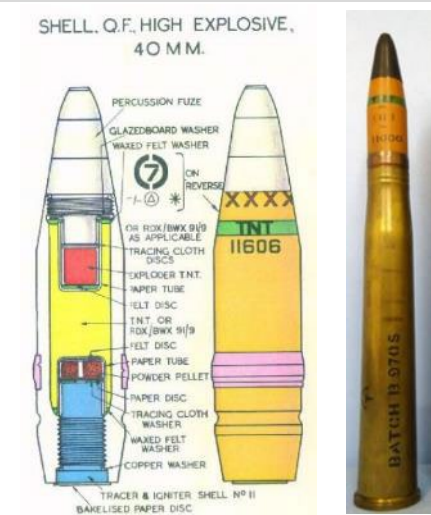
Fuse Type: Impact fuse

Appearance: Grey body, copper driving bands, brass neck

Rate of Fire: 120 rpm

Ceiling: 7,000m

Variants: HE or AP shells. Both with rear tracer compartment



Z Battery - 3" U.P Rocket

Rocket Weight: 24.5kg

Warhead Weight: 1.94kg

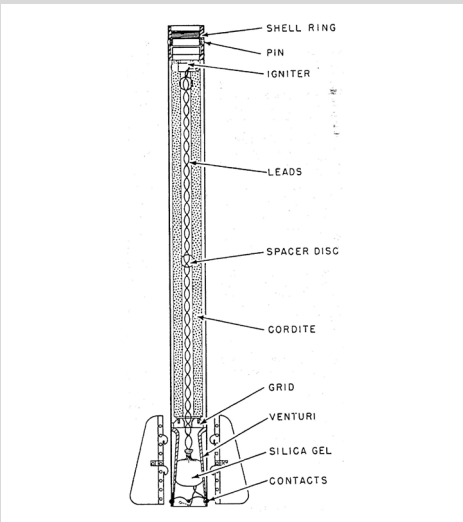
Filling: TNT warhead. Black Powder solid fuel rocket motor.

Fuse Type: Mechanical Time Delay fuse

Rocket Dimensions: 1,930mm x 76mm

Ceiling: 6,770m

Operation: Fired from single, tandem and (later) 36 x rail launchers (Z Batteries). Limited use throughout the UK.



AA	Anti-Aircraft (defences)
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
ASW	Anti-Submarine Warfare
BDU	Bomb Disposal Unit (historic term for EOD)
Bgl	Below Ground Level
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot (German bomb)
GI	Ground Investigation
HAA	Heavy Anti-Air (gun battery)
Ha	Hectare (10,000m2)
HE	High Explosive
IB	Incendiary Bomb
Kg	Kilogram
LAA	Light Anti Air (gun battery)
LCC	London County Council
LRRB	Long Range Rocket Bomb (V2)
LSA	Land Service Ammunition
Luftwaffe	German Air Force
OB	Oil Bomb (German bomb)
PM	Parachute Mine (German bomb)
RAF	Royal Air Force
RFC	Royal Flying Corps
RN	Royal Navy (British)
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SAA	Small Arms Ammunition
SD2	2kg AP bomb (German bomb)
SI	Site Investigation
U/C	Unclassified (German) bomb
UP	Unrotating Projectile (British 3” AA rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V1	German Flying (pilotless) bomb - “Doodlebug”
V2	German LRRB - “Big Ben”
WAAF	Women’s Auxiliary Air Force
WWI	World War One
WWII	World War Two

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BRIMSTONE SITE INVESTIGATION LTD, REGISTERED IN ENGLAND AND WALES UNDER
COMPANY NUMBER 10253758

WWW.BRIMSTONEUXO.COM

TEL: 0207 117 2492

ENQUIRE@BRIMSTONEUXO.COM

North West

**William Smith House
173 – 183 Witton Street
Northwich
Cheshire
CW9 5LP**

Tel: 01606 334 844

Midlands

**Unit 5, Alfred Court
Saxon Business Park
Stoke Prior
Bromsgrove
Worcestershire
B60 4AD**

Tel: 01215 729 014

www.brownfield-solutions.com

