

GEOENVIRONMENTAL ASSESSMENT

ROUNDWAY

**LAND AT THE REAR OF 163-173, THE ROUNDWAY, TOTTENHAM N17 7HE
HILL PARTNERSHIPS**

GEA-21914M-22-463

DECEMBER 2022

IDOM



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EXECUTIVE SUMMARY

A Geo-Environmental Assessment was requested by Hill Partnerships. The purpose of the assessment was to identify any geotechnical issues associated with former land uses at *Roundways, Land at the rear of 163-173, The Roundway, Tottenham N17 7HE* which might impact on the site's purchase and redevelopment.

SITE DETAILS

Approximate site area	0.15 ha
Current use / historic use	The site is currently disused land, previously used as allotment gardens.
Proposed use	A single-storey residential property comprising five units.

PHASE 1 NON-INTRUSIVE INVESTIGATION

Expected geology	The published geology indicates that the site is directly underlain by bedrock of the London Clay Formation.
Groundwater	The bedrock geology is classified as an Unproductive Stratum. The site is not within a groundwater Source Protection Zone (SPZ). No potable groundwater or surface water abstractions are located within 1 km of the site.
Surface water	A stream called Moselle Brook flows along the northern boundary of site.

PHASE 2 EXPLORATORY INVESTIGATION

Ground Conditions	Made Ground over a thin layer of Head Deposits overlying weathered London Clay.
Contamination	Contamination in the form of PAH, lead and phytotoxins has been encountered in the topsoil / made ground.
Geotechnical issues	Potential need to de-water foundation excavations.

RECOMMENDATIONS

Geotechnical	Based on the ground conditions encountered across the site, it is envisaged that traditional shallow strip footings or pad foundations will be feasible for the proposed development.
Remediation	Clean cover to 600 mm depth in private soft landscaped areas and 300 mm in communal gardens.
Waste classification	Previous reports have suggested the presence of Japanese knotweed. None was observed by IDOM Merebrook, but a management plan should be provided.

SECTION 1 INTRODUCTION

- 1.1 Hill Partnerships proposes to develop an area of land located at the Rear of 163 – 173, The Roundway, Tottenham. The proposed development comprises five pre-fabricated residential units with emergency vehicular access. IDOM Merebrook Limited (IDOM) has been commissioned by The Hill Group to undertake a supplementary site investigation works and to advise on the geo-environmental and geotechnical implications of the development of the site for the proposed end use.
- 1.2 The objectives of the investigation are to:
- i.* Assess the ground gas regime at the site;
 - ii.* Provide recommendations to mitigate potential risk associated with previously identified ground contamination; and
 - iii.* Provide comment upon the likely foundation solution for the site.
- 1.3 A Phase 1 (Non-intrusive Investigation) and a Phase 2 (Intrusive Investigation) have been undertaken previously for the subject by others. The following reports have been considered in compiling this GEA report:
- i.* Listers Geo Ltd; Ground Investigation Report, The Roundway, Tottenham (Ref: 21.08.016); November 2021;
- 1.4 The following reports should also be read in conjunction with this report:
- i.* Practical Ecology; Preliminary Ecological Appraisal Report: The Roundway, Tottenham (Ref: Version 1); September 2021;
 - ii.* Thomson Environmental Consultants; Aboricultural Survey: Land Rear of 163-173 The Roundway, Tottenham (Ref: Project No.: MINW114/001/001/001); September 2021; and
 - iii.* Select Surveys; Detailed Unexploded Ordnance (UXO) Risk Assessment: Land Rear of 163 -173 The Roundway, Tottenham (Ref: 21-IWL-3142); 30 September 2021.
- 1.5 This report presents the findings of the geo-environmental investigation and provides an interpretation of the geo-environmental conditions that exist at the site.
- 1.6 This report has been prepared for Hill Partnerships for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Hill Partnerships and IDOM as to the extent to which the findings may be appropriate for their use.

SECTION 2 PHASE 1 (NON-INTRUSIVE INVESTIGATION) SUMMARY**2.1 INTRODUCTION**

- 2.1.1 A Ground Investigation Report was undertaken for the subject site by Listers Geo (Ref: 21.08.016); dated February 2021. This included a Phase 1 Desk Study.
- 2.1.2 Historical maps at scales of 1:10,000, 1:10,560, 1:1,250, 1:1,056 and 1:2,500 were reviewed for historical contamination of the site and surrounding areas. The site itself was occupied agricultural land until 1935 when the site was redeveloped into allotment gardens. From at least 1999, the site appears to be largely overgrown and unlikely to have remained in use as allotments.
- 2.1.3 The Moselle Brook (stream) was located approximately 40 m north of the site until 1935, when mapping shows it located immediately along the northern boundary of the site. At this time, residential properties are developed surrounding the site with The Roundway immediately to the south of the site.
- 2.1.4 A site walkover was conducted on 6 October 2021 by Listers Geo. Access to the site was *via* a gateway leading off The Roundway. The shape of the site was irregular and the topography was generally flat. No buildings were present and the site consisted mostly of grassy soft landscaping. Possible evidence of Japanese Knotweed was noted during the onsite walkover.
- 2.1.5 The potential on site sources of contamination, were identified as:
- i.* Made Ground from historical allotments, previous levelling of the site and development adjacent residential properties.

2.2 GEOLOGY

- 2.2.1 The published geological map information on the area indicates that the site is underlain by the London Clay Formation. It is anticipated that the thickness of the London Clay Formation is approximately 20 m, underlain by deposits of the Lambeth Group comprising clay with silty / sandy layers and localised sand and gravels. Underlying the Lambeth Group, the Thanet Formation comprises clayey glauconitic sand and beneath, approximately 45 m below ground level (bgl), the White Chalk Subgroup with flints is present.
- 2.2.2 No historic borehole logs from the British Geological Survey were identified within the vicinity of the site.

2.3 HYDROGEOLOGY

- 2.3.1 The London Clay Formation was classed as an Unproductive Stratum.
- 2.3.2 The site is not within a groundwater Source Protection Zone.

2.3.3 There are no recorded current groundwater abstraction licences within 1 km of the site.

2.4 **HYDROLOGY**

2.4.1 The Moselle Brook is immediately adjacent to the northern boundary of the site.

2.4.2 There is a moderate risk of groundwater flooding.

2.5 **CURRENT SITE ISSUES**

2.5.1 Potentially significant environmental issues have been investigated within relevant distances of the site, based on the Lister Geo Report. These relate to the following searches:

- i.* Water discharge or pollution incidents within 250 m of the site;
- ii.* Waste management sites within 250 m of the site;
- iii.* Statutory authorisations within 50 m of the site;
- iv.* Trade directory entries of possible contaminative use within 50 m of the site;
- v.* Special protection or conservation areas within 50 m of the site; and
- vi.* Any other relevant issues.

2.5.2 Potentially significant environmental issues identified by the above searches are summarised in Table 1 below

Table 1: Potentially significant environmental issues

ENVIRONMENTAL CATEGORY	DESCRIPTION
Water discharge or pollution incidents within 250 m	No water discharge or pollution incidents with 250 m.
Waste management sites within 250 m	One record within 250 m, relating to a waste exemption to sort and denature drugs, located approximately 184 m north east of the site.
Statutory authorisations within 50 m	None within 50 m.
Trade directory entries of possible contaminative use within 50 m	None within 50 m
Special protection or conservation areas within 50 m	None identified.

2.6 RADON GAS

2.6.1 The site does not lie within a Radon Affected Area.

2.7 PREVIOUS INVESTIGATIONS

2.7.1 *Ground Investigation Report* by Listers Geo in November 2021.

2.7.2 The investigation comprised the following scope of work:

- i. One cable percussive borehole up to 15.0 m bgl;
- ii. Three windowless sample boreholes up to 6.0 m bgl;
- iii. Three hand auger boreholes up to 1.0 m bgl; and
- iv. Four dynamic cone penetrometer (DCP) tests.

2.7.3 All boreholes encountered topsoil from depths between 0.00 m to 0.60 m bgl, except HA03, which recorded made ground throughout. In addition, CT03 encountered buried topsoil between 0.65 m to 0.90 m bgl.

2.7.4 Topsoil comprised brown slightly organic, slightly sandy, slightly gravelly silt or clay with inclusions of flint, brick, and occasional fragments of pottery. Made ground was encountered at a thickness between 0.65 m to 1.60 m bgl and comprised of brown mottled orange slightly sandy, slightly gravelly silt/clay with inclusions of flint, brick and occasional fragments of pottery. The London Clay Formation was encountered from depths between 0.10 m to 1.80 m bgl, reaching depths up to 15.0 m bgl in BH01, consisting generally of firm to stiff clay.

2.7.5 A groundwater strike was encountered in CT01 at a depth of 0.80 m bgl, considered to be seepage of perched groundwater. A slight groundwater seepage was encountered at CT02 at a depth of 5.0 m bgl in the London Clay Formation.

2.7.6 Monitoring wells were installed in two windowless sample boreholes (CT01 and CT02). Ground gas monitoring was conducted on two occasions. Methane was not detected; carbon dioxide was detected up to 8.1 % v/v and oxygen was depleted to 10.0 % v/v. The maximum recorded flow rate was 3.3 (l/h); the well response zones were flooded.

2.7.7 Soil samples collected from exploratory holes were submitted for chemical analysis and were analysed against risk-based criteria protective of a residential development where the consumption of homegrown produce is not expected.

2.7.8 The site investigation recorded contamination of topsoil and made ground by PAH compounds and hydrocarbons. s of PAHs.

- 2.7.9 One sample of natural soil from the top of the London Clay Formation recorded concentrations of arsenic in excess of the screening criteria.

SECTION 3 SUPPLEMENTARY SITE INVESTIGATION RATIONALE

3.1 INTRODUCTION

- 3.1.1 A supplementary site investigation rationale has been devised to obtain additional environmental and geotechnical data and to supplement the findings of the earlier investigation. Groundwater levels and ground gas monitoring were also undertaken.
- 3.1.2 Intrusive sampling locations were chosen on the basis of providing geotechnical data to assist in the design of foundations.

3.2 SITE INVESTIGATION METHODS

- 3.2.1 An intrusive investigation was carried out by IDOM on 26 October 2022 and comprised the following scope of work:
- i.* Five shallow windowless sample probe holes (MWS101 to MWS105) to a depth of 5.0 m bgl
- 3.2.2 Exploratory hole locations are indicated on drawing 21914m-304-001 in Appendix 1. Logging of exploratory holes was undertaken by an IDOM Officer. Exploratory hole logs are contained in Appendix 2.
- 3.2.3 A tracked windowless sampling rig was used to advance MWS01 to MWS05. This comprised a rig-mounted drop hammer to drive a hollow steel barrel into the ground. The barrel is recovered along with a removable plastic sleeve, which lines the barrel and holds a core of soil which is retracted for logging and sampling. SPTs were performed at approximate 1 m intervals in all windowless sample holes.
- 3.2.4 Four of the windowless sample boreholes were installed with monitoring standpipes, details of which are included on the borehole logs.
- 3.2.5 Representative soil samples were taken from various depths and strata to assess the contaminative status of the site. Soil samples were submitted to an MCERTS/UKAS accredited laboratory for chemical analysis of a broad suite of potential contaminants. The results are provided in Appendix 3.
- 3.2.6 A programme of geotechnical laboratory testing was performed on selected soil samples obtained from the boreholes to determine the potential for desiccation. The results are provided in Appendix 4.

SECTION 4 GROUND CONDITIONS

4.1 SURFACE GROUND CONDITIONS

- 4.1.1 The site at the time of attendance was covered by grass.

4.2 SUB-SURFACE GROUND CONDITIONS

4.2.1 The intrusive investigation revealed Made Ground over a thin layer of Head Deposits over weathered London Clay Formation. The published geological maps did not record the presence of Head Deposits.

4.2.2 A summary of the ground conditions encountered is presented in Table 2, whilst a more detailed assessment of the strata is contained in the following sections of the report.

Table 2: Summary of Sub-surface Ground Conditions

STRATA	DEPTH TO TOP RANGE (m bgl)	THICKNESS RANGE (m)
Made Ground	0.00	0.40- 1.00
Head Deposits	0.40- 1.00	0.40- 1.10
Weathered London Clay Formation	1.20- 1.40	3.20- >3.80
London Clay Formation	4.50-4.60	Base Not Proven

4.2.3 Made Ground

4.2.3.1 The Made Ground was typically described as a slightly gravelly and slightly sandy clay. Gravel comprised flint, concrete, clinker and brick. Other than the anthropogenic inclusions, no visual or olfactory evidence of contamination was observed within the Made Ground

4.2.3.2 No perched water was encountered within the Made Ground.

4.2.4 Head Deposits

4.2.4.1 Head Deposits were typically described as soft orang brown mottled grey gravelly clay. The gravel was flint.

4.2.4.2 No visual or olfactory evidence of contamination was observed within the Head Deposits.

4.2.4.3 No groundwater was encountered within the Head Deposits

4.2.4.4 SPT tests undertaken within the Head Deposits recorded SPT "N" Values of between 4 and 12 indicating the soils of the head deposits were low to medium strength.

4.2.4.5 One Atterberg (plasticity) test was undertaken on a sample of the Head Deposits, This recorded a modified plasticity index of 32, classifying the head deposits as medium volume change potential in accordance with NHBC Standards 2022. As the moisture content was above the plasticity index the Head Deposits does not indicate evidence of desiccation.

4.2.5 London Clay Formation

- 4.2.5.1 The London Clay Formation was weathered near surface and was described as firm orangish brown clay containing occasional decomposed roots and selenite (Gypsum) crystals. The weathering persisted to between 4.50 and 4.60 m bgl in all locations, with the exception of MWS102 where it persisted to the full depth of 5.00 m bgl. Below the weathering, the London Clay Formation was described as firm grey clay with occasional pockets of silt.
- 4.2.5.2 No groundwater strikes were recorded within the London Clay Formation.
- 4.2.5.3 No visual or olfactory evidence of contamination was observed within the London Clay Formation.
- 4.2.5.4 SPT tests undertaken within the London Clay Formation recorded SPT “N” Values of between 8 and 17 indicating low to high strength ground conditions.
- 4.2.5.5 A total of fourteen Atterberg (plasticity) tests were undertaken within the London Clay Formation. The tests showed moisture contents ranging between 25.8 and 35, with plastic limits ranging between 26 and 31. Most moisture contents were slightly above their respective plastic limits. However, MWS101 and MWS102 at 1.5 m bgl were slightly below their plastic limit indicating some potential desiccation at this depth. The tests also recorded modified plasticity index's ranging between 38 and 49 classifying the London Clay Formation as high-volume change potential in accordance with NHBC Standards 2022.

SECTION 5 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

5.1 FOUNDATIONS

- 5.1.1 The proposed development comprises five units with associated driveway, parking areas and green open space.
- 5.1.2 The recent investigations found a limited thickness of Made Ground and Head Deposits over the London Clay Formation.
- 5.1.3 The London Clay Formation was weathered near surface with the weathering often persisting to 4.50m bgl and greater than 5.0m bgl in one location. Nonetheless, the London Clay Formation.
- 5.1.4 Based on the ground conditions encountered across the site, it is envisaged that traditional shallow strip footings or pad foundations will be feasible for the proposed development.
- 5.1.5 Atterberg testing within the London Clay formation indicated that some desiccation maybe present at around 1.5m bgl near locations MWS101 and MWS102 and therefore the foundation depth recommendations have been updated and it is recommended to extend to a minimum depth of 2.0m bgl. The tests also showed

the London Clay Formation has high volume change potential in accordance with NHBC Standards 2022.

- 5.1.6 All footings should be founded at a minimum depth of 2.0m bgl within the London Clay Formation. Footings may need to be locally deepened where soft (low strength) clay is present initially, or where new building footprints are situated within the zone of influence of any existing, proposed or removed trees, in accordance with NHBC guidelines.
- 5.1.7 Allowable bearing pressures (ABPs) of 75 kN/m² will be achievable for strip footings up to 1.0 m wide founded within firm and stiff (medium and high strength) clay at a minimum depth of 2.0m bgl. Anticipated total settlements would be <25mm.
- 5.1.8 For a Square Pad Foundation up to 1 m wide by 2.0 m bgl ABPs of 90kN/m² will be achievable and for a square pad foundation anticipated total settlement for both options would be less than <25mm.
- 5.1.9 If building footprints are proposed in the zone of influence of existing trees / hedgerows or proposed trees, more detailed assessment may be necessary to determine whether piled foundations are required. Should foundation trenches reveal live roots or rootlets then foundations must be extended to greater depth to bypass the unsuitable soils.

5.2 EXCAVATIONS AND GROUNDWATER

- 5.2.1 Groundwater level monitoring was undertaken on two occasions – 28 October and 10 November 2022. Between the two monitoring rounds groundwater was recorded between 0.30 m and 2.90 m bgl. It is therefore possible that foundation excavations will require dewatering, especially if undertaken during periods of wetter weather.
- 5.2.2 Based on the ground conditions observed at the site, any shallow excavations have the potential to become unstable in the short term, therefore, if man-entry is required, excavations should be supported by shoring or otherwise battered back to a safe angle in order to protect the workforce from possible collapse.

5.3 FLOOR SLABS

- 5.3.1 The Head Deposits recorded medium volume change potential and the London Clay Formation recorded high volume change potential, therefore, it is recommended that suspended floor slabs are adopted for the proposed development.

SECTION 6 ENVIRONMENTAL ASSESSMENT

6.1 SOIL QUALITY

- 6.1.1 A total of four topsoil / made ground soil samples were submitted to the laboratory for chemical analysis. The laboratory chemical analysis certificates are contained in Appendix 3. The results of the analysis are summarised in Table 3.

- 6.1.2 An initial screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against *Suitable for Use Levels* (S4ULs) published in 2015 by LQM/CIEH¹. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. In this report S4ULs have been selected for a residential land without homegrown produce and assuming a soil organic matter of 1 %. For lead the DEFRA Category 4 Screening Level² has been used as this is based on updated toxicological data and a low risk to human health.
- 6.1.3 An additional set of phytotoxin screening levels have been adopted from 'The Code of Agricultural Practice for the Protection of Soil' Ministry of Agriculture, Fisheries and Food (MAFF), 1993, which are protective of healthy plant growth.

Table 3: Summary of Soils Chemical Analysis Results

CONTAMINANT	No of Tests	MAX (mg.kg ⁻¹)	MEAN (mg.kg ⁻¹)	SCREENING LEVEL (SL) (mg.kg ⁻¹)	No > SL*
HUMAN HEALTH RISK ASSESSMENT					
Asbestos in soil	4	Not detected		Detected	0
pH	4	7.5	7.3	5 – 9	0
Arsenic	4	38.0	28.3	40	0
Cadmium	4	0.9	0.9	85	0
Chromium (total)	4	51.0	47.0	910	0
Hexavalent Chromium	4	Below Detection Limit of <1.8		6	0
Lead	4	820.0	522.5	310	2
Mercury	4	0.6	0.6	56	0
Nickel	4	52.0	42.0	180	0
Selenium	4	Below Detection Limit of <1.0		430	0
TPH Aliphatic >EC ₅ - EC ₆	4	Below Detection Limit of <0.001		78	0
TPH Aliphatic >EC ₆ - EC ₈	4	Below Detection Limit of <0.001		230	0
TPH Aliphatic >EC ₈ - EC ₁₀	4	Below Detection Limit of <0.001		65	0
TPH Aliphatic >EC ₁₀ - EC ₁₂	4	Below Detection Limit of <1.0		330	0
TPH Aliphatic >EC ₁₂ - EC ₁₆	4	Below Detection Limit of <2.0		2400	0
TPH Aliphatic >EC ₁₆ - EC ₂₁	4	Below Detection limit of <8.0		92000	0
TPH Aliphatic >EC ₂₁ - EC ₃₅	4	Below Detection Limit of <10		92000	0
TPH Aromatic >EC ₅ - EC ₇	4	Below Detection Limit of <0.001		690	0

¹ Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. *The LQM/CIEH S4ULs for Human Health Risk Assessment*. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3100. All rights reserved. Including August 2015 nickel update.

² SP1010 *Development of Category 4 Screening Levels Main Report* (Dec 2013) and SP1010 *Policy Companion Document* (Mar 2014).

CONTAMINANT	No of Tests	MAX (mg.kg ⁻¹)	MEAN (mg.kg ⁻¹)	SCREENING LEVEL (SL) (mg.kg ⁻¹)	No > SL*
TPH Aromatic >EC ₇ - EC ₈	4	Below Detection Limit of <0.001		1800	0
TPH Aromatic >EC ₈ - EC ₁₀	4	Below Detection Limit of <0.001		110	0
TPH Aromatic >EC ₁₀ - EC ₁₂	4	1.70	1.70	590	0
TPH Aromatic >EC ₁₂ - EC ₁₆	4	2.40	2.20	2300	0
TPH Aromatic >EC ₁₆ - EC ₂₁	4	31.00	21.50	1900	0
TPH Aromatic >EC ₂₁ - EC ₃₅	4	75.00	36.33	1900	0
Benzene	4	Below Detection limit of <1.0		0.7	0
Toluene	4	Below Detection limit of <1.0		1900	0
Ethylbenzene	4	Below Detection limit of <1.0		190	0
Xylene	4	Below Detection limit of <1.0		180	0
Naphthalene	4	0.22	0.22	5.6	0
Acenaphthylene	4	0.45	0.25	4600	0
Acenaphthene	4	0.17	0.17	4700	0
Fluorene	4	0.18	0.13	3800	0
Phenanthrene	4	4.50	1.95	1500	0
Anthracene	4	1.20	0.52	35000	0
Fluoranthene	4	13.00	5.53	1600	0
Pyrene	4	12.00	5.23	3800	0
Benzo(a)anthracene	4	6.10	2.64	14	0
Chrysene	4	7.40	3.20	31	0
Benzo(b)fluoranthene	4	7.50	3.15	4	1
Benzo(k)fluoranthene	4	4.20	1.91	110	0
Benzo(a)pyrene	4	7.70	3.33	3.2	1
Indeno(1,2,3-c,d)pyrene	4	4.30	1.86	46	0
Dibenzo(a,h)anthracene	4	0.83	0.35	0.32	1
Benzo(g,h,i)perylene	4	4.40	2.02	360	0
Phenol	4	Below Detection limit of <1.0		690	0
PHYTOTOXICITY RISK ASSESSMENT					
Copper	4	270.0	169.8	200	2
Nickel	4	52.0	42.0	110	0
Zinc	4	520.0	352.5	300	3

Notes: * Number of samples exceeding screening level

nd = not detected

6.1.4 Zootoxic Metals (harmful to human health)

- 6.1.4.1 Concentrations of lead in excess of the screening criteria protective of human health were recorded in two locations. Samples from MWS101 (0.4 m bgl) and MWS104

(0.50 m bgl), were collected from topsoil / made ground which was observed to contain clinker, brick, tarmac and concrete.

6.1.5 Phytotoxic Metals (harmful to plant health)

6.1.5.1 Copper was found to exceed its respective screening value in terms of harm to plants in two samples of topsoil / made ground (MWS101 at 0.4 m & MWS104 at 0.5m bgl).

6.1.5.2 Zinc was encountered at a concentration exceeding the applicable screening criteria, in three samples of topsoil / made ground (MWS101 at 0.4 m, MWS103 at 0.4 m and MWS104 m bgl).

6.1.6 Organic Contaminants

6.1.6.1 Concentrations of benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(a,h)anthracene in excess of the screening criteria protective of human health were encountered in one sample of topsoil / made ground in MWS104 at 0.5 m bgl. This sample from made ground / topsoil comprised clinker, concrete and brick in a gravelly sandy clay.

6.1.7 Inorganic Contaminants

6.1.7.1 No exceedances of the applicable screening criteria were encountered.

6.1.8 Summary

6.1.8.1 Topsoil / made ground was found to be contaminated by lead, PAHs and phytotoxins in the western section of the site, associated with inclusions of, brick, clinker, tarmac and concrete. Phytotoxins (zinc and copper) were encountered in the eastern parcel of the site.

6.2 **GROUNDWATER**

6.2.1 Groundwater level monitoring was undertaken on two occasions – 28 October and 10 November 2022. First monitoring round recorded resting water levels between 2.85 m – 2.90 m bgl in boreholes MWS103 and MWS104. This is likely to be groundwater seepage from the surface infiltrating the topsoil / made ground. The second monitoring round recorded variable water levels between 0.30 m to 1.91 m bgl in all monitoring wells.

6.3 **HAZARDOUS GAS**

6.3.1 Gas monitoring has been undertaken on three occasions. Levels of methane, carbon dioxide, and oxygen were recorded in each standpipe, together with associated parameters including borehole flow and ambient air pressure. The results of these gas monitoring rounds are contained in Appendix 5.

6.3.2 Each borehole was installed into natural strata.

- 6.3.3 The monitoring rounds were undertaken at moderate barometric pressures ranging from 1000 to 1026 mb. Positive flow was not recorded. Over the three monitoring rounds methane (CH₄) was not detected, carbon dioxide (CO₂) was detected to a maximum of 2.9 % v/v with a corresponding depleted oxygen concentration of 12.3 % v/v.

6.4 **WASTE CLASSIFICATION, OFF-SITE DISPOSAL OR RE-USE**

6.4.1 Waste Considerations

- 6.4.1.1 Based upon the chemical data recorded, topsoil and made ground soils would be classed as non-hazardous waste for disposal. Further WAC testing would be required to determine whether disposal at inert landfill was possible. Natural soils (excluding topsoil) would be classed as inert waste for disposal.

- 6.4.1.2 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statutes including the *Environmental Protection Act 1990* (as amended), *The Controlled Waste Regulations 2012* (as amended), *The Waste (England and Wales) Regulations 2011* (as amended), *The Hazardous Waste (England and Wales) Regulations 2005* as amended, *The Waste Management (England and Wales) Regulations 2006*, and *The Environmental Permitting (England and Wales) Regulations 2016* (as amended).

- 6.4.1.3 It is a requirement of these regulations that waste sent to landfill should have been subject to measures to reduce the amount of waste, reduce harmful or hazardous properties and facilitate recycling. These requirements may be satisfied by measures such as segregation and screening of wastes to recover suitable fill and material for crushing, segregation of inert materials and putrescible wastes.

6.4.2 Re-use Considerations

- 6.4.2.1 As a sustainable alternative to off-site disposal, it may be possible to re-use site-won soils provided the following criteria are met:

- i.* Use of the material will not create an unacceptable risk of pollution to the environment or harm to human health;
- ii.* The material must be chemically and geotechnically suitable without further treatment;
- iii.* There must be certainty of use within the scheme;
- iv.* Material should only be used in the quantity necessary for that use.

- 6.4.2.2 Provided these criteria are met, the re-use of site-won materials is unlikely to be deemed a waste activity. Production of a *Materials Management Plan* under the industry *CL:AIRE Code of Practice on the Definition of Waste* represents a robust

method of demonstrating that the proposed re-use of material meets the criteria and is not liable for landfill tax.

SECTION 7 RISK ASSESSMENT

- 7.1 The potential sources of contamination at the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment.
- 7.2 The investigations demonstrate that the former uses of the site have resulted in contamination by heavy metals (lead), phytotoxic metals, TPH, PAHs and ground gases. These materials are considered for their potential to act as sources for a number of pollutant linkages.
- 7.3 The potential impacts of contamination sources have been considered with respect to the following receptors:
- i.* The general public and present site users,
 - ii.* Residents of future development,
 - iii.* Groundwater,
 - iv.* Surface water,
 - v.* Construction workers,
 - vi.* Adjacent land, and
 - vii.* Infrastructure.
- 7.4 In each case the existence of a pollutant linkage requires a pathway by which the receptor could be exposed to the source. A qualitative assessment of risk is thus considered in the first instance with respect to the site in its current condition and is summarised in the sections below.
- 7.5 **The general public and present site users**
- 7.5.1 Access to the site is restricted by locked metal gate and the site is currently disused. As a result, the potential for contamination risk to current site users is low.
- 7.6 **Residents of future development**
- 7.6.1 Soil contamination (chemical)
- 7.6.1.1 Contamination was encountered in soil, principally as PAHs and heavy metals (lead) within topsoil / made ground.
- 7.6.1.2 In the absence of mitigation measures there is the potential for direct contact and accidental ingestion of soil and inhalation of contaminated dust. It is therefore deemed as low to moderate risk.

7.6.2 Asbestos

7.6.2.1 No asbestos was encountered during the investigation and no risk has been identified from this contaminant.

7.6.3 Hazardous Soil Gas/Vapours (including hydrocarbon vapours/radon)

7.6.3.1 This investigation encountered no volatile contamination on site and does not lie within a radon affected area.

7.6.3.2 CIRIA 665 / BS8485(2015+A1:2019) / NHBC guidance has been followed to assess the recorded soil gas and flow conditions. It should be noted that the previous investigation conducted by Listers Geo, detected levels of carbon dioxide at 8.1 % v/v and a positive flow rate up to 3.3 (l/h) which would class the site as requiring CS2 or NHBC Amber 1 Gas protection measures. However, the boreholes were noted to be flooded at the time of the Listers monitoring. As a result, the data is not considered reliable and has been discounted.

7.6.3.3 Based upon the more recent monitoring data, the site would conform to CIRIA Characteristic situation 1, where-by gas protection measures are not required.

7.7 Controlled waters

7.7.1 The contamination on site is contained within the topsoil / made ground and the contaminants encountered are not considered radially leachable or mobile.

7.7.2 The risk to groundwater and surface waters is assessed as low, based on the low permeability which is likely to inhibit the vertical and lateral migration of contamination.

7.8 Construction workers

7.8.1 Potentially, construction workers are initially at the greatest risk from exposure to hazardous contamination due to excavation works and during the handling of materials including imported soils. When undertaking construction, site workers must be made aware of the potential for encountering contaminated shallow soils.

7.9 Adjacent land

7.9.1 Soil based contamination encountered within shallow topsoil / made ground is not considered to pose a risk to adjacent land due to its limited extent and low mobility.

7.9.2 The current surrounding land use of the site, being residential, is not considered to pose a potential contaminative risk to the site.

7.9.3 Therefore, the risk to and from adjacent land is considered to be low.

7.10 Infrastructure

- 7.10.1 This investigation identified phytotoxic metals (zinc and copper) in topsoil / made ground that may pose a risk to healthy plant growth in soft landscaped areas. Furthermore, it is proposed that levels across the site are raised with clean imported material. Therefore, the risk to planting schemes is deemed to be low.
- 7.10.2 It is recommended that the utility provider is consulted with respect to their requirements for water supply pipes. Utility companies apply strict guideline levels on use of polymeric pipes and may consider all made ground unsuitable for typical plastic pipe materials to be used.

SECTION 8 UPDATED CONCEPTUAL MODEL

- 8.1 Following the assessment of Phases 1 and 2 Ground Investigation Report by Listers Geo, and completion of a supplementary Phase 2 Geoenvironmental Report by IDOM with a qualitative risk assessment, the conceptual model for the site, with relation to pollutant linkages, has been updated. The revised model is presented in Table 4 below.

Table 4: Revised Conceptual Model

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Heavy metals and hydrocarbons (topsoil / made ground)	Contact with contaminated soil	Human health (current users)	Low risk identified Contamination by PAHs, TPH and lead has been detected to date. However, the site is secured limiting potential exposure.
	Ingestion and inhalation of contaminated soil and dust	Human health (current users)	
Heavy metals and hydrocarbons (topsoil / made ground)	Contact with contaminated soil	Human health (future residents and construction workers)	Low to moderate risk identified Topsoil / made ground contains elevated metals, PAHs and TPH.
	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	Low risk identified No asbestos was detected in the samples taken.
Contamination (all forms)	Vertical migration to aquifer	Controlled waters	Low risk identified Heavy metals, TPH and PAHs were detected above screening levels. The underlying London Clay Formation will serve as an aquitard.
Contamination (all forms)	Horizontal migration to surface water	Controlled waters	Low risk identified The majority of topsoil / made ground comprised silt and clay, and the contaminants identified are not considered to be mobile.
Hydrocarbons	Direct contact	Plastic water pipes	Low to moderate risk identified Contamination with the potential to permeate polymeric services has been identified by this investigation. Utility providers should be contacted to ensure risks are further mitigated.

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Hazardous Gas/Vapours In soil	Ingress into buildings and voids	Human health (future residents and construction workers)	Low risk identified Ground gas monitoring found low levels of ground gas and no flows.
Adjacent Land	Lateral migration via made ground and perched waters	Controlled Waters and Human Health	Low risk identified Contamination with the potential to affect adjacent sites is not expected.

SECTION 9 PRELIMINARY REMEDIATION STRATEGY

- 9.1 The identified risks at the site can be mitigated by removal of either the source, pathway or receptor. With reference to the conceptual model for the site a remediation strategy, based on source or pathway removal, has been designed.
- 9.2 The previous Listers report has identified the potential for Japanese knotweed. This was not noted during the IDOM site investigation. However, the site investigation was undertaken outside the principal growing season. Where there is the potential for Japanese knotweed, soils should be excavated in the presence of a suitable qualified Clerk of Works or treated in an appropriate manner.
- 9.3 Remedial measures are recommended and should consist of the following:
- The provision of clean cover in areas of soft landscaping comprising 600 mm of clean imported soil in areas of private soft landscaping and 300 mm in communal areas.
- 9.4 Material imported for the formation of landscaped areas should be obtained from a validated source and the validation should incorporate an assessment of the provenance of the material and chemical analysis.
- 9.5 Potential risks to construction workers have been identified and the adoption of appropriate Health and Safety procedures will ensure that risks to operatives from hazardous materials at the site are minimised. Operatives should not be allowed to eat, drink or smoke on site except in designated areas and should be required to wash all exposed skin at the end of each shift. Operatives should be informed of the potential hazards at the site and should be required to report any observations of suspect material.
- 9.6 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statutes including the *Environmental Protection Act 1990* (as amended), *The Controlled Waste Regulations 2012* (as amended), *The Waste (England and Wales) Regulations 2011* (as amended), *The Hazardous Waste (England and Wales) Regulations 2005* as amended, *The Waste Management (England and Wales) Regulations 2006*, and

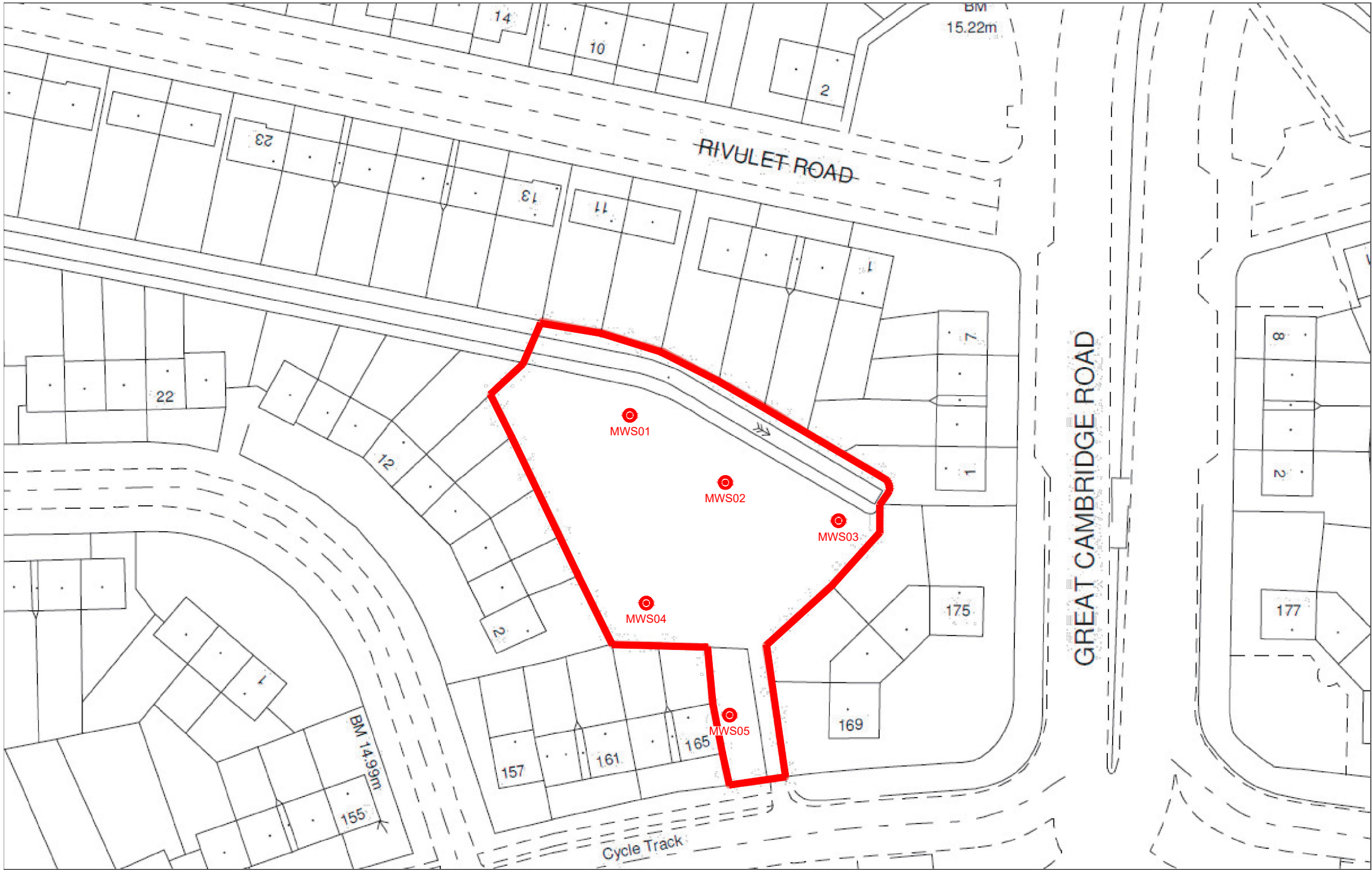
The Environmental Permitting (England and Wales) Regulations 2016 (as amended).

- 9.7 It is recommended that this report is submitted to the regulators (Local Authority EHO and Planners, Environment Agency Planning Liaison and NHBC) for approval prior to commencement of the works.
- 9.8 Any observations of ground conditions atypical of those already described should be reported to IDOM immediately so that an assessment of appropriate action can be made.

SECTION 10 CONCLUSIONS

- 10.1 The intrusive investigation revealed Made Ground over a thin layer of Head Deposits over weathered London Clay Formation.
- 10.2 Based on the ground conditions encountered across the site, it is envisaged that traditional shallow strip footings or pad foundations will be feasible for the proposed development. All footings should be founded at a minimum depth of 2.0 m bgl within the London Clay Formation.
- 10.3 The made ground / topsoil has been found to be impacted across the site by contamination in the form of PAHs, TPH, heavy metals and phytotoxins. Based on the underlying rich clay geology and fine-grained soils within topsoil / made ground, combined with the type and nature of contamination (which is not readily soluble or mobile), the potential risk to controlled waters is low.
- 10.4 The proposed remedial actions are the provision of clean soils in areas of soft landscaping.
- 10.5 The previous Listers report has identified the potential for Japanese knotweed. This was not noted during the IDOM site investigation. However, the site investigation was undertaken outside the principal growing season. Where there is the potential for Japanese knotweed, soils should be excavated in the presence of a suitable qualified Clerk of Works or treated in an appropriate manner.

APPENDIX 1 ▪ Drawings



LEGEND

--- Site boundary

● Merebrook window sample with location reference

MWSref

First Issue	10/11/2022		-
	FDO	MJB	MJB
	DWN	CHD	APP'D
ISSUE PURPOSE	PRELIMINARY		
CLIENT	Hill Partnerships Ltd		
PROJECT	Roundways, Tottenham		
DWG TITLE	Site Investigation Location Plan		
DWG NO.	21914m-304-001		REVISION -
SCALE N.T.S	DATE November 2022	FRAM DIMENSIONS (mm) (A3) 400 x 280	
DRAWN FDO	CHECKED MJB	APPROVED MJB	

London

Kent

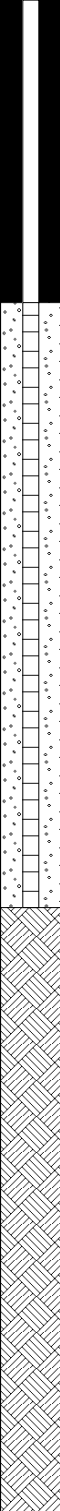
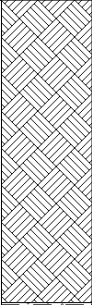
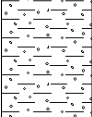
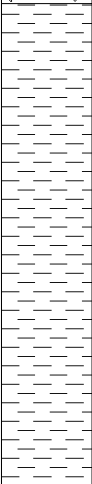
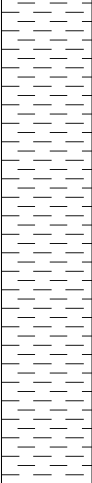
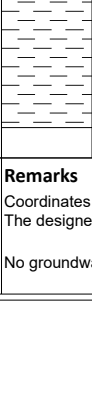
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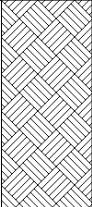
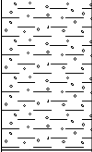
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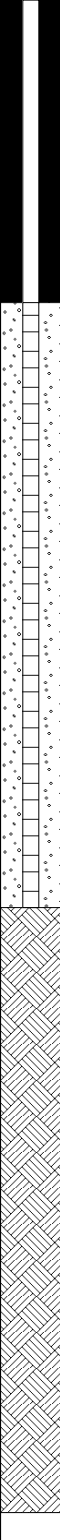
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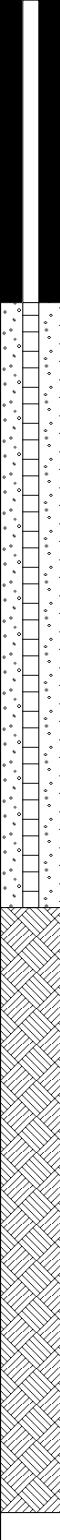
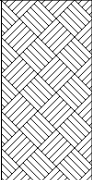
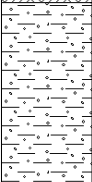
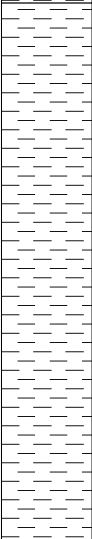
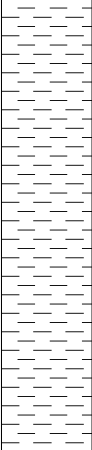
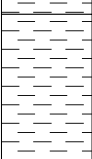
APPENDIX 2 ▪ Exploratory Hole Logs

					Windowless Sample Log		Borehole No. MWS101 Sheet 1 of 1				
Project Name: Roundways			Project No. 21914m		Co-ords:		Scale 1:25				
Location: Tottenham					Level (m):		Logged By MB				
Equipment: Premier Compact 110 Series					Dates: 26/10/2022		Checked By				
Well	Wtr Strk	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.40	D,J					Very soft brown slightly gravelly slightly sandy CLAY with occasional rootlets and roots. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint, concrete, tarmac and brick. [TOPSOIL / MADE GROUND]	1		
		0.50	D								
		1.00	SPT(S)	N=8 (1,2/2,2,2,2)	1.00			Soft orangish brown mottled grey slightly gravelly CLAY with rare roots. Gravel is rounded to subrounded fine to coarse flint. [HEAD DEPOSITS]			
		1.50	D		1.40						
		2.00	SPT(S)	N=17 (3,3/3,4,5,5)				Firm orangish brown mottled greyish blue CLAY with occasional partially decomposed wood fragments and rare roots. [WEATHERED LONDON CLAY FORMATION]	2		
		2.50	D								
		3.00	SPT(S)	N=17 (2,3/4,4,4,5)				Firm orangish brown mottled greyish blue CLAY with occasional partially decomposed wood fragments and rare roots. [WEATHERED LONDON CLAY FORMATION]	3		
		3.50	D								
		4.00	SPT(S)	N=16 (2,3/3,4,4,5)				Firm orangish brown mottled greyish blue CLAY with occasional partially decomposed wood fragments and rare roots. [WEATHERED LONDON CLAY FORMATION]	4		
		4.50	D								
	5.00	SPT(S)	N=15 (2,2/3,4,4,4)	5.00			End of Borehole at 5.00m		5		
D = small disturbed sample (tub) J = organic sample (amber glass jar) V = volatile sample (amber glass vial) B = bulk bag sample					SPT(C) = Standard Penetration Test (Cone) SPT(S) = Standard Penetration Test (Split Spoon) HSV = hand shear vane (kPa) PP = pocket penetrometer (kg.cm2) PID = photoionisation detector (ppm)					Remarks Coordinates and levels, where indicated, must not be used for design purposes. The designer is responsible for verifying all site and setting out dimensions. No groundwater encountered during drilling	

IDOM					Windowless Sample Log		Borehole No. MWS102 Sheet 1 of 1				
Project Name: Roundways			Project No. 21914m		Co-ords:		Scale 1:25				
Location: Tottenham					Level (m):		Logged By MB				
Equipment: Premier Compact 110 Series					Dates: 26/10/2022		Checked By				
Well	Wtr Strk	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.20	D,J	N=5 (1,1/1,1,1,2)	0.70		Very soft brown slightly gravelly slightly sandy CLAY with occasional rootlets and roots. Sand is fine to coarse. Gravel is subangular fine to coarse flint, concrete, coal and brick. [TOPSOIL / MADE GROUND]	1			
		0.50	D								
		0.90	D,J								
		1.00	SPT(S)	N=9 (1,1/2,2,3,2)	1.20		Soft to firm orangish brown mottled grey slightly gravelly CLAY. Gravel is rounded to subrounded fine to coarse flint. [HEAD DEPOSITS]	2			
		1.50	D								
		2.00	SPT(S)								
		2.50	D	N=8 (1,1/2,2,2,2)	3						
		3.00	SPT(S)								
		3.50	D								
		4.00	SPT(S)	N=11 (1,1/2,3,3,3)	4						
4.50	D										
		5.00	SPT(S)	N=15 (1,2/3,3,5,4)	5.00		End of Borehole at 5.00m	5			
D = small disturbed sample (tub) J = organic sample (amber glass jar) V = volatile sample (amber glass vial) B = bulk bag sample					SPT(C) = Standard Penetration Test (Cone) SPT(S) = Standard Penetration Test (Split Spoon) HSV = hand shear vane (kPa) PP = pocket penetrometer (kg.cm2) PID = photoionisation detector (ppm)					Remarks Coordinates and levels, where indicated, must not be used for design purposes. The designer is responsible for verifying all site and setting out dimensions. No groundwater encountered during drilling	

					Windowless Sample Log		Borehole No. MWS103 Sheet 1 of 1				
Project Name: Roundways			Project No. 21914m		Co-ords:		Scale 1:25				
Location: Tottenham					Level (m):		Logged By MB				
Equipment: Premier Compact 110 Series					Dates: 26/10/2022		Checked By				
Well	Wtr Strk	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.20	D,J		0.40		Very soft brown slightly gravelly slightly sandy CLAY with occasional rootlets and roots. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint, concrete, clinker and brick. [TOPSOIL / MADE GROUND]	1			
		0.50	D				Soft to firm orangish brown mottled grey slightly gravelly CLAY with rare roots. Gravel is rounded to subrounded fine to coarse flint. [HEAD DEPOSITS]				
		1.00	SPT(S)	N=6 (1,1/1,2,1,2)	1.30						
		1.50	D				Firm orangish brown CLAY with occasional partially decomposed wood fragments and occasional gypsum crystals. [WEATHERED LONDON CLAY FORMATION]				
		2.00	SPT(S)	N=11 (1,1/2,3,3,3)			2				
		2.50	D								
		3.00	SPT(S)	N=12 (2,2/2,3,4,3)			3				
		3.50	D			Moderately weak light orange cobble of mudstone encountered.					
		4.00	SPT(S)	N=11 (1,1/2,3,3,3)			4				
		4.50	D		4.50	Firm grey CLAY with occasional pockets of grey silt. [LONDON CLAY FORMATION]					
	5.00	SPT(S)	N=15 (2,3/3,4,5)	5.00		End of Borehole at 5.00m	5				
D = small disturbed sample (tub) J = organic sample (amber glass jar) V = volatile sample (amber glass vial) B = bulk bag sample					SPT(C) = Standard Penetration Test (Cone) SPT(S) = Standard Penetration Test (Split Spoon) HSV = hand shear vane (kPa) PP = pocket penetrometer (kg.cm2) PID = photoionisation detector (ppm)					Remarks Coordinates and levels, where indicated, must not be used for design purposes. The designer is responsible for verifying all site and setting out dimensions. No groundwater encountered during drilling	

IDOM Windowless Sample Log Borehole No. MWS104 Sheet 1 of 1									
Project Name: Roundways			Project No. 21914m		Co-ords:		Scale 1:25		
Location: Tottenham					Level (m):		Logged By MB		
Equipment: Premier Compact 110 Series					Dates: 26/10/2022		Checked By		
Well	Wtr Strk	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D					Very soft brown slightly gravelly slightly sandy CLAY with occasional rootlets and roots. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint, concrete, clinker and brick. [TOPSOIL / MADE GROUND]	1
		0.60	D,J						
		1.00	SPT(S)	N=12 (2,2/3,3,3,3)	0.90			Soft orangish brown mottled grey slightly gravelly CLAY with rare roots. Gravel is rounded to subrounded fine to coarse flint. [HEAD DEPOSITS]	
		1.50	D		1.40				
		2.00	SPT(S)	N=10 (1,2/1,3,3,3)				Firm orangish brown CLAY with occasional partially decomposed wood fragments and occasional gypsum crystals. [WEATHERED LONDON CLAY FORMATION]	2
		2.50	D						
		3.00	SPT(S)	N=10 (1,2/2,2,3,3)				Firm grey CLAY with occasional pockets of grey silt. [LONDON CLAY FORMATION]	3
		3.50	D						
		4.00	SPT(S)	N=11 (2,2/2,3,3,3)				Firm grey CLAY with occasional pockets of grey silt. [LONDON CLAY FORMATION]	4
		4.50	D		4.60				
	5.00	SPT(S)	N=15 (1,2/3,4,4,4)	5.00		End of Borehole at 5.00m		5	
D = small disturbed sample (tub) J = organic sample (amber glass jar) V = volatile sample (amber glass vial) B = bulk bag sample SPT(C) = Standard Penetration Test (Cone) SPT(S) = Standard Penetration Test (Split Spoon) HSV = hand shear vane (kPa) PP = pocket penetrometer (kg.cm2) PID = photoionisation detector (ppm)					Remarks Coordinates and levels, where indicated, must not be used for design purposes. The designer is responsible for verifying all site and setting out dimensions. No groundwater encountered during drilling				

					Windowless Sample Log		Borehole No. MWS105 Sheet 1 of 1		
Project Name: Roundways			Project No. 21914m		Co-ords:		Scale 1:25		
Location: Tottenham					Level (m):		Logged By MB		
Equipment: Premier Compact 110 Series					Dates: 26/10/2022		Checked By		
Well	Wtr Strk	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D,J		0.60		Very soft brown slightly gravelly slightly sandy CLAY with occasional rootlets and roots. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint, concrete, clinker and brick. [TOPSOIL / MADE GROUND]	1	
		0.50	D						
		1.00	SPT(S)	N=4 (1,1/1,1,1,1)	1.20		Soft orangish brown mottled grey slightly gravelly CLAY with rare roots. Gravel is rounded to subrounded fine to coarse flint. [HEAD DEPOSITS]		
		1.50	D						
		2.00	SPT(S)	N=10 (2,2/2,3,2,3)			Firm orangish brown CLAY with occasional partially decomposed wood fragments and occasional gypsum crystals. [WEATHERED LONDON CLAY FORMATION]	2	
		2.50	D						
		3.00	SPT(S)	N=11 (1,2/2,3,3,3)			Firm grey CLAY with occasional pockets of grey silt. [LONDON CLAY FORMATION]	3	
		3.50	D						
		4.00	SPT(S)	N=13 (2,2/3,3,3,4)	4.50		Firm grey CLAY with occasional pockets of grey silt. [LONDON CLAY FORMATION]	4	
		4.50	D						
	5.00	SPT(S)	N=14 (1,2/3,3,4,4)	5.00		End of Borehole at 5.00m	5		
D = small disturbed sample (tub) J = organic sample (amber glass jar) V = volatile sample (amber glass vial) B = bulk bag sample SPT(C) = Standard Penetration Test (Cone) SPT(S) = Standard Penetration Test (Split Spoon) HSV = hand shear vane (kPa) PP = pocket penetrometer (kg.cm2) PID = photoionisation detector (ppm)					Remarks Coordinates and levels, where indicated, must not be used for design purposes. The designer is responsible for verifying all site and setting out dimensions. No groundwater encountered during drilling				

APPENDIX 3

- Soil Chemistry
- Summary Spreadsheet
- Laboratory Analysis Certificates

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Croxley Green
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Analytical Report Number : 22-93523

Project / Site name:	Roundways, Tottenham	Samples received on:	28/10/2022
Your job number:	21914M	Samples instructed on/ Analysis started on:	28/10/2022
Your order number:	22-2-FDO-LABS	Analysis completed by:	08/11/2022
Report Issue Number:	1	Report issued on:	08/11/2022
Samples Analysed:	4 soil samples		


Signed:

Dominika Warjan
Junior 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: 22-93523

Project / Site name: Roundways, Tottenham

Your Order No: 22-2-FDO-LABS

Lab Sample Number				2481369	2481370	2481371	2481372
Sample Reference				MWS101_ES	MWS103_ES	MWS104_ES	MWS105_ES
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.20	0.50	0.45
Date Sampled				26/10/2022	26/10/2022	26/10/2022	26/10/2022
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	19	21	14	14
Total mass of sample received	kg	0.001	NONE	0.5	0.5	0.5	0.5

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	7.3	7.5	7.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble SO ₄ ²⁻ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.085	0.013	0.041	0.08
Sulphide	mg/kg	1	NONE	19	22	37	14
Organic Matter (automated)	%	0.1	MCERTS	7.7	4.4	5.1	2.6

Total Phenols

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

Naphthalene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.22	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	0.08	< 0.05	0.45	0.23
Acenaphthene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.17	< 0.05
Fluorene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.18	0.08
Phenanthrene	mg/kg	0.05	NONE	0.9	0.59	4.5	1.8
Anthracene	mg/kg	0.05	NONE	0.27	0.16	1.2	0.44
Fluoranthene	mg/kg	0.05	NONE	2.5	2	13	4.6
Pyrene	mg/kg	0.05	NONE	2.2	1.9	12	4.8
Benzo(a)anthracene	mg/kg	0.05	NONE	1.4	0.76	6.1	2.3
Chrysene	mg/kg	0.05	NONE	1.4	1.2	7.4	2.8
Benzo(b)fluoranthene	mg/kg	0.05	NONE	1.3	1.2	7.5	2.6
Benzo(k)fluoranthene	mg/kg	0.05	NONE	1	0.75	4.2	1.7
Benzo(a)pyrene	mg/kg	0.05	NONE	1.5	1.2	7.7	2.9
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	0.73	0.69	4.3	1.7
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	0.14	0.14	0.83	0.3
Benzo(ghi)perylene	mg/kg	0.05	NONE	0.92	0.84	4.4	1.9

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	14.3	11.4	73.7	28.2
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	30	22	38	23
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.9	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	47	51	50	40
Copper (aqua regia extractable)	mg/kg	1	MCERTS	270	88	230	91
Lead (aqua regia extractable)	mg/kg	1	MCERTS	820	300	660	310
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.6	0.6	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	47	34	52	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	420	310	520	160

Analytical Report Number: 22-93523
 Project / Site name: Roundways, Tottenham
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Lab Sample Number				2481369	2481370	2481371	2481372
Sample Reference				MWS101_ES	MWS103_ES	MWS104_ES	MWS105_ES
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.20	0.50	0.45
Date Sampled				26/10/2022	26/10/2022	26/10/2022	26/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status	

Monoaromatics & Oxygenates

Benzene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS 1D AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS 1D AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS 1D AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH CU 1D AL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH CU 1D AL	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 EH CU 1D AL	mg/kg	8	NONE	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH CU 1D AL	mg/kg	8	NONE	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC35 - EC40 EH CU 1D AL	mg/kg	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC35) EH CU+HS 1D AL	mg/kg	10	NONE	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 HS 1D AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS 1D AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS 1D AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH CU 1D AR	mg/kg	1	NONE	< 1.0	< 1.0	1.7	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH CU 1D AR	mg/kg	2	NONE	< 2.0	< 2.0	2.4	2
TPH-CWG - Aromatic >EC16 - EC21 EH CU 1D AR	mg/kg	10	NONE	< 10	< 10	31	12
TPH-CWG - Aromatic >EC21 - EC35 EH CU 1D AR	mg/kg	10	NONE	< 10	13	75	21
TPH-CWG - Aromatic >EC35 - EC40 EH CU 1D AR	mg/kg	10	NONE	< 10	< 10	15	< 10
TPH-CWG - Aromatic (EC5 - EC35) EH CU+HS 1D AR	mg/kg	10	NONE	12	18	110	35
TPH Total C5 - C40 EH CU+HS 1D TOTAL	mg/kg	10	NONE	< 10	13	130	35

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

Analytical Report Number : 22-93523

Project / Site name: Roundways, Tottenham

* 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 *
2481369	MWS101_ES	None Supplied	0.4	Brown clay and loam with gravel and vegetation.
2481370	MWS103_ES	None Supplied	0.2	Brown clay and loam with gravel and vegetation.
2481371	MWS104_ES	None Supplied	0.5	Brown clay and loam with gravel and vegetation.
2481372	MWS105_ES	None Supplied	0.45	Brown clay and loam with gravel and vegetation.

Analytical Report Number : 22-93523

Project / Site name: Roundways, Tottenham

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
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
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	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
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
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	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	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	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

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

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

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

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

Analytical Report Number : 22-93523

Project / Site name: Roundways, Tottenham

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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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

Sample Deviation Report



Analytical Report Number : 22-93523

Project / Site name: Roundways, Tottenham

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
MWS101_ES	None Supplied	S	2481369	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
MWS101_ES	None Supplied	S	2481369	b	TPHCWG (Soil)	L088/76-PL	b
MWS103_ES	None Supplied	S	2481370	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
MWS103_ES	None Supplied	S	2481370	b	TPHCWG (Soil)	L088/76-PL	b
MWS104_ES	None Supplied	S	2481371	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
MWS104_ES	None Supplied	S	2481371	b	TPHCWG (Soil)	L088/76-PL	b
MWS105_ES	None Supplied	S	2481372	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
MWS105_ES	None Supplied	S	2481372	b	TPHCWG (Soil)	L088/76-PL	b

APPENDIX 4 ▪ Geotechnical Laboratory Certificates

4041

Client: Merebrook
 Client Address: First Floor, 1 Leonard Place,
 Westerham Road, Keston,
 BR2 6HQ
 Contact: Matt Baylis
 Site Address: Roundways Tottenham

Client Reference: 21914M
 Job Number: 22-97158
 Date Sampled: 26/10/2022
 Date Received: 17/11/2022
 Date Tested: 18/11/2022
 Sampled By: Client - Matt Baylis

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

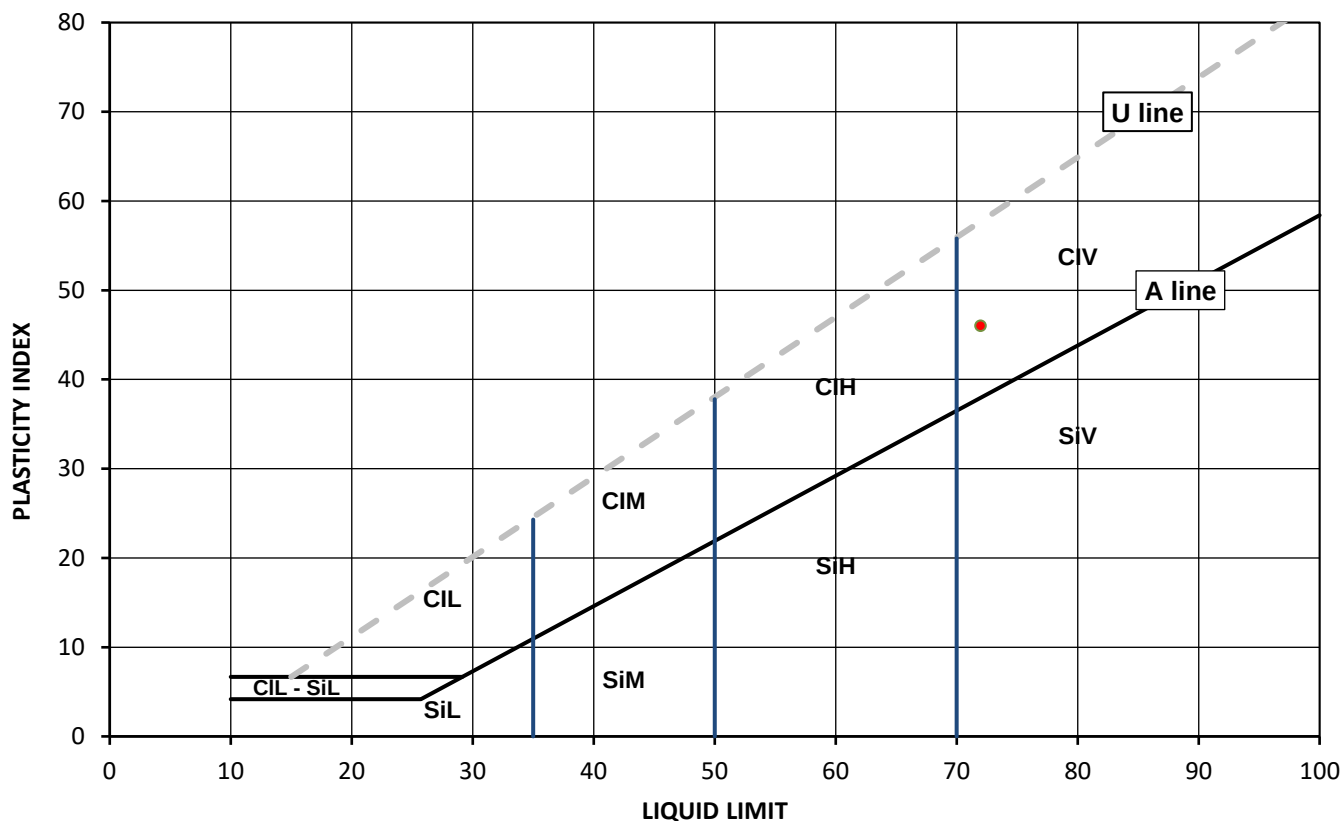
Test Results:

Laboratory Reference: 2502087
 Hole No.: MWS101_D
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly CLAY

Depth Top [m]: 1.50
 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
25.8	72	1.038	26	46	93



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

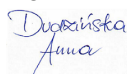
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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

Remarks:

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

4041

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 BR2 6HQ
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Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

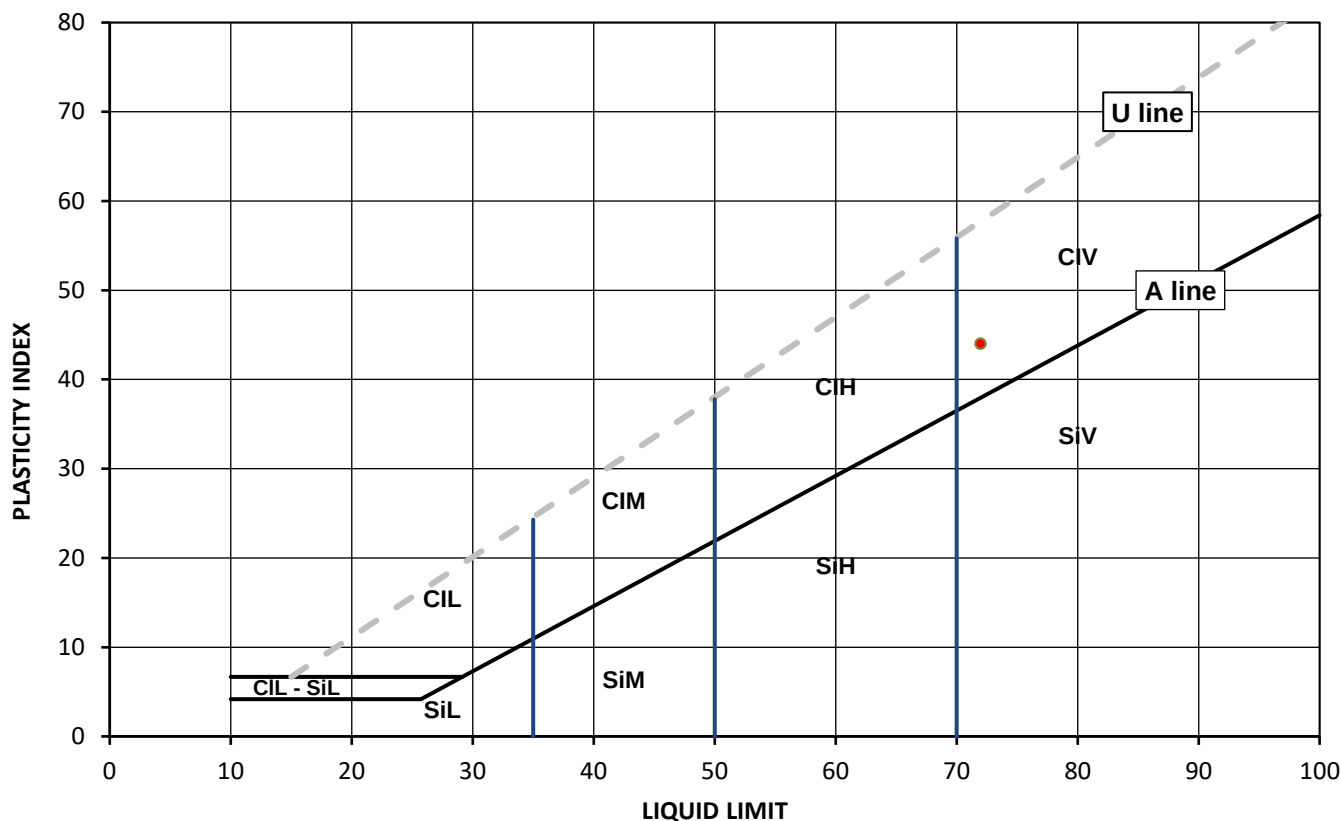
Test Results:

Laboratory Reference: 2502088
 Hole No.: MWS101_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 3.50
 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
28.8	72	0.984	28	44	100



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

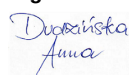
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

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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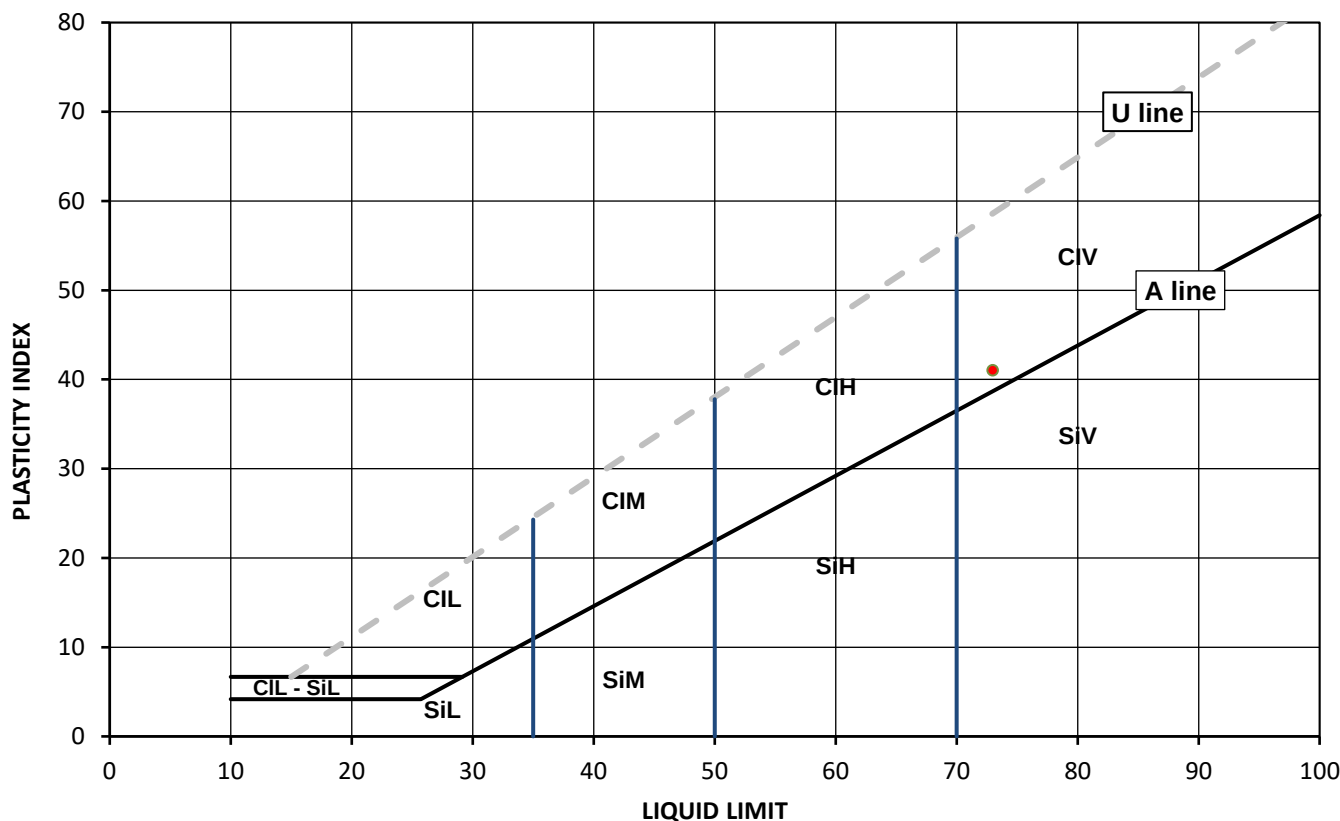
Test Results:

Laboratory Reference: 2502089
 Hole No.: MWS102_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 1.50
 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
28.5	73	1.000	32	41	100



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

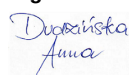
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

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

4041

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 Westerham Road, Keston,
 BR2 6HQ
 Contact: Matt Baylis
 Site Address: Roundways Tottenham

Client Reference: 21914M
 Job Number: 22-97158
 Date Sampled: 26/10/2022
 Date Received: 17/11/2022
 Date Tested: 18/11/2022
 Sampled By: Client - Matt Baylis

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

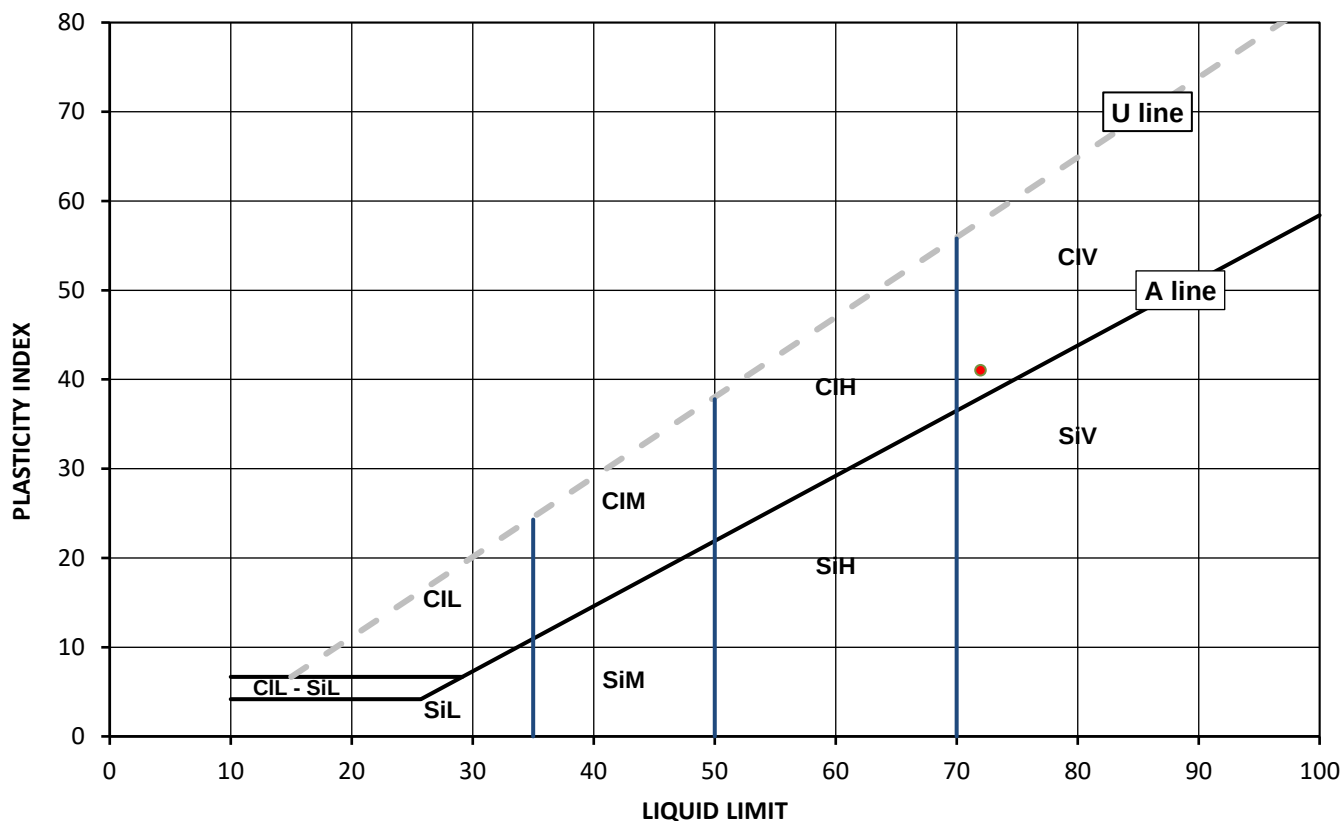
Test Results:

Laboratory Reference: 2502090
 Hole No.: MWS102_D
 Sample Reference: Not Given
 Sample Description: Brownish grey CLAY

Depth Top [m]: 2.50
 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
33.6	72	1.075	31	41	100



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

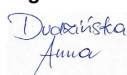
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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

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

4041

Client: Merebrook
 Client Address: First Floor, 1 Leonard Place,
 Westerham Road, Keston,
 BR2 6HQ
 Contact: Matt Baylis
 Site Address: Roundways Tottenham

Client Reference: 21914M
 Job Number: 22-97158
 Date Sampled: 26/10/2022
 Date Received: 17/11/2022
 Date Tested: 18/11/2022
 Sampled By: Client - Matt Baylis

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

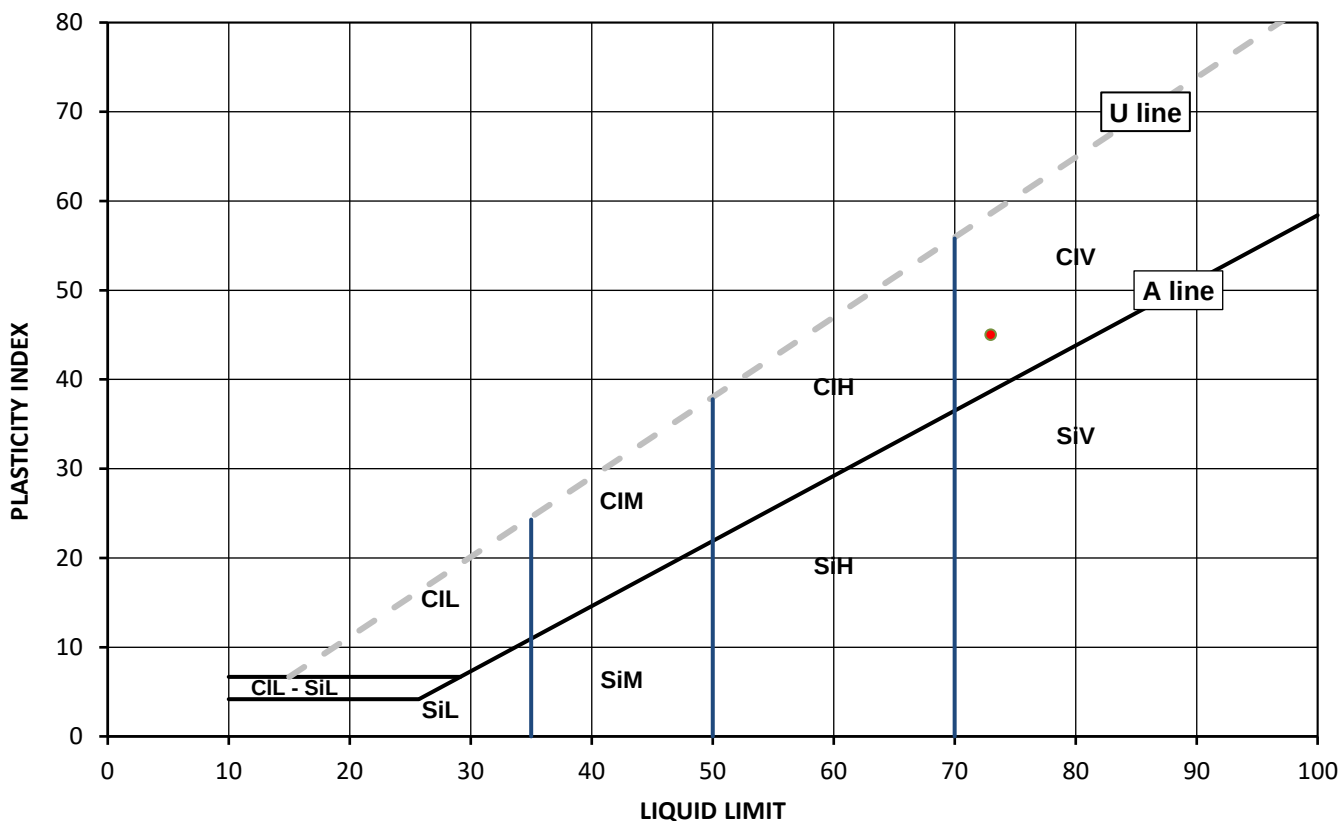
Test Results:

Laboratory Reference: 2502091
 Hole No.: MWS102_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY with gypsum crystals

Depth Top [m]: 4.50
 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
33.0	73	1.000	28	45	100



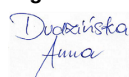
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
		50 to 70
		exceeding 70
		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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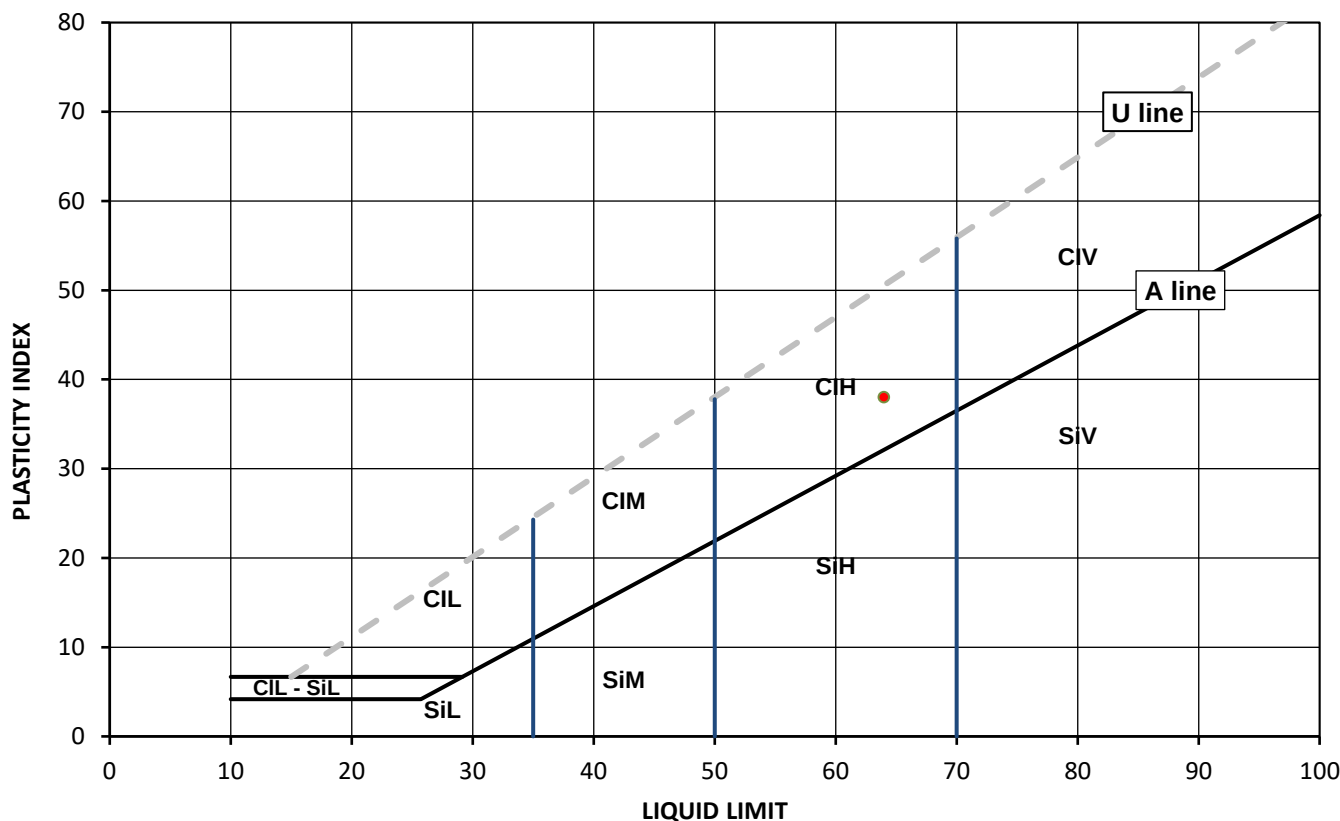
Test Results:

Laboratory Reference: 2502092
 Hole No.: MWS103_D
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly CLAY

Depth Top [m]: 0.50
 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
33.4	64	1.055	26	38	84



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

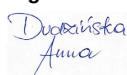
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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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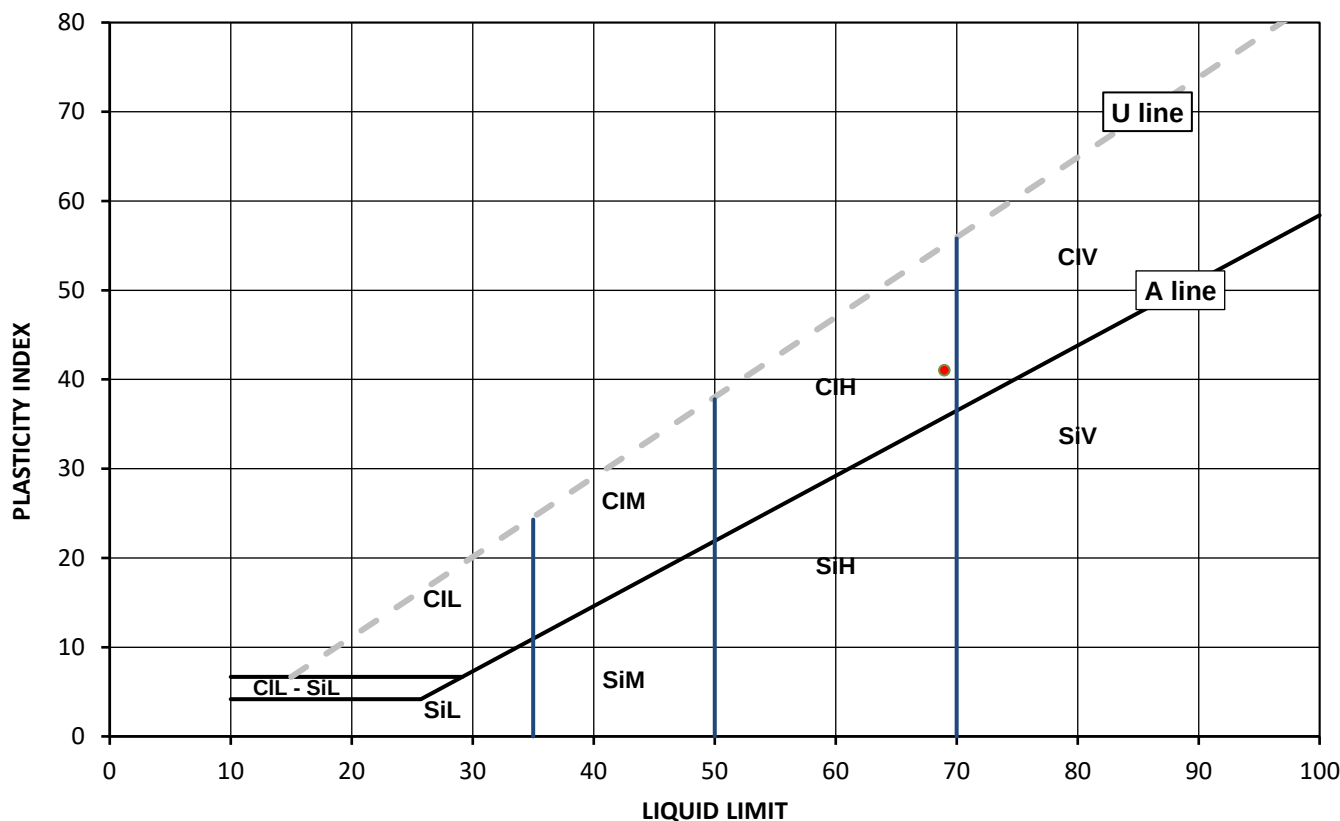
Test Results:

Laboratory Reference: 2502093
 Hole No.: MWS103_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 1.50
 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
30.1	69	1.036	28	41	100



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

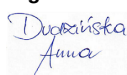
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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

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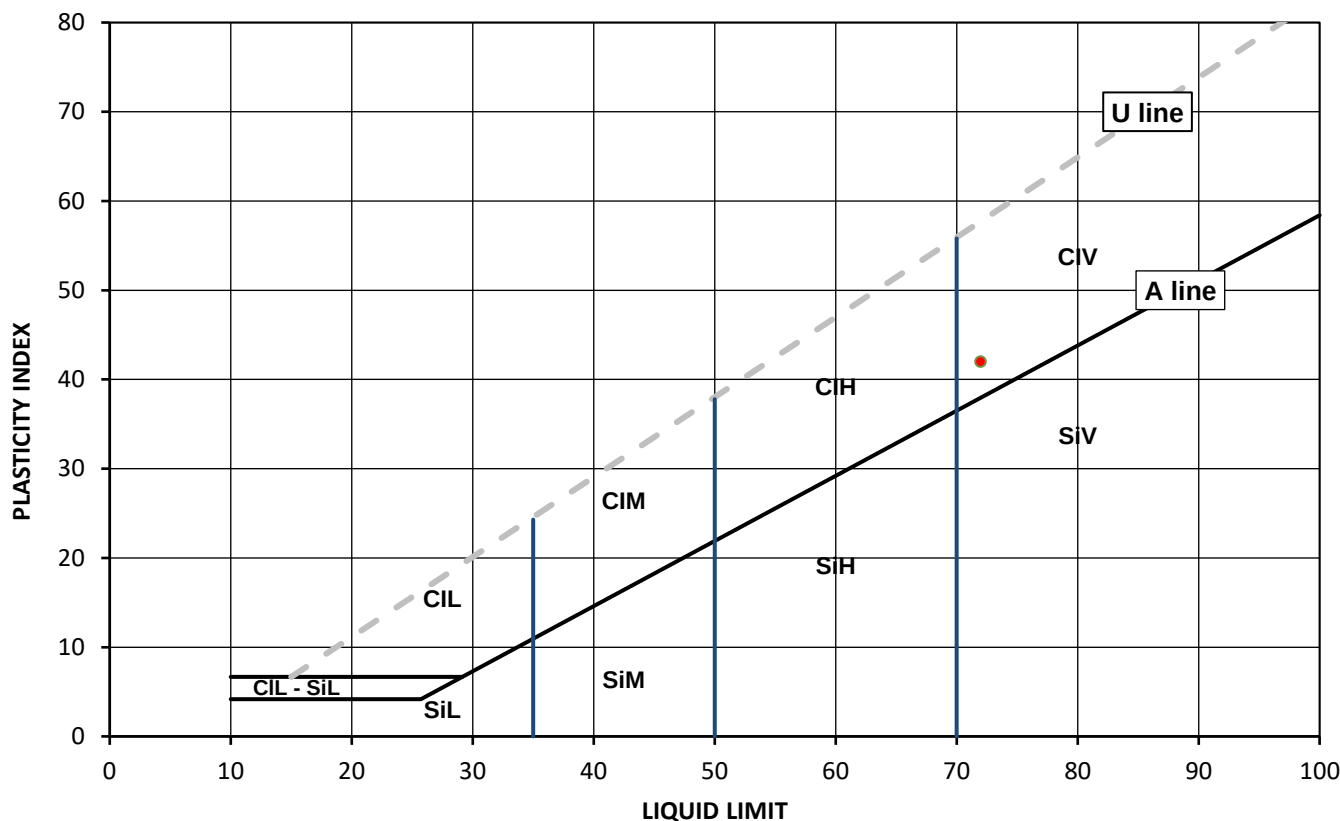
Test Results:

Laboratory Reference: 2502094
 Hole No.: MWS103_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 3.50
 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
32.2	72	1.003	30	42	100



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

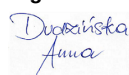
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

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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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS EN ISO 17892-12:2018+A1:2021,
Clause 5.3.14 and 5.5, Fall Cone Method, 1 Point Test

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

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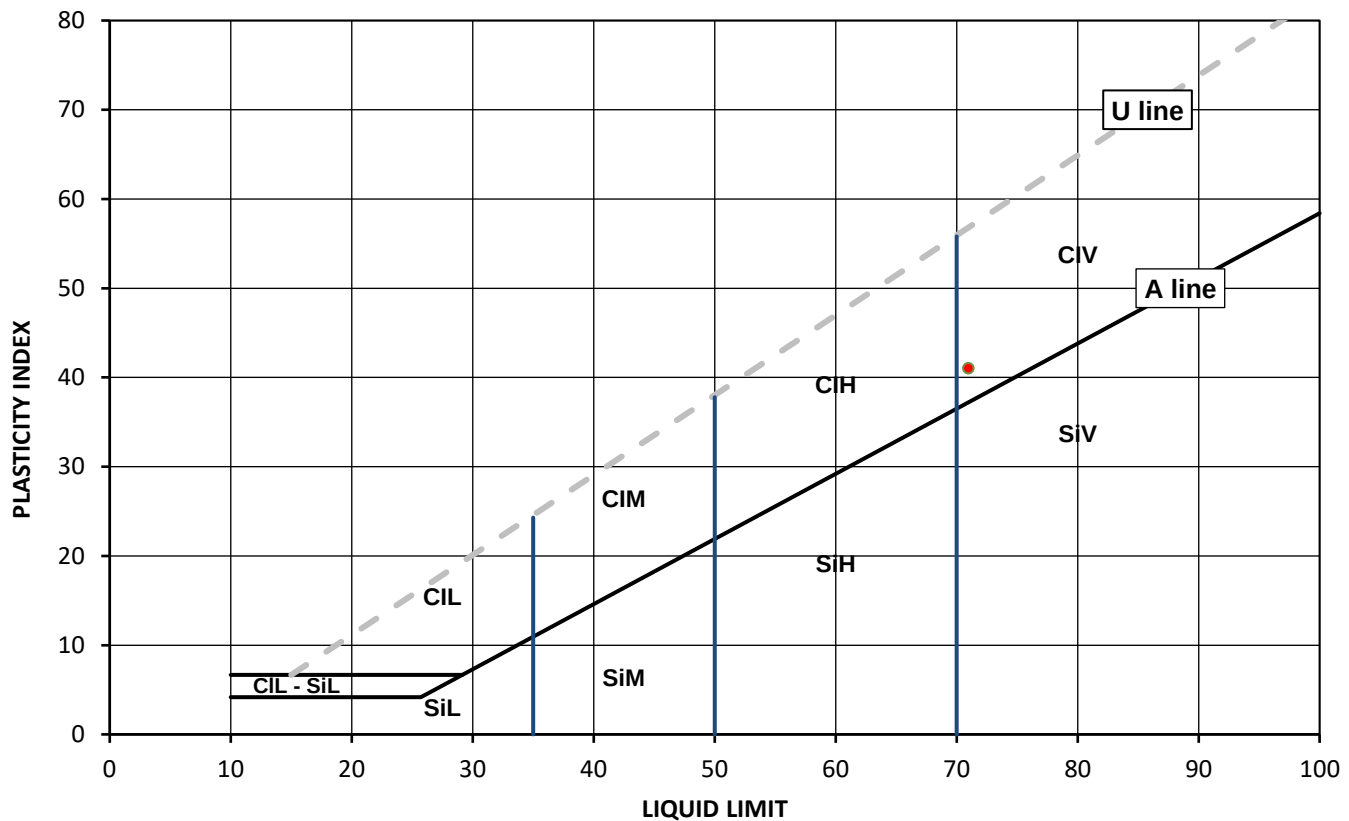
Test Results:

Laboratory Reference: 2502095
Hole No.: MWS103_D
Sample Reference: Not Given
Sample Description: Brown CLAY

Depth Top [m]: 4.50
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
32.3	71	0.967	30	41	100



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

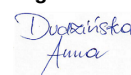
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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

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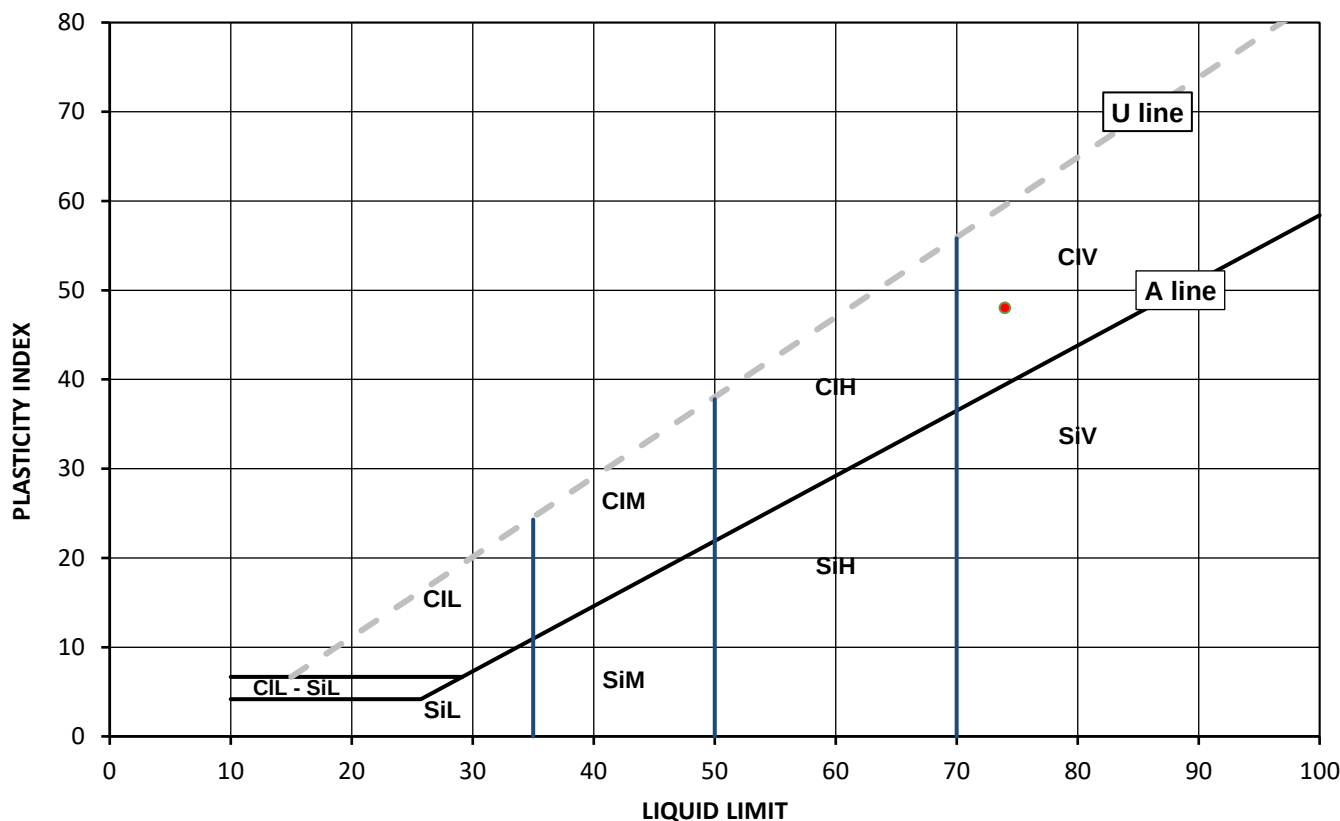
Test Results:

Laboratory Reference: 2502096
 Hole No.: MWS104_D
 Sample Reference: Not Given
 Sample Description: Brown slightly gravelly CLAY with gypsum crystals

Depth Top [m]: 2.50
 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
32.9	74	1.001	26	48	99



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

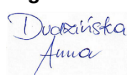
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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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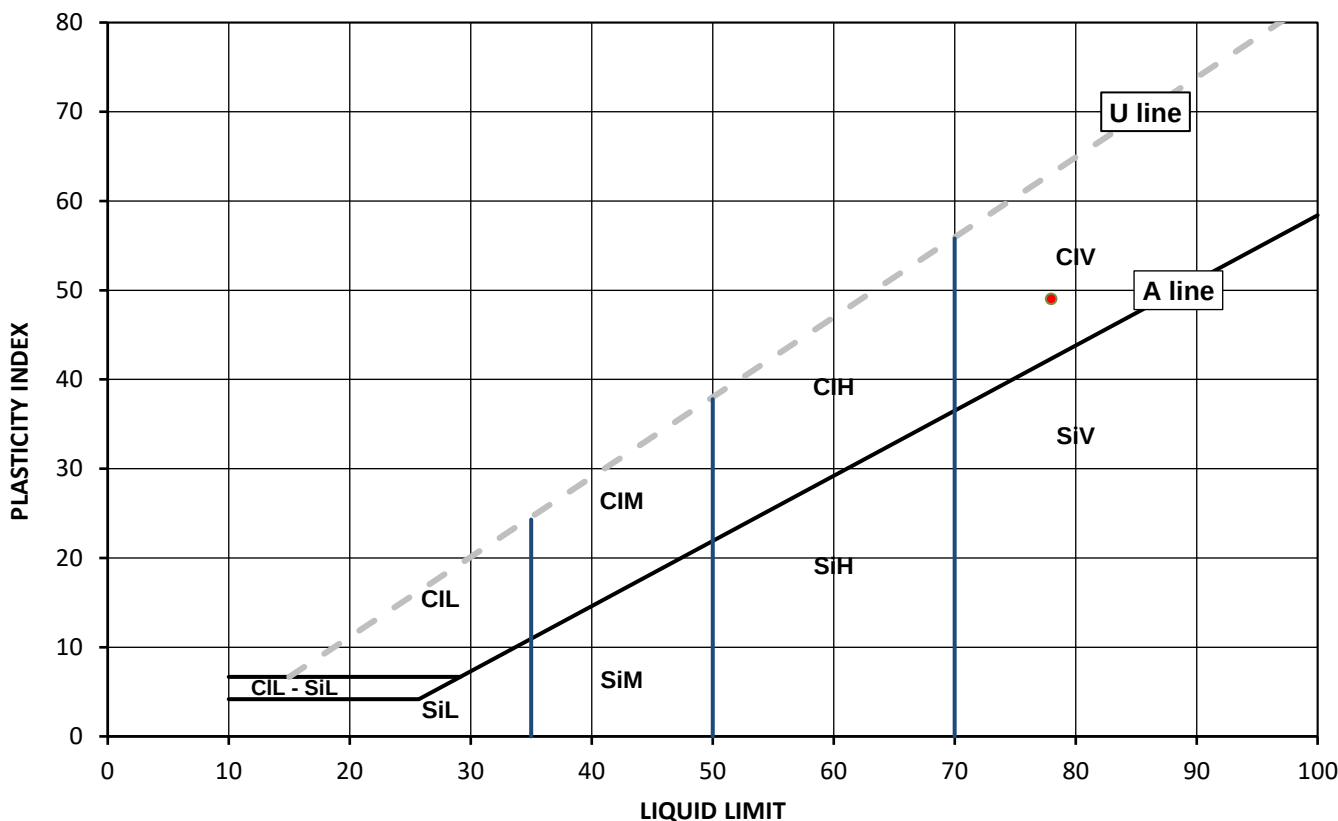
Test Results:

Laboratory Reference: 2502097
 Hole No.: MWS104_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 3.50
 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
32.8	78	0.983	29	49	100



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

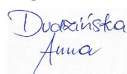
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
		50 to 70
		exceeding 70
		append to classification for organic material (eg CIHO)

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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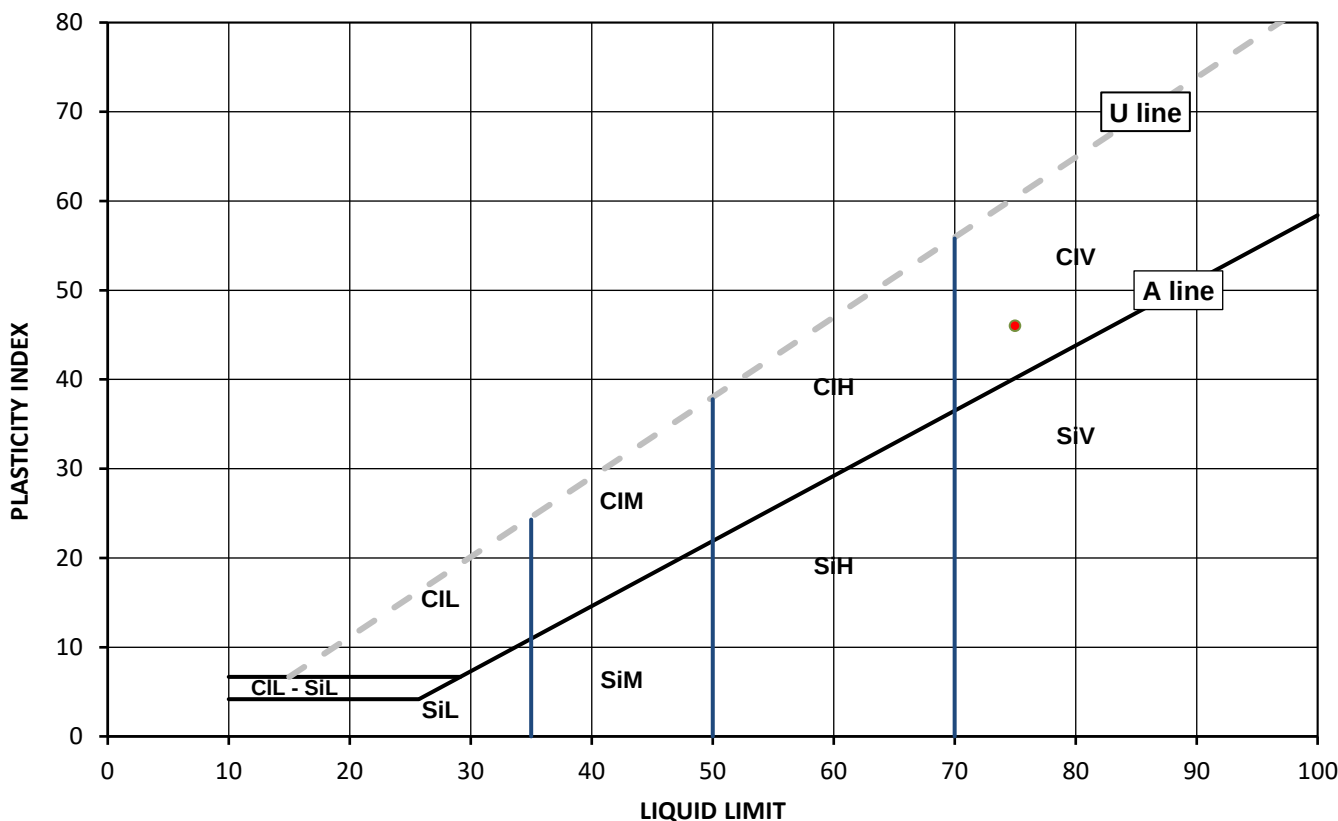
Test Results:

Laboratory Reference: 2502098
 Hole No.: MWS104_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 4.50
 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
31.9	75	1.001	29	46	100



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

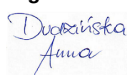
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

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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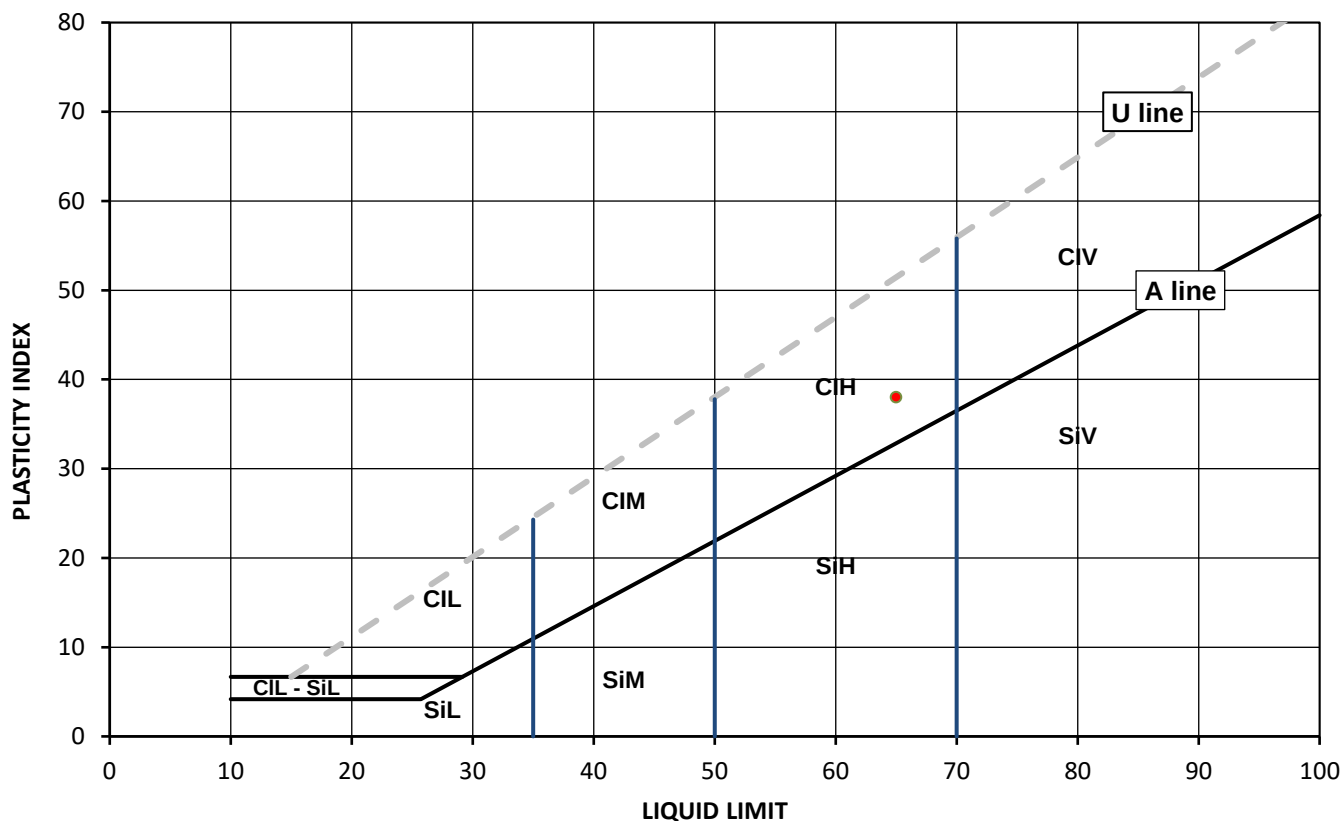
Test Results:

Laboratory Reference: 2502099
 Hole No.: MWS105_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 1.50
 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
25.8	65	1.036	27	38	100



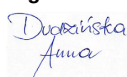
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
		50 to 70
		exceeding 70
		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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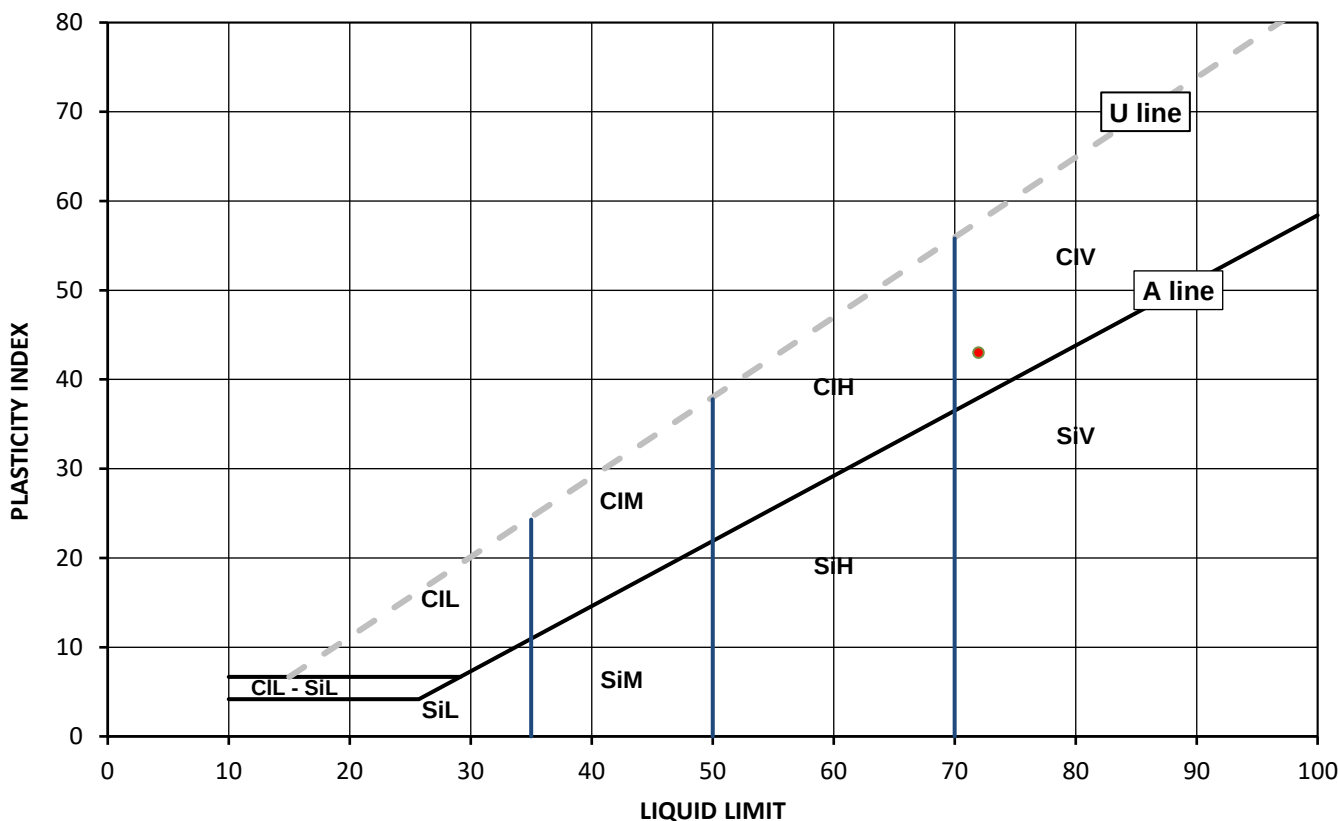
Test Results:

Laboratory Reference: 2502100
 Hole No.: MWS105_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY with gypsum crystals

Depth Top [m]: 3.50
 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
32.8	72	1.016	29	43	100



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

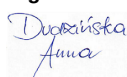
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

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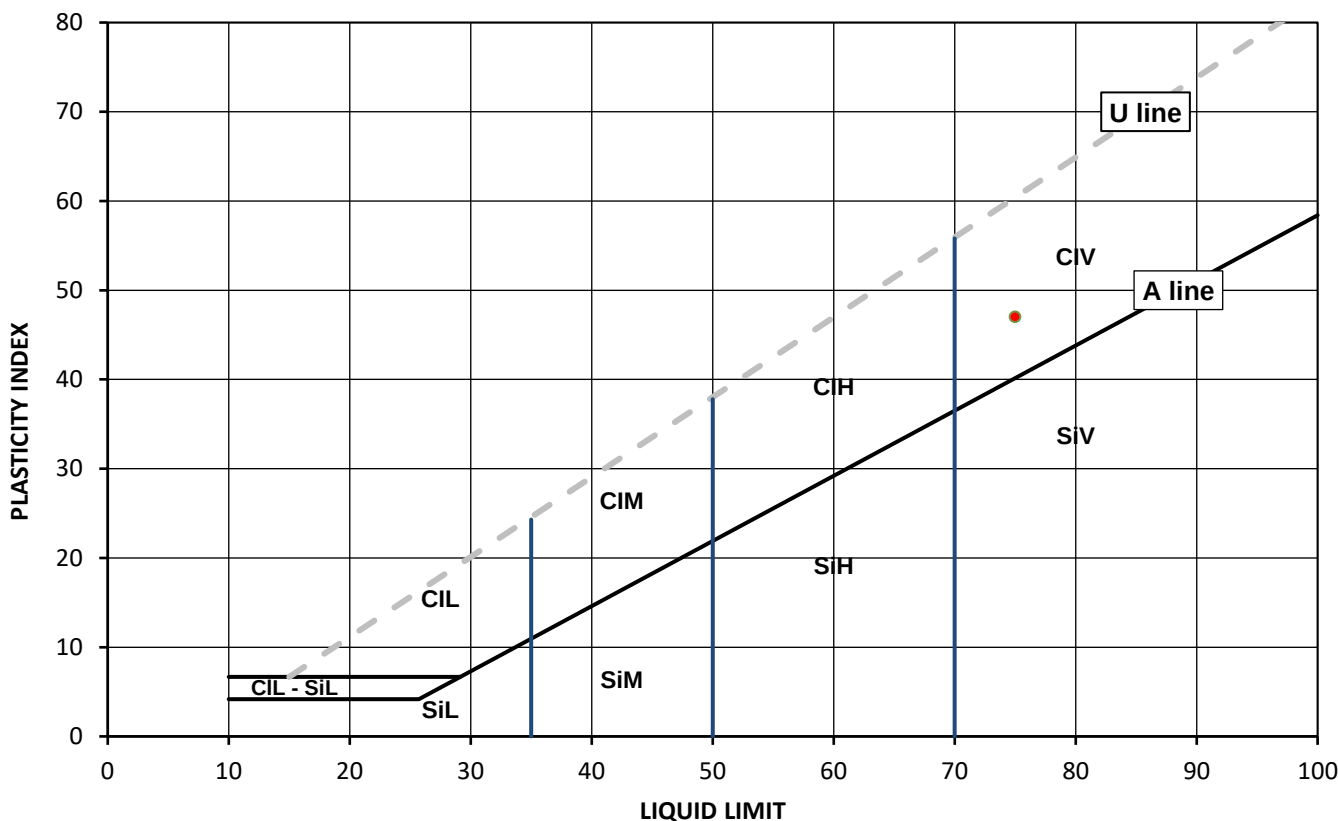
Test Results:

Laboratory Reference: 2502101
 Hole No.: MWS105_D
 Sample Reference: Not Given
 Sample Description: Brown CLAY

Depth Top [m]: 4.50
 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
35.0	75	0.949	28	47	100



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

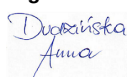
	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

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

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

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

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



Environmental Science

Client Reference: 21914M
 Job Number: 22-97158
 Date Sampled: 26/10/2022
 Date Received: 17/11/2022
 Date Tested: 18/11/2022
 Sampled By: Client - Matt Baylis

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					%	%		%	%			Mg/m3	Mg/m3	Mg/m3	
2502087	MWS101_D	Not Given	1.50	Not Given	D	Brown slightly gravelly CLAY	Atterberg 1 Point	25.8	93	72	1.038	26	46	80g/30 deg	N/A				
2502088	MWS101_D	Not Given	3.50	Not Given	D	Brown CLAY	Atterberg 1 Point	28.8	100	72	0.984	28	44	80g/30 deg	N/A				
2502089	MWS102_D	Not Given	1.50	Not Given	D	Brown CLAY	Atterberg 1 Point	28.5	100	73	1.000	32	41	80g/30 deg	N/A				
2502090	MWS102_D	Not Given	2.50	Not Given	D	Brownish grey CLAY	Atterberg 1 Point	33.6	100	72	1.075	31	41	80g/30 deg	N/A				
2502091	MWS102_D	Not Given	4.50	Not Given	D	Brown CLAY with gypsum crystals	Atterberg 1 Point	33.0	100	73	1.000	28	45	80g/30 deg	N/A				
2502092	MWS103_D	Not Given	0.50	Not Given	D	Brown slightly gravelly CLAY	Atterberg 1 Point	33.4	84	64	1.055	26	38	80g/30 deg	N/A				
2502093	MWS103_D	Not Given	1.50	Not Given	D	Brown CLAY	Atterberg 1 Point	30.1	100	69	1.036	28	41	80g/30 deg	N/A				
2502094	MWS103_D	Not Given	3.50	Not Given	D	Brown CLAY	Atterberg 1 Point	32.2	100	72	1.003	30	42	80g/30 deg	N/A				
2502095	MWS103_D	Not Given	4.50	Not Given	D	Brown CLAY	Atterberg 1 Point	32.3	100	71	0.967	30	41	80g/30 deg	N/A				
2502096	MWS104_D	Not Given	2.50	Not Given	D	Brown slightly gravelly CLAY with gypsum crystals	Atterberg 1 Point	32.9	99	74	1.001	26	48	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:

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



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: Merebrook
Client Address: First Floor, 1 Leonard Place,
Westerham Road, Keston,
BR2 6HQ

Contact: Matt Baylis
Site Address: Roundways Tottenham

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: 21914M
Job Number: 22-97158
Date Sampled: 26/10/2022
Date Received: 17/11/2022
Date Tested: 18/11/2022
Sampled By: Client - Matt Baylis

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														
2502097	MWS104_D	Not Given	3.50	Not Given	D	Brown CLAY	Atterberg 1 Point	32.8	100	78	0.983	29	49	80g/30 deg	N/A			
2502098	MWS104_D	Not Given	4.50	Not Given	D	Brown CLAY	Atterberg 1 Point	31.9	100	75	1.001	29	46	80g/30 deg	N/A			
2502099	MWS105_D	Not Given	1.50	Not Given	D	Brown CLAY	Atterberg 1 Point	25.8	100	65	1.036	27	38	80g/30 deg	N/A			
2502100	MWS105_D	Not Given	3.50	Not Given	D	Brown CLAY with gypsum crystals	Atterberg 1 Point	32.8	100	72	1.016	29	43	80g/30 deg	N/A			
2502101	MWS105_D	Not Given	4.50	Not Given	D	Brown CLAY	Atterberg 1 Point	35.0	100	75	0.949	28	47	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:

Signed:

Anna Dudzinska

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

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APPENDIX 5

- Field Monitoring Records
- Groundwater Level Data
- Hazardous Soil Gas Data

GAS MONITORING RECORD ROUND 1

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		l hr ⁻¹		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS101	10:50	0	0	1013	0	0	0	2.3	17.3	-10	0	0.000	0	DRY	2.90	-
MWS103	10:55	0	0	1013	0	0	0	1	19.4	0	0	0.000	0	2.90	3.05	-
MWS104	11:00	0	0	1013	0	0	0	1.6	18.3	0	0	0.000	0	2.85	3.00	-
MWS105	11:05	0	0	1013	0	0	0	1.3	18.5	0	0	0.000	0	DRY	2.95	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weather:		Sunny / Cloudy				nr = not recorded		Gas Analyser		PID		Site:		Roundway, Tottenham		
						Model:		GFM 436-1		MiniRAE 3000		Project Number:		21914m		
						Serial Number:		2633/2518		592-920925		Monitored By:		Matt Baylis		
						Date of Last Calibration:		24/05/2022		28/10/2021		Date:		28.10.2022		

GAS MONITORING RECORD ROUND 2

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		l hr ⁻¹		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS101	14:10	0	0	1026	0	0	0	1.8	15.2	0	0	0.000	0	1.91	2.90	-
MWS103	14:15	0	0	1025	0	0	0	0.7	19.8	0	0	0.000	0	0.30	3.05	-
MWS104	14:20	0	0	1023	0	0	0	0.9	18.9	0	0	0.000	0	0.77	2.95	-
MWS105	14:25	0	0	1024	0	0	0	0.8	19.9	0	0	0.000	0	1.00	3.00	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weather:		Sunny				nr = not recorded			Gas Analyser		PID		Site:		Roundway, Tottenham	
						Model:			GFM 436-1		MiniRAE 3000		Project Number:		21914m	
						Serial Number:			2633/2518		592-920925		Monitored By:		Matt Baylis	
						Date of Last Calibration:			24/05/2022		28/10/2021		Date:		11.11.22	

GAS MONITORING RECORD ROUND 3

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		l hr ⁻¹		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS101	09:00	0	0	1000	0	0	0	2.9	12.3	0	0	0.000	nr	2.67	2.90	-
MWS103	09:10	0	0	1000	0	0	0	0.8	18.8	0	0	0.000	nr	0.33	3.05	-
MWS104	09:20	0	0	1000	0	0	0	0.9	19.6	0	0	0.000	nr	0.54	2.95	-
MWS105	09:30	0	0	1000	0	0	0	0.8	19.5	0	0	0.000	nr	1.07	3.00	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weather:		Cloudy with partial sun.				nr = not recorded			Gas Analyser		PID		Site:		Roundway, Tottenham	
						Model:			GFM 436-1		-		Project Number:		21914m	
						Serial Number:			2633/2518		-		Monitored By:		Joe Bertram	
						Date of Last Calibration:			24/05/2022		-		Date:		18/11/2022	

APPENDIX 6 ▪ Gas Risk Assessment

MODIFIED WILSON AND CARD GAS CHARACTERISTIC SITUATION

SITE: Roundway, Tottenham

JOB NUMBER: 21914m

05/12/2022

Carbon Dioxide			Methane		
Maximum Gas Concentration	2.90	%	Maximum Gas Concentration	0.10	%
Maximum Measured Peak Flow	0.10	L hr ⁻¹	Maximum Measured Peak Flow	0.10	L hr ⁻¹
Gas Screening Value	0.00	L hr ⁻¹	Gas Screening Value	0.00	L hr ⁻¹
Characteristic Situation	1		Characteristic Situation	1	
If measured values are zero then resolution limit of instrument is used for calculation of GSV worst case carbon dioxide or methane characteristic situation value defines overall characteristic situation for the site					

Carbon Dioxide			Methane		
Maximum Gas Concentration	2.90	%	Maximum Gas Concentration	0.10	%
Maximum Measured Steady Flow	0.10	L hr ⁻¹	Maximum Measured Peak Flow	0.10	L hr ⁻¹
Gas Screening Value	0.00	L hr ⁻¹	Gas Screening Value	0.00	L hr ⁻¹
Characteristic Situation	1		Characteristic Situation	1	

if measured values are zero then resolution limit of instrument is used for calculation of GSV
worst case carbon dioxide or methane characteristic situation value defines overall characteristic situation for the site

Modified Wilson and Card Classification

					BS 8485:2015+A1:2019 Gas Protection Scores - refer to standard for full guidance			
					Minimum Gas Protection Score Required			
Characteristic Situation	Risk Classification	Gas Screening Value Threshold (L hr ⁻¹)	Additional Factors	Typical Source of Generation	Type A Building	Type B Building	Type C Building	Type D Building
1	very low risk	<0.07	typically methane not to exceed 1% and/or carbon dioxide 5% otherwise consider increase to situation 2	natural soils with low organic content; 'typical' made ground	0	0	0	0
2	low risk	0.07 to <0.7	borehole air flow rate not to exceed 70 L hr ⁻¹ otherwise consider increase to situation 3	natural soils with high peat/organic content; 'typical' made ground	3.5	3.5	2.5	1.5
3	moderate risk	0.7 to <3.5		old landfill, inert waste, mineworking flooded	4.5	4	3	2.5
4	moderate to high risk	3.5 to <15	quantitative risk assessment required to evaluate scope of protective measures	mineworking susceptible to flooding, completed landfill	6.5 ^{A)}	5.5 ^{A)}	4.5	3.5
5	high risk	15 to <70		mineworking unflooded inactive with shallow workings near surface	hazard too high for this method to define protection measures	6 ^{A)}	5.5	4.5
6	very high risk	>70		recent landfill site	hazard too high for this method to define protection measures	hazard too high for this method to define protection measures	hazard too high for this method to define protection measures	6

BS 8485:2015+A1:2019 Gas Protection Measures - refer to standard for full guidance					
Select two or more elements from the following three types of protection to achieve score (only one element per type permitted)					
Structural Barrier	Score ^{A)}	Ventilation Measures		Score	Gas Resistant Membrane
Precast suspended segmental subfloor (i.e. beam and block)	0	Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building)		0.5	Gas resistant membrane meeting all of the following criteria:
Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)	0.5	Passive sub floor dispersal layer	Very good performance ^{E)}	2.5	1. sufficiently impervious, both in the sheet material and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and/or carbon dioxide through the membrane. <i>A membrane with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1:2007 manometric method) is regarded as sufficiently impervious.</i>
			Good performance ^{E)}	1.5	2. sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions 3. sufficiently strong* to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc) and to withstand in-service stresses (e.g. settlement if placed below a floor slab)
Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations	1 or 1.5 ^{B)}	Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers ^{E)}		1.5 to 2.5	
Basement floor and walls conforming to BS 8102:2009, Grade 2 waterproofing ^{C) D)}	2	Active positive pressurization by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket ^{E)}		1.5 to 2.5	5. capable, after installation, of providing a complete barrier to the entry of the relevant gas 6. verified in accordance with CIRIA C735 * For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m ² and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs
Basement floor and walls conforming to BS 8102:2009, Grade 3 waterproofing ^{C) D)}	2.5	Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park) ^{E)}		4	

Notes

A) The scores are conditional on breaches of floor slabs, etc., being effectively sealed

C) The score is conditional on the waterproofing being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall).

E) Refer to BS 8485:2015 Annex B to determine performance and assign score

Building Types

Type A

Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.

FOR TYPE A BUILDINGS ACTIVE VENTILATION MEASURES ARE INAPPROPRIATE

Type B

Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.

B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in

D) If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas resistant membrane in that table

F) Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F

Type C

Commercial building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building, including the gas protection measures. Single occupancy of ground floor and basement areas. Small to large size rooms with active ventilation or good passive ventilation of all rooms and other internal spaces throughout ground floor and basement areas. Probably civil engineering construction. Examples include offices, some retail premises, and parts of some public buildings (such as schools, hospitals, leisure centres and parts of hotels).

Type D

Industrial style building having large volume internal space(s) that are well ventilated. Corporate ownership with building management controls on alterations to the ground floor and basement areas of the building and on maintenance of ground gas protective measures. Probably civil engineering construction. Examples are retail park sales buildings, factory shop floor areas, warehouses. (Small rooms within these style buildings should be separately categorized as Type B or Type C).

IDOM

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