



Whitefield Fire Station, Whitefield

Phase 2 Geo-Environmental Investigation Report

For: Greater Manchester Combined Authority (GMCA)

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1.0 INTRODUCTION

This Phase 2 Geo-Environmental Investigation Report has been prepared at the request of Greater Manchester Combined Authority (GMCA). Instructions to proceed were received in October 2022.

This report pertains to a c. 0.35 Ha site located to the east of Bury New Road, Whitefield, at the approximate postcode M45 7SY. The National Ordnance Survey Grid Reference for the centre of the site is 380477E, 406478N.

The site is currently occupied by a single-storey masonry fire station building with associated five-storey training tower, areas of hardstanding in the northern site section and soft landscaping in the southern site section. Access to the site is off Bury New Road along the western boundary of the site. The site is bound by residential dwellings to the north and east, Bury New Road to the west and a gym to the south. An aerial photo of the site is included below and a Site Location Plan is contained in Appendix 2.



Figure 1: Aerial image of the site dated March 2019. The approximate site boundary is highlighted in red.

This Phase 2 Geo-Environmental Investigation Report is to be used for submission to the Local Authority as part of a planning application. It is the Client's intention to

demolish the existing fire station and construct a new two-storey fire station building with associated training tower, access road and areas of hard standing.

A proposed development plan (including floor plans) is contained in Appendix 2 with an extract below as Figure 2.

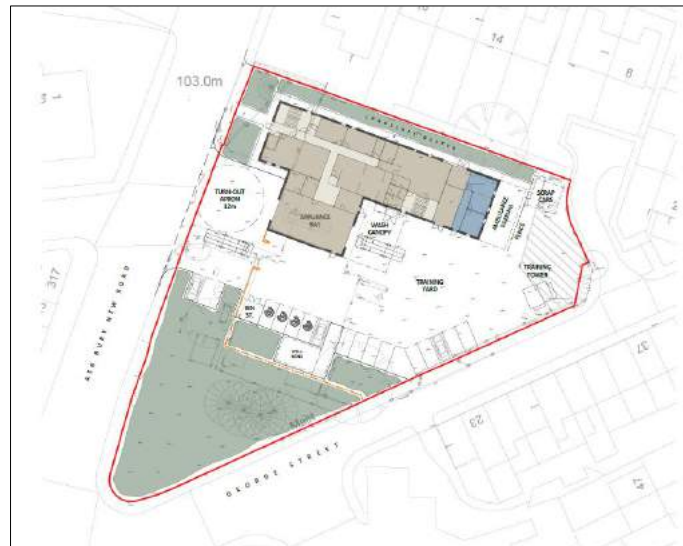


Figure 2: Proposed development layout

1.1 Brief

The brief was to carry out a Phase 2 intrusive geo-environmental ground investigation for the site based upon the findings of the *IGE Consulting Phase 1 Geo-Environmental Report (3866a-01, Rev A)* and the proposed development outlined in Section 1.0. The investigation was to include the following tasks:

- a) Undertake / install appropriate exploratory holes and collect representative samples from exploratory holes and arrange appropriate chemical testing in accordance with the latest legal framework, record olfactory and / or visual evidence of contamination during intrusive works and undertake on site in-situ and laboratory geotechnical testing;
- b) Refine conceptual models to accommodate the findings of the ground investigation works in terms of the risk to human health, ground gas, controlled waters and the wider environment;
- c) Undertake ground gas monitoring including 6 No. visits over 3 No. months;

- d) Identify the risks and evaluate whether a Phase 3 numerical risk assessment and / or a Remedial Strategy, is required; and
- e) Undertake an assessment of the ground conditions to provide outline recommendations for the proposed foundations.

A report was to be provided to summarise the findings and recommendations.

1.2 Third Parties

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2.0 SCOPE OF INVESTIGATION WORK

This Phase 2 Geo-Environmental Investigation has been designed based on the findings of the *IGE Consulting Phase 1 Geo-Environmental Investigation (3866a-01, Rev A)* and the Client's requirements in relation to the proposed development outlined in Section 1.0.

The ground investigation works were undertaken in three phases. The first phase comprised 4 No. dynamic sampling boreholes and was undertaken on 15th December 2022.

The second phase of investigation was undertaken between 25th January and 2nd February 2023 and comprised 3. No cable percussion boreholes, one hand dug inspection pit and 4 No California Bearing Ratio (CBR) determinations via dynamic cone penetrometer (DCP). The boreholes and CBR determinations were undertaken spatially across the site, where access permitted. Laboratory testing was undertaken between 20th December 2022 and 1st March 2023.

The third phase of investigation included the dedicated sampling of shallow site soils for PFAS concentrations and the excavation of 2 No. foundation inspection pits adjacent the existing structure. PFAS laboratory analysis was undertaken between 7th April and 2nd May 2023.

Drilling of cable percussion boreholes was completed by DMW Ltd and Borehole Solutions Ltd. Drilling of dynamic sampling boreholes was carried out by RP Drilling Ltd. Testing of soil samples for environmental and geotechnical purposes was carried out by i2 Analytical, and testing of soils and water for PFAS was completed by ALS Environmental, both in accordance with the Environment Agency's MCERTS (Monitoring Certification) quality assurance accreditation scheme. These organisations were appointed directly by IGE Consulting to carry out these contracting works.

The locations of the exploratory holes were topographically surveyed (X-Y-Z axis) with an accuracy of 20mm.

The ground investigation was undertaken in general accordance with:

- BS 5930 (2015) + A1 (2020) Code of Practice for Ground Investigation;
- BS EN ISO 17892 Geotechnical investigation and testing – Laboratory testing of soil;
- BS 10175 (2011) Investigation of Potentially Contaminated Sites – Code of Practice; and
- BS EN 1997-2 (2007) Eurocode 7 – Geotechnical Design – Ground Investigation and Testing.

The environmental sampling strategy for the site has been completed in accordance with CLR4 and the design of the investigation was carried out in accordance with R&D Technical Report P 5-TR066, LCRM (2020) and BS:8485 (2015) + A1 (2019). Further details pertaining to the ground investigation works are outlined in the following sections.

The limitations of the investigation work and report are included in Appendix 1.

The cable percussion and dynamic sample boreholes were undertaken in order to achieve the following:

- to establish the thickness, extent and characteristics of any possible Made Ground and underlying natural superficial deposits;
- to undertake in-situ geotechnical testing within these deposits;
- to obtain samples from these deposits for classification and laboratory testing;
- to allow for the installation of ground gas and groundwater monitoring wells.

An extract of the exploratory hole location plan is presented below as Figure 3, with the full plan contained in Appendix 2.



Figure 3: Exploratory Hole Location Plan extract. Taken from IGE Drawing SI-05 rev A.

2.1 Cable Percussion Boreholes

3 No. cable percussion boreholes (BH02, BH03 and BH04) were completed using a combination of 200 and 150mm diameter casing and tools to depths of between 9.90m and 19.95m bgl (93.03m and 82.86m AOD). The boreholes were placed beneath the proposed building footprint. BH01 was attempted in the central western site section but could not be progressed deeper than 0.50m bgl due to an underground obstruction, potentially a service. This exploratory hole was renamed **HDP01**. The cable percussion boreholes were begun by coring the hardstanding at the surface to allow for drilling to take place.

Upon completion, boreholes BH02 and BH04 were backfilled with hydrated bentonite pellets and returned to flush hardstanding at the surface. BH03 was installed with a combined gas and groundwater monitoring well. HDP01 was backfilled with arisings and reinstated with grass.

The locations of the boreholes are shown on the exploratory hole location plan in Appendix 2 and exploratory hole logs are contained in Appendix 3.

2.2 Dynamic Sampling Boreholes

4 No. dynamic sampling boreholes (DS01 to DS04, inclusive) were drilled spatially across the site to depths between 4.38m and 6.00m bgl (98.24m to 97.22m AOD). Dynamic sample boreholes DS01, DS02 and DS03 were begun by coring the hardstanding at the surface to allow for drilling to take place. All dynamic sample boreholes were installed with a combined gas and groundwater monitoring well.

Dynamic probing (DPSH) was undertaken from 6.00m bgl at the base of DS04 to a depth of 11.90m bgl.

The locations of the dynamic sampling boreholes are shown on the exploratory hole location plan in Appendix 2 and the dynamic sampling borehole logs are contained in Appendix 4.

2.3 PFAS Sampling

Anecdotal evidence at the site suggested that aqueous fire-fighting foam (AFFF) had not been used at the site for training purposes. The risk of PFAS compounds being present in the ground and able to reach the sensitive receptors identified (Principal Aquifer within bedrock) was assessed to be low.

In order to confirm the assessment of the Phase 1 report that the site is at a low risk from PFAS compounds, a supplementary phase of investigation was completed to determine the concentrations of PFAS within the site soils.

During this supplementary phase of investigation, IGE personnel followed industry-wide best-practice guidance for PFAS sampling, including using fresh, powderless, nitrile gloves for the handling of all sample media and soil, rinsing all sampling equipment with PFAS-free de-ionised water prior to use and not allowing the use of PFAS containing equipment including permanent markers, waterproof clothing and spray paint.

3 No. concrete cores (PFC-01, PFC-02 and PFC-03, inclusive) were undertaken in the eastern site section to allow for the collection of shallow site soils for PFAS analysis. The sub-base material directly beneath the hardstanding was collected and submitted for PFAS in soils analysis. As part of a quality assurance programme, a duplicate sample (DUP-A) was collected from one of the locations and also submitted for PFAS in soils analysis.

The concrete core barrel equipment and the shovels used for sampling were rinsed with PFAS-free de-ionised water before sampling. A rinsate sample from the concrete core and shovel (FIELD-BLANK) was collected and submitted for PFAS in water analysis. A sample of the on-site water supply (SITE-BLANK) was also collected and submitted for PFAS in water analysis.

A concrete swab was performed on an approximate 100mm x 100mm area of hardstanding at the site and submitted for PFAS in concrete (swab) analysis.

The PFAS sampling locations are shown on the exploratory hole location plan in Appendix 2.

2.4 Foundation Inspection Pits

In order to determine the presence and condition of existing foundations, 2 no. foundation inspection pits (FP02 and FP03) were excavated by hand at the northern and southern walls of the main fire station structure. These pits were initiated by breaking the hardstanding with an hydraulic breaker before excavating using hand tools to 1.20m bgl. FP01 was initially proposed at the western wall but no safe location could be found, given the extensive presence of site services.

The foundation inspection pit locations are shown on the exploratory hole location plan in Appendix 2 and the exploratory hole logs are included in Appendix 5.

2.5 California Bearing Ratio Testing

CBR determinations via DCP were undertaken at 3 No. locations (DCP01, DCP02, DCP03). These determinations were to provide approximations of subgrade strength for hardstanding design.

The locations of the CBR determinations are shown on the Exploratory Hole Location Plan in Appendix 2. The DCP data and calculations are contained in Appendix 5.

2.6 Site Testing and Sampling

The following site tests and sampling were carried out:

- a) Retrieval of environmental samples and bulk disturbed samples from cable percussion boreholes and dynamic sampling sleeves for the purposes of chemical and geotechnical laboratory testing and classification.
- b) Retrieval of shallow soil samples from beneath concrete cores, concrete swab performed on hardstanding and water samples (from site supply and rinsate) for PFAS analysis.
- c) Standard Penetration Tests (SPTs) were undertaken at regular 1.00m intervals between 1.00m and 5.00m bgl within the dynamic sampling and cable percussion boreholes. SPTs were undertaken at regular 1.50m intervals beneath 5.00m bgl in the cable percussion boreholes.
- d) Undisturbed thick-wall 100mm diameter (U100) samples were recovered from cable percussion boreholes where ground conditions allowed.
- e) CBR determinations via dynamic cone penetrometer tests were undertaken at DCP01, DCP02 and DCP03.
- f) DS04 was extended by dynamic probing (DPSH) to 11.90m bgl (91.55m AOD)
- g) Infiltration testing via falling head test method was completed at DS01, DS03 and DS04.

2.7 Laboratory Testing

2.7.1 Chemical Laboratory Testing

9 No. soil samples were obtained during exploratory hole construction and sent to i2 Analytical laboratories for chemical testing. These samples were placed into sterile sealed containers to facilitate MCERTS chemical laboratory testing of potential

contaminants. Chemical testing suites are outlined below and are based upon a wide range of possible contaminative sources.

Asbestos ID, sulfate, pH, nitrate, total and free cyanide, arsenic, barium, beryllium, boron, cadmium, chromium, chromium (hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc, Total Petroleum Hydrocarbon screen and Speciated Polyaromatic Hydrocarbons.

4 No. soil samples, 1 No. concrete swab and 2 No. water samples were obtained during the supplementary phase of investigation for PFAS presence and sent to ALS Environmental laboratories for chemical testing. These samples were placed into sterile sealed containers to facilitate MCERTS chemical laboratory testing of PFAS compounds.

2.7.2 Geotechnical Laboratory Testing

The following geotechnical laboratory tests were carried out on selected samples obtained from across the site:

- a) Determination of moisture content, liquid limit and plastic limit in accordance with BS1377-2 (1990) Clauses, 3.2, 4.4 and 5.0, respectively;
- b) Determination of particle size analysis by dry/wet sieving and hydrometer method in accordance with BS1377-2 (1990) Clauses 9.2 and 9.5, respectively;
- c) Determination of undrained shear strength in triaxial compression (without measurement of pore pressure) in accordance with BS1377-7 (1990) Clause 8; and
- d) Determination of concrete aggressivity in line with BRE SD1 (2005).

3.0 FINDINGS

3.1 Ground Conditions

The typical ground conditions encountered across the site are as follows:

Ground Surface

- Hardstanding was encountered at all exploratory holes with the exception of DS04 and HDP01. This generally comprised asphalt between 0.04m and 0.05m thick underlain by concrete to a depth between 0.34m and 0.40m bgl. At BH02, no asphalt was encountered and the concrete was recorded to be 0.23m thick.
- The hardstanding was generally underlain by a sub-base comprising either SAND or GRAVEL of concrete and limestone to depths between 0.50m (BH02) and 2.00m bgl (BH04). It should be noted that no sub-base material was recorded beneath DS02.
- At DS04 and HDP01, a soft dark brown sandy CLAY with roots and rootlets was recorded to 0.15m bgl.

Made Ground

Made Ground was recorded at all locations, with the base of the formation proven at depths ranging from 0.75m bgl (102.70m AOD) at DS04 to 2.80m bgl (100.15m AOD) at DS01.

- Soft dark brown sandy gravelly CLAY was recorded at DS01, DS02 (directly beneath hardstanding), DS04 and BH02. Gravel generally comprised brick fragments, concrete, mudstone and sandstone, with timber, slate, ceramic and clinker recorded locally. The material was encountered to depths between 0.75m bgl (DS04) and 2.80m bgl (DS01)
- Organic CLAY was recorded at DS02 (0.85m to 1.35m bgl) and DS03 (0.90m to 1.60m bgl). This material contained anthropogenic gravel.
- At HDP01 only, a suspected concrete slab was encountered at 0.80m bgl, causing the cessation of the hole.

Glaciofluvial Sheet Deposits

Natural strata representative of Glaciofluvial Sheet Deposits were recorded directly beneath Made Ground at all exploratory hole locations with the exception of HDP01. All exploratory holes with the exception of HDP01, BH02 and BH03 terminated in strata representative of Glaciofluvial Sheet Deposits.

- Dark brown pseudofibrous PEAT and very soft organic CLAY were recorded at all exploratory hole locations with the exception of BH04. The material was first encountered at depths from 0.75m bgl at DS04 to 2.80m bgl at DS01, and proven to maximum depths between 1.40m bgl at DS04 and 2.90m bgl at DS02 and BH02. It should be noted that between 2.00m and 3.00m bgl in BH03, pockets of black amorphous PEAT were recorded within a stratum of loose grey silty SAND. At DS03 only, this organic CLAY was noted to be thickly interbedded with SILT.
- Beneath the organic material, a series of interbedded fine and coarse soils was encountered.
- Fine soils generally comprised soft becoming firm (and locally stiff) silty sandy gravelly CLAY.
- Coarse soils generally comprised silty gravelly fine to coarse SAND or very silty SAND and GRAVEL, with a soil described as clayey sandy GRAVEL recorded at DS04 only. The coarse soils were generally described as loose becoming medium dense.

Glacial Till

Natural strata representative of Glacial Till were recorded beneath the Glaciofluvial Sheet Deposits at BH02 and BH03. The base of the formation was not proven at either location.

- Firm to stiff slightly sandy slightly gravelly CLAY was recorded from 8.85m bgl (94.08m AOD) at BH02 and 9.00m bgl (93.81m AOD) at BH03. BH02 was terminated in this stratum at 9.90m bgl and BH03 was terminated in this stratum at 19.95m bgl.
- Firm laminated sandy silty CLAY was recorded between 12.00m and 12.45m bgl at BH03 only.

3.2 Foundations

At FP02 and FP03, no evidence of existing foundations was recorded between ground level and 1.20m bgl. Made Ground similar to that encountered in the other exploratory holes was recorded to depth, with the existing brick wall exposed to the full depth of the inspection pit.

3.3 Visual and Olfactory Contamination Findings

During the intrusive exploratory hole investigation works, the soils were examined carefully for both visual and olfactory evidence of contamination. No visual and / or olfactory evidence of contamination was encountered during the ground investigation.

3.4 Water Strikes

Groundwater was encountered in all exploratory holes with the exception of HDP01. The groundwater strikes were all recorded within Glaciofluvial Sheet Deposits.

Location	Groundwater strike depth - m bgl (m AOD)	Groundwater depth after 20 minutes - m bgl (m AOD)
DS01	3.25 (99.70)	3.25 (99.70)
DS02	2.90 (99.77)	2.90 (99.77)
DS03	2.20(100.42)	2.20(100.42)
DS04	1.40(102.25)	1.40(102.25)
BH02	3.80 (99.13)	3.80 (99.13)
BH02	7.90 (95.03)	6.00 (96.93)
BH03	3.00 (99.81)	2.70 (100.11)
BH04	6.00 (96.65)	3.70 (98.95)

3.5 Obstructions

A hand dug service pit could not be completed in the vicinity of the exploratory hole initially named BH01. An obstruction, inferred to be representative of an underground service, was encountered at 0.80m bgl, causing the termination of the hole.

A water tank was encountered in the vicinity of BH04 whilst coring the hardstanding. The hardstanding cover was noted to be 550mm thick and comprise two layers of

reinforced concrete. The tank itself was measured to be 2.75m deep (from ground level) with dimensions approximately 3.5m². It should be noted that the location of the water tank was not shown on the pre-investigation ground penetrating radar scan provided to IGE.

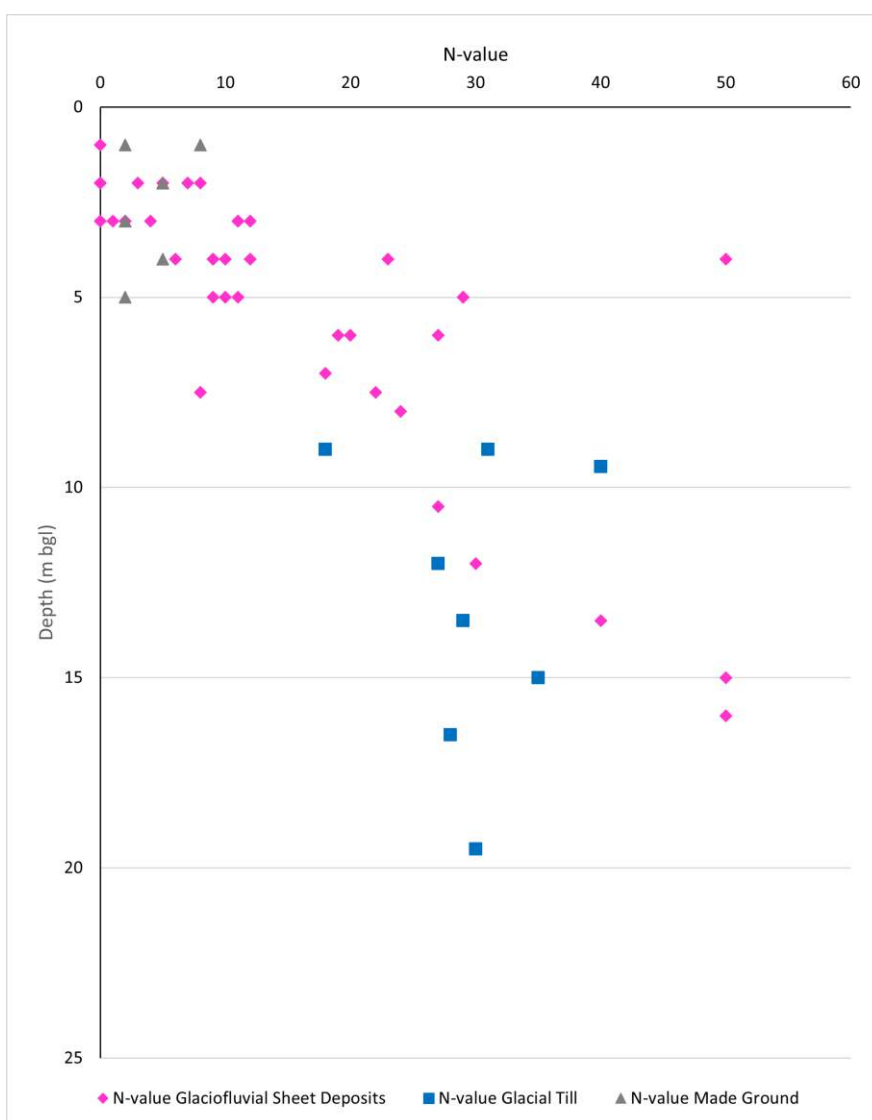
3.6 Geotechnical Site Testing

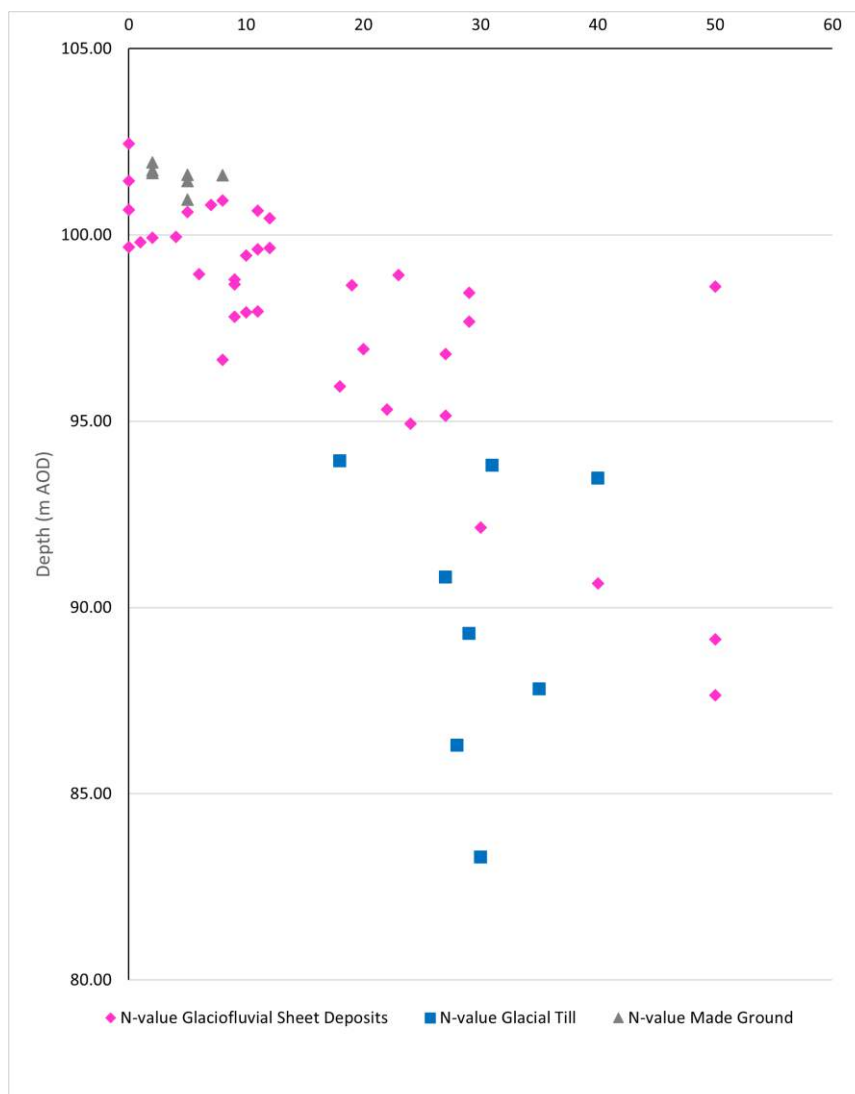
The results of the geotechnical testing undertaken during the ground investigation are summarised below.

3.6.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken at regular 1.00m intervals between 1.00m and 5.00m bgl within the dynamic sampling boreholes. SPTs were generally undertaken at regular 1.50m intervals beneath 5.00m bgl in the cable percussion boreholes.

The following scatter graphs show that there was a positive correlation between increasing uncorrected N-values with depth, both bgl and AOD.





SPT results are included on the cable percussion and dynamic sample borehole logs presented in Appendices 3 and 4, respectively.

3.6.2 Dynamic Cone Penetrometer Testing

3 No. dynamic cone penetrometer tests were undertaken to depths of between 0.824 and 0.923m bgl at DCP01 to DCP03, inclusive. The results are shown below. CBR determinations were attempted at DS01, DS02 and DS03 but given the significant thickness of hardstanding encountered and the high density of the sub base, these tests were unsuccessful.

Location	Layer	Equivalent CBR Value (%)	Layer Thickness (mm)	Total Depth (mm)
DCP01	1	3.8	127	238
	2	30.5	35	273
	3	12.2	291	564
	4	5.0	397	861

DCP02	1	4	548	622
	2	28	184	806
DCP03	1	2.8	830	899

Full dynamic cone penetrometer results are included in Appendix 5.

3.7 Geotechnical Laboratory Testing

The results of the geotechnical laboratory tests undertaken during the ground investigation are summarised below. The full geotechnical laboratory test results are included in Appendix 6.

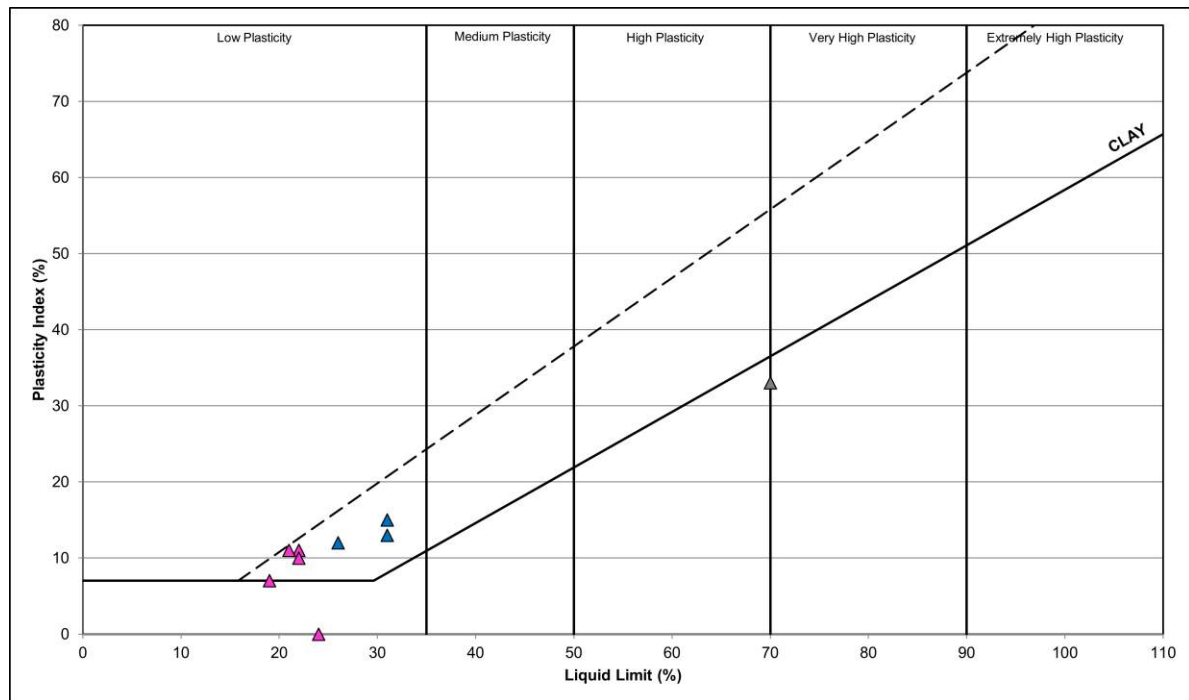
3.7.1 Atterberg Limit Tests

Atterberg limit tests were undertaken on 1 No. sample of Made Ground, 6 No. samples of natural Glaciofluvial Sheet Deposits and 3 No. samples of natural Glacial Till deposits. The results of the Atterberg testing are as follows:

Sample	Sample Depth (m bgl)	Strata	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Passing through 425 micron (%)	Modified Plasticity Index
DS01*	2.00	MG	71	70	37	33	99	33
DS01	5.00	GFS	14	22	11	11	90	10
DS02*	2.00	GFS	286	239	128	111	95	105
DS02*	3.00	GFS	18	24	NP	NP	67	NP
DS04	3.00	GFS	16	19	12	7	88	6
BH03	5.00	GFS	15	22	12	10	94	9
BH03	10.50	GT	25	31	18	13	99	13
BH03	16.50	GT	16	31	16	15	98	15
BH03	18.00	GT	15	26	14	12	90	11
BH04	5.00	GFS	12	21	10	11	84	9
Average			16	25	13	11	92	10

Samples marked * have not been included in average calculations. MG = Made Ground. GFS = Glaciofluvial Sheet Deposits.

GT = Glacial Till. Green = low volume change potential. Orange = medium volume change potential. Red = high volume change potential.



The sample of organic clay from 2.00m bgl at DS02 is not included on the above Cassagrande chart.

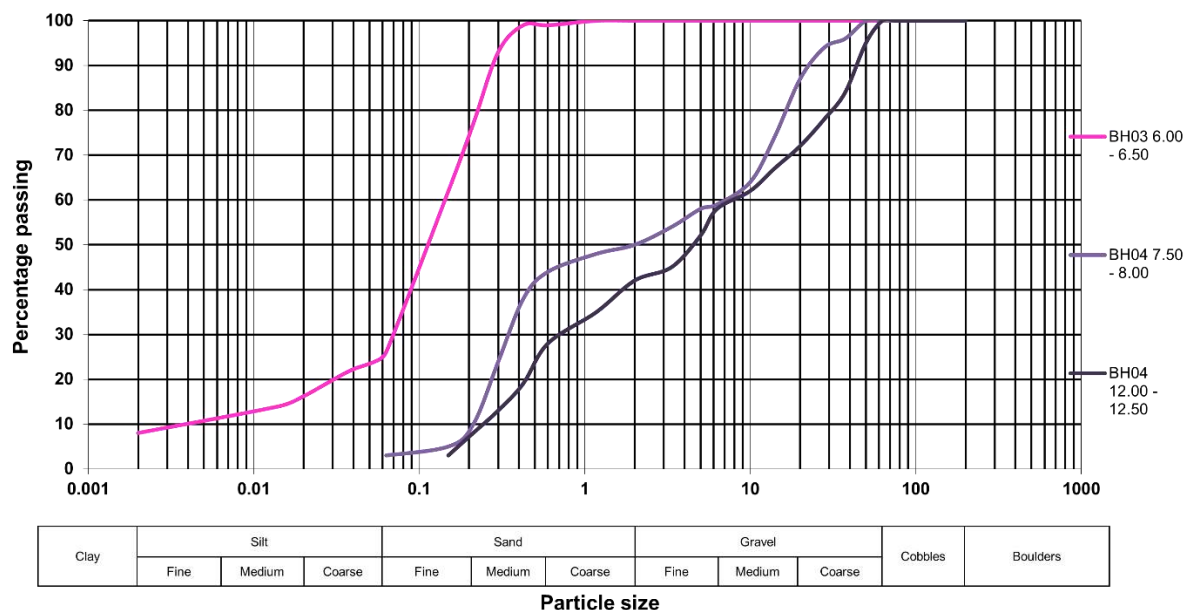
The Atterberg Limit tests indicate that both the Glacial Till and Glaciofluvial Sheet Deposits are generally of low plasticity in-line with BS14688 Part 2 and low volume change potential in-line with NHBC Chapter 4.2 guidance.

1 No. sample of Glaciofluvial Sheet Deposits was found to be non-plastic, and 1 No. sample of organic clay from the Glaciofluvial Sheet Deposits was found to be of extremely high plasticity and high volume change potential.

The Made Ground was found to be of high plasticity and medium volume change potential.

3.7.2 Particle Size Distribution Tests

Particle size distribution tests were undertaken on 3 No. samples of Glaciofluvial Sheets Deposits. The results are summarised below:



The samples from BH04 are shown to be consistent in composition, having been recorded as SAND and GRAVEL. The sample from BH03 is recorded as a slightly gravelly silty SAND.

3.7.3 Quick Undrained Triaxial Testing

1 No. sample of Glaciofluvial Sheet Deposits and 2 No. samples of Glacial Till were analysed for undrained shear strength in triaxial compression. The results are summarised below.

Sample	Sample Depth (m bgl)	Strata	Moisture content (%)	Bulk Density	Dry Density	Undrained Shear Strength (kPa)	Mode of failure	Strength
BH03	10.50	GT	25	2.00	1.59	50	Compound	Medium
BH03	18.00	GT	15	2.21	1.93	119	Compound	High
BH04	5.00	GFS	12	2.29	2.04	202	Compound	Very High

The sample of Glaciofluvial Sheet Deposits recorded an undrained shear strength of 202 kPa and is considered to be a very high strength material. The Glacial Till sample from 18.00m bgl recorded an undrained shear strength of 119kPa and should be considered a high strength material.

The unexpectedly low result of 50kPa recorded on the sample of Glacial Till at 10.50m bgl is potentially due to a number of factors. It is possible that a granular band (sand or gravel) was sampled within the clay, reducing the measured shear strength.

The most likely explanation is indicated by the index testing; the water content is significantly higher than other sample of clay at the site (25% compared with an average of 16%). It is also of note that the bulk and dry density of this sample are significantly lower than those recorded by the other samples. It is again considered likely that this is due to a relatively high moisture content causing 'water softening'.

3.7.4 BRE Special Digest Suite Testing

In accordance with BRE Special Digest 1: Concrete in Aggressive Ground (2005), the site has been classified as brownfield with mobile groundwater. BRE SD1 testing suites were undertaken on 3 No. samples of Glaciofluvial Sheet Deposits (including one of organic clay) in order to determine the Design Sulfate (DS) levels and the Aggressive Chemical Environment for Concrete (ACEC).

Sample	Depth (m bgl)	DS Class	ACEC Class
DS01	3.00	DS-1	AC-2z
DS02	5.00	DS-1	AC-1
DS03	3.00	DS-2	AC-2

3.8 Environmental Laboratory Test Results

The findings of the chemical test results, summarised below, will be assessed against generic assessment criteria (GAC) for the purposes of screening allowable concentrations in comparison to the measured site concentrations. The GAC are defined based on the critical receptors identified at the site, detailed in the Phase 1 Investigation. Receptors are considered in relation to:

- Human health receptors (e.g. end-users, construction workers and the general public) via measured solid concentrations, and;
- Additional receptors which may be relevant e.g. flora/fauna, water, buried concrete.

The GAC adopted for assessment of soils in relation to Human Health are based on published LQM/CIEH S4ULs (2015) for those compounds for which published criteria are available for varying scenarios (residential, commercial, allotment, public open space). In the absence of LQM/CIEH S4ULs (2015) the following GAC defining documents are adopted - CL:AIRE Soil GAC for Human Health Assessment (2010) and Category 4 Screening Levels (C4SLs) (2014).

The primary risk to human receptors from free cyanide in soils is an acute risk (i.e. a single dose could have a lethal affect as opposed to adverse effects from cumulative intake (chronic affect)). There is no current UK guidance available for calculating acute risks from free cyanide, therefore an in-house methodology has been used to derive an acute GAC of 60 mg/kg for all exposure scenarios. The value is given for Free or Easily Liberatable Cyanide but should be used to assess Total Cyanide in the absence of cyanide speciation. In cases where the Total Cyanide exceeds the GAC then analysis for Free or Easily Liberatable Cyanide should be completed.

Given the relatively long time since part of the site was used for allotment gardens it was assessed that any local use of pesticides and herbicides would no longer be evident in the site soils. Any pesticides or herbicides which may have been used are not likely to include the persistent organochloride pesticides such as Dieldrin, Aldrin and DDT. The redevelopment of the site to its current use in the 1960s was likely to have removed any traces of herbicides and pesticides.

Chemical laboratory testing results are included in Appendix 7. Screening tables for 7 No. samples of Made Ground (DS01 at 0.80 and 1.50m bgl, DS02 at 0.50 and 1.00m bgl, DS03 at 1.20m bgl, DS04 at 0.50m bgl and HDP01 at 0.40m bgl) and 2 No. samples of Glaciofluvial Sheet Deposits (DS03 at 2.00m bgl and DS04 at 1.50m bgl) are included in Appendix 8 and summarised below. All results have been assessed against the relevant GACs for a **commercial end use** scenario based on a measured organic matter content of **2.5%**.

3.8.1 Asbestos

An asbestos screen was performed on all samples. Asbestos was found to be present **only** in the sample taken from HDP01 at 0.40m bgl. Chrysotile was recorded by the laboratory at a concentration of 0.001% by weight; this is the laboratory detection limit.

3.8.2 Polycyclic Aromatic Hydrocarbons (PAHs)

No exceedances of the GAC were recorded in any of the samples for any of the sixteen PAH compounds analysed.

3.8.3 Metals and Metalloids

No exceedances of any heavy metals or metalloids were recorded in any of the samples submitted for laboratory analysis.

3.8.4 Total Petroleum Hydrocarbons (TPH)

TPH compounds were recorded in excess of the laboratory detection limit in a number of samples; none of the concentrations were in excess of the GAC for any of the TPH-CWG bands. It was therefore not considered necessary to complete speciation testing on these samples.

3.8.5 PFAS

Analysis for PFAS concentrations in soils, water and on the concrete hardstanding was completed across the site. No exceedances of the laboratory detection limit for any PFAS compounds were recorded in soil samples or the concrete swab. Analysis on the field equipment rinsate (FIELD-BLANK) water sample showed no concentrations in excess of the laboratory detection limit.

Analysis on the sample of the site water supply (SITE-BLANK) showed one compound in excess of the laboratory detection limit, PFOA (335-67-1), where a concentration of 1.03 ng/l was recorded, compared to a laboratory detection limit of 0.65 ng/l.

3.9 Ground Gas Monitoring Results

Exploratory holes BH03, DS01, DS02, DS03 and DS04 were installed with a standpipe to allow for monitoring of ground gas concentrations and any underlying groundwater which may be present:

Exploratory Hole	Response Zone Stratum	Response Zone Depth m bgl (m AOD)	
		Top of Response Zone	Base of Response Zone
DS01	Made Ground comprising CLAY and GRAVEL of concrete, brick fragments, limestone, mudstone and sandstone	1.00 (101.95)	2.00 (100.95)
DS02	Glaciofluvial Sheet Deposits comprising organic CLAY, pseudofibrous PEAT and sandy gravelly CLAY.	2.00 (100.67)	4.00 (98.67)
DS03	Glaciofluvial Sheet Deposits comprising silty organic CLAY, sandy gravelly CLAY and silty SAND.	2.00 (100.62)	4.00 (98.62)

DS04	Glaciofluvial Sheet Deposits comprising organic CLAY and sandy CLAY.	1.00 (102.45)	2.00 (101.45)
BH03	Glaciofluvial Sheet Deposits comprising gravelly silty SAND and Glacial Till comprising sandy gravelly CLAY.	6.00 (96.81)	10.00 (92.81)

The monitoring wells are constructed of 51mm diameter HDPE plain pipe to the depth of the response zone. The response zones comprise slotted pipe surrounded by a gravel annulus which are sealed above and below with hydrated bentonite seals. The monitoring wells are topped with flush lockable covers.

A gas monitoring programme of 6 visits over 12 weeks has been completed for the dynamic sample boreholes; the results have been summarised below. It should be noted that BH03 was only monitored three times given its installation as part of a later stage of investigation. DS02 was monitored five times; the response zone was flooded on all occasions.

Gas Monitoring Well	Steady O ₂ Concentration (%)	Peak CO ₂ Concentration (%)	Peak CH ₄ Concentration (%)	Peak H ₂ S Concentration (ppm)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)
DS01	20.1 – 20.8	<0.1	<0.1	<1	978 – 1017	<0.1
DS02	14.9 – 19.6	1.2 – 8.7	1.5 – 5.3	<1 - 90	978 – 1020	<0.1
DS03	10.3 – 20.2	0.3 – 2.0	<0.1 – 12.6	<1	977 – 1014	<0.1
DS04	14.6 – 19.3	0.8 – 4.5	<0.1	<1	976 – 1017	<0.1
BH03	20.0 – 20.7	<0.1 - 0.6	<0.1	<1	976 - 1020	<0.1

Ground gas monitoring was undertaken utilising a GFM 4300 gas analyser.

The ground gas monitoring results are included in Appendix 9.

3.10 Groundwater Depth Monitoring Results

The above wells were also installed for the purposes of groundwater depth monitoring.

Groundwater Monitoring Well	Response Zone (m bgl)	Water Level (m bgl)
DS01	1.00 – 2.00	1.64 – 1.69
DS02	2.00 – 4.00	0.83 – 1.12
DS03	2.00 – 4.00	1.82 – 2.42
DS04	1.00 – 2.00	0.87 – 1.70

BH03	6.00 – 10.00	1.64 - 2.69
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The groundwater monitoring results are included with the gas monitoring results in Appendix 9.

4.0 ENVIRONMENTAL CONCLUSIONS

4.1 Assessment of Environmental Results

Soil sample analyses have assessed the presence of contaminants on a spatial basis, and the concentrations at which they occur across the site.

No GAC exceedances for the '*commercial*' land use scenario were recorded for any of the samples (Made Ground and Glaciofluvial Deposits) sent for laboratory chemical testing.

No exceedances of laboratory detection limits for PFAS were recorded in either the soil or concrete swab analysed, including the quality assurance duplicate sample. No exceedances of laboratory detection limits were recorded for the quality assurance rinsate water sample.

An exceedance of the laboratory detection limit for PFOA (335-67-1) was recorded in the water sample taken from the on-site water supply, taken for quality assurance purposes.

Of the nine samples analysed, one tested positive for the presence of asbestos with chrysotile (loose fibres) recorded in the sample taken from 0.40m bgl at HDP01. Quantification by weight showed the total asbestos (%) in the sample to be below the laboratory detection limit of 0.001%. In accordance with CAR: Soil (2012), this meets the definition of 'trace' asbestos and no precautions regarding asbestos in soil are required at the site.

No other visual or olfactory evidence of contamination was found.

4.2 Revised Conceptual Models

The original conceptual models produced in the *IGE Consulting Phase 1 Geo-Environmental Investigation Report* have been revised / updated using the findings from the Geo-Environmental Ground Investigation.

4.2.1 Human Health Risk Assessment

The possible sources of on-site contamination identified within the Phase 1 report include:

- Made Ground
- Historical Allotment Gardens
- Use as Fire Station – including potential use of PFAS containing fire-fighting foam.

The human health receptors identified within the Phase 1 report include:

- End users (residents – ‘residential with home grown produce’ land use scenario).
- Construction workers.
- The general public and adjacent site users including from possible changes in ground gas regime following development.

The human health pathways identified within the Phase 1 report include:

- Ingestion of soil directly (including on home grown produce) and indoor dust*;
- Inhalation of soil dust (indoor and outdoor);
- Dermal contact with soil (indoor and outdoor);
- Inhalation of soil vapours (indoor and outdoor);
- Oral background;
- Inhalation background.

** Treated as one pathway*

Revised Conceptual Model for Human Health Risk Assessment

Widespread Made Ground was identified across the site during the ground investigation works. However, no human health GAC exceedances were recorded on-site for the commercial land use scenario. Asbestos was recorded at trace levels in one sampling location and is not considered to pose a significant risk.

Consequently, the site is considered to pose a **very low risk** to human health of site occupants, the general public and construction workers. Any potential increase in risk

to construction workers associated with acute interaction with soils can be mitigated with appropriate PPE and health and safety procedures.

4.2.2 Ground Gas Risk Assessment

Potential ground gas sources identified within the Phase 1 report include:

- Possible Made Ground
- Off-site infilled reservoirs (30-70m away, infilled between 1940s and 1970s).
- Though not identified during the Phase 1 investigation, the intrusive works recorded the presence of peats and organic clays; these should be considered a ground gas source.

Potential ground gas pathways identified within the Phase 1 report include:

- Preferential migration beneath hardstanding
- Foundations, service ducts and trenches
- Dissolved gases within groundwater
- Ingress through wall cavities / floors and subsequent accumulation
- Inhalation of ground gas and vapours
- Vertical and lateral migration through granular deposits / granular bands in cohesive deposits

Potential ground gas receptors identified within the Phase 1 report include:

- End users, and to a lesser extent, site workers, if confined spaces are present in which gases are able to accumulate
- Building and structures

Revised Conceptual Model for Ground Gas Risk Assessment

Made Ground and organic (peaty) clays were recorded on site. Both are considered potential ground gas sources. There are response zones screening the Made Ground, organic clays and deeper Glaciofluvial Sheet Deposits across the site.

The results of the 4 No. ground gas monitoring visits completed so far have been assessed in accordance with BS 8485 (2015) + A1 (2019). It should be noted that the response zone at DS02 (2.00m – 4.00m bgl) was flooded during each monitoring visit. In accordance with BS 8485 (2015) + A1 (2019), data from flooded response

zones should be considered unreliable and removed from the dataset. A flooded response zone was also recorded at DS03 during the first visit. During the second monitoring visit, groundwater was recorded at 2.06m bgl in DS03; the response zone of DS03 was installed between 2.00m and 4.00m bgl. Whilst this response zone is not completely flooded, the results from this visit should be treated as unreliable.

The characteristic Gas Screening Value (GSV) is calculated by dividing the maximum methane or carbon dioxide concentration by 100 and multiplying by the maximum steady flow rate recorded at the same monitoring point (the instrument detection limit of 0.1 l/hr is utilised when below detection limit flow rates are recorded). If required, the worst case GSV can be calculated by dividing the maximum carbon dioxide and methane concentration by 100 and multiplying by the maximum steady flow rate on-site.

Excluding the unreliable data from flooded wells, ground gas monitoring has recorded a maximum peak carbon dioxide concentration of 4.5% v/v (DS04, visit 4) and a maximum methane concentration of 4.3% v/v (DS03, visit 3). No steady flow rates above detection limits were recorded.

As no steady flow rates were recorded on-site, the GSV and the worst case GSV for carbon dioxide at the site can be calculated as $(4.5/100) \times 0.1 = 0.0045 \text{ l/hr}$.

The GSV and the worst case GSV for methane at the site can be calculated as $(4.3/100) \times 0.1 = 0.0043 \text{ l/hr}$.

It is assessed that the source of the elevated methane concentrations is the organic clay / peat material present both within Made Ground and Glaciofluvial Sheet Deposits. Peat is considered a high concentration, low generation source of ground gas i.e. methane accumulates in peat due to its presence in anaerobic conditions, but the emission is very slow and low volume. This is borne out by the lack of recorded steady flow rates recorded during the monitoring programme. It is therefore assessed that the organic deposits at the site do not pose a significant risk of permanent ground gases.

Consequently, the ground gas risk on-site is deemed to be **very low** and in-line with Characteristic Situation 1 (CS1). Therefore, no ground gas protection measures are deemed necessary in the proposed development, in-line with BS8485 + A1 (2019). This assessment will be reviewed upon completion of the gas monitoring programme (6 visits over 12 weeks).

Radon

The Indicative Atlas of Radon in England and Wales produced by the Health Protection Agency and British Geological Survey indicates that the site lies within a lower probability area, less than 1% of homes are above the action level. Consequently, no radon protection measures are necessary in the construction of new dwellings or extensions.

4.2.3 Controlled Waters Risk Assessment

The possible sources of on-site contamination identified within the Phase 1 report include:

- Made Ground
- Use as Fire Station including potential use of PFAS in firefighting foam

The controlled water receptors identified within the Phase 1 report include:

- Groundwater contained within the underlying Secondary Undifferentiated Aquifer within the superficial deposits and Principal Aquifer within the bedrock (unknown depth >50m bgl).
- Surface Water Courses

The controlled waters pathways identified within the Phase 1 report include:

- Vertical migration along future foundations and pooling at base / beneath foundations.
- Vertical migration through possible granular Made Ground (if present) and granular lenses in natural cohesive deposits.
- Lateral migration along low permeability natural deposits and pooling at relative low points.
- Negligible infiltration through low-permeability natural cohesive deposits.
- Migration through underlying bedrock.

- Migration along groundwater flow.
- Overland flow

Revised Conceptual Model for Controlled Waters Risk Assessment

Made Ground was encountered on-site, however, no chemical laboratory results were noted to exceed soil assessment thresholds. In conjunction with the laboratory assessment and the lack of visual and olfactory evidence noted, no significant contaminative sources exist on site.

Laboratory analysis for the presence of PFAS compounds was performed on shallow site soils and on a concrete swab adjacent a site drain. A quality assurance duplicate sample was taken from one of the sampling locations (DUP-A). No exceedances of laboratory detection limits were recorded on the soil samples or the concrete swab.

Consequently, the risk to controlled waters is deemed **very low** as no contaminative linkages have been identified. No further assessment or remedial measures are considered necessary.

Whilst the use of fire fighting foam at site is not anticipated, further works to quantify this are in progress following recommendation in the Phase 1 Report. This report will be updated with the findings of this PFAS assessment work.

4.2.4 Conceptual Model for Building Materials & Services

In accordance with BRE Special Digest 1: Concrete in Aggressive Ground (2005), the site has been classified as brownfield with mobile groundwater. The natural soils have been classified as Design Sulfate level DS-2 and subsequently within the Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2. Concrete used on site should be designed to meet these requirements.

The chemical laboratory testing results are contained within Appendix 7.

5.0 GEOTECHNICAL CONCLUSIONS

5.1 Geotechnical Assessment of Ground Conditions

The site investigation works have revealed that the ground conditions at the site were fairly consistent comprising Made Ground underlain by Glaciofluvial Sheet Deposits and Glacial Till in places. Made Ground (including hardstanding and sub-base) has not been considered in this section.

The principal strata identified are outlined in further detail below.

5.1.1 Glaciofluvial Sheet Deposits – organic material

Very soft and soft organic clays and peats were recorded at DS01, DS02, DS03, DS04, BH02 and BH03. 4 No. SPTs were completed in this stratum, with N-values between 0 and 5 (mean and median of 2).

1 No. sample of organic clay (2.00m bgl at DS02) was submitted for Atterberg (liquid and plastic) Limit analysis. The material recorded a moisture content of 286% and a plasticity index of 111%. This extremely high plasticity material is also likely to be of very high compressibility and very low strength. In light of this, the organic clays and peats are not considered suitable founding strata for even the most lightly loaded structures at the site.

5.1.2 Glaciofluvial Sheet Deposits – Shallow (above 5.00mbgl)

A series of interbedded soft to firm clays and loose becoming medium dense sands and gravels was recorded beneath the organic material to approximately 5.00m bgl. 22 No. SPTs were completed in the Glaciofluvial Sheet Deposits between 1.00m and 5.00m bgl, with N-values ranging from 0 to 50 (mean of 15, median of 11). It should be noted that the result of 50 at 4.00m bgl at DS03 is assessed to be due to the presence of gravel within the sample, rather than a true representation of a very dense material.

Laboratory analysis on these strata comprised 4 No. Atterberg Limit analyses and 1 No. quick undrained triaxial determination. These tests showed the material to be of low plasticity and low volume change potential. The triaxial analysis showed the

material at 5.00m bgl to be of very high strength.

5.1.3 Glaciofluvial Sheet Deposits – Deep (below 5.00mbgl)

Beneath 5.00m bgl, the Glaciofluvial Sheet Deposits were generally recovered as medium dense coarse soils. 12 No. SPTs were completed in this stratum with N-values ranging from 8 to 50 (mean 28, median 25). It should be noted that the SPT result of 8 was recorded at 7.50m bgl in a stratum described by the driller as 'blowing'. It is therefore assessed that this test has been affected by groundwater 'piping' and is a falsely low N-value. Two refusals (N=50) were recorded in BH04 at 15.00m and 16.00m bgl, indicating that the material is very dense at depth.

Particle Size Distribution analysis showed the material to be characterised as either slightly gravelly very silty fine to coarse sands, or silty sands and gravels.

5.1.4 Glacial Till

Glacial Till deposits were encountered from 8.85m and 9.00m bgl in BH02 and BH03, respectively and were noted to comprise firm to stiff clays. A thin stratum of laminated clay was recorded at BH03 only. 8 No. SPTs were undertaken in this material, with N-values ranging from 18 – 40 (mean and median of 30).

Laboratory analysis comprised 3 No. Atterberg Limit analyses and 2 No. quick undrained triaxial determinations. These tests showed the material to be of low plasticity and low volume change potential. The triaxial analysis showed the material at 18.00m bgl to be of high strength and the material at 10.50m bgl to be of medium strength. It is inferred that the sample at 10.50 has undergone softening due to the high water content, whilst the presence of coarse constituents may also have caused a falsely low measurement.

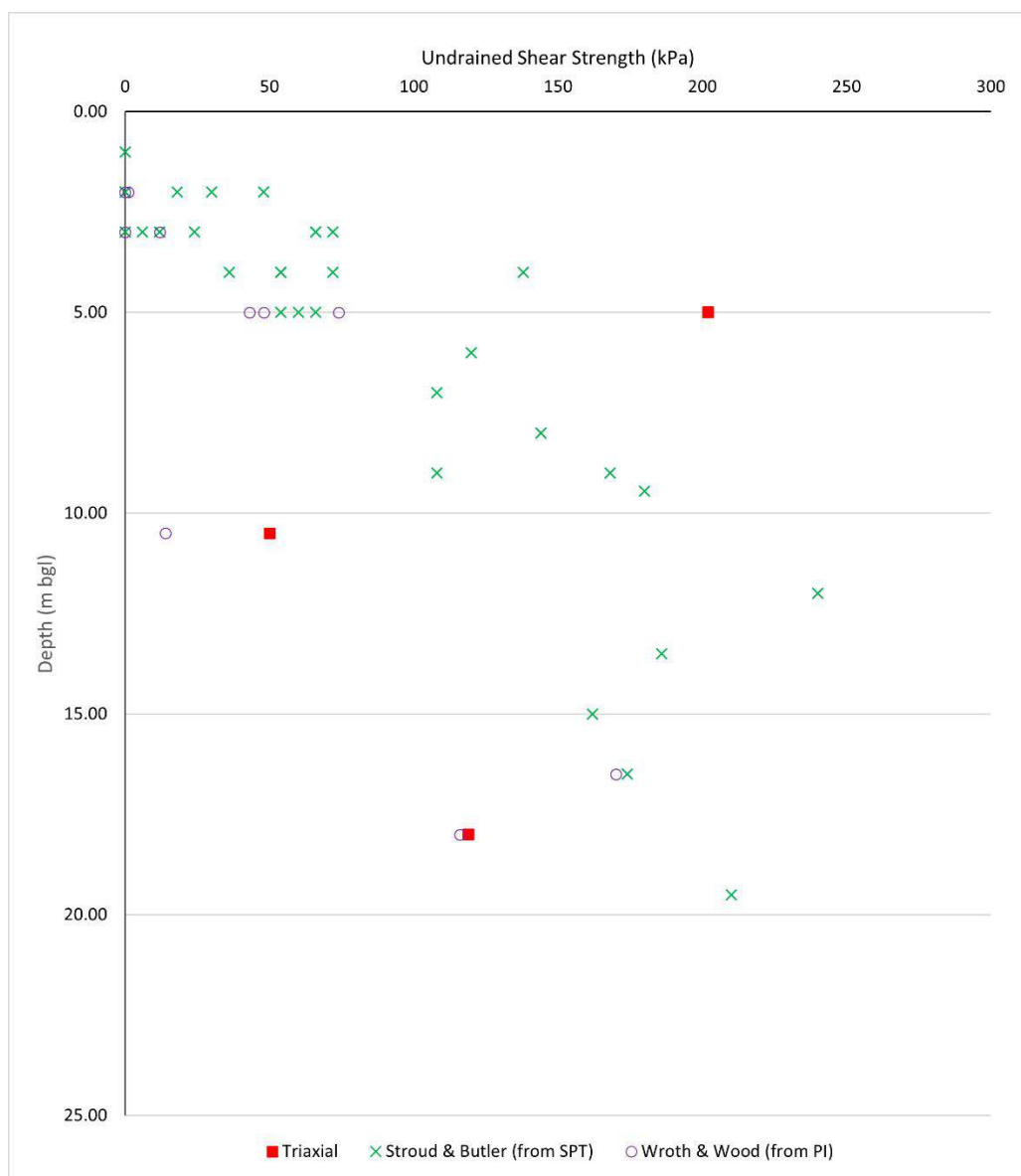
5.2 Foundations

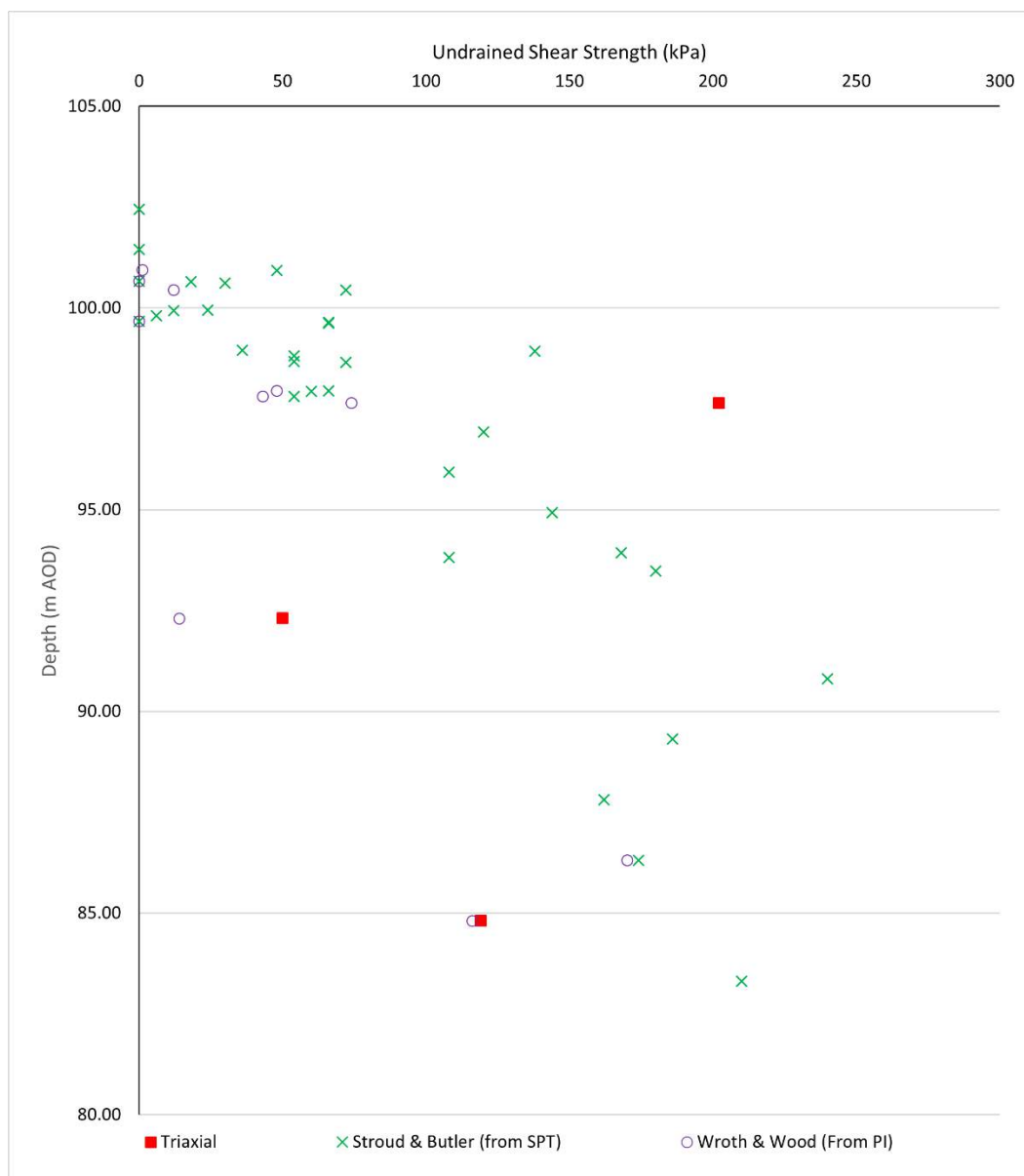
Given the presence of low strength, variable material and shallow groundwater from existing ground level to 5.00m bgl the use of traditional shallow foundations is not envisaged to be suitable. Consequently, it is envisaged that deep (piled) foundations will be necessary at the site, particularly for the training tower given the anticipated

column loadings. General material parameters for suitable formation stratum are detailed below.

5.2.1 Cohesive Material

Utilising the *Stroud and Butler (1975)* empirical correlation between N-values and undrained shear strengths, and the correlation of *Wroth and Wood (1978)*, the cohesive deposits (both Glaciofluvial and Glacial Till) are assessed to have an undrained shear strength in excess of 100 kPa from 5.00m bgl (approximately 97.00m AOD). This is shown on the depth plots below. As noted in §3.6.3 and 5.1.4, the triaxial result of 50kPa on a sample of Glacial Till at 10.50m bgl is inferred to be a falsely low measurement.





5.2.2 Granular Material

The median SPT N-value in the deep granular soils is 25. Using this average value and following the guidance of Peck et al, an equivalent angle of shearing resistance (Φ) of 34° is considered appropriate for pile design. It is recommended that the piles should be installed into the medium dense material first encountered at BH02, BH03 and BH04 at 6.00m bgl (96.93 to 96.65m AOD).

5.2.3 Piled Foundations

Piled foundations should bear onto the stiff cohesive (clay) soils or medium dense becoming dense coarse (sand and gravel) soils encountered below 5.00m bgl. Given the presence of residential properties at the northern and eastern boundaries, and the potential impact upon existing services, consideration should be given to a non-

percussive piling technique or advice sought from piling contractor into mitigating this risk i.e. construction of 'cut off trenches etc

Given the presence of numerous established trees at the site boundaries, heave precaution may be necessary for ground floor slabs subject to proposed levels.

It is recommended that a temporary working platform is undertaken in line with BRE470 with appropriate in-situ testing undertake to validate the installation. The movement / tracking of the piling rig onto and across site should be considered within the design, particularly in light of the levels on site. It is recommended that suitable plate incremental tests take to appropriate pressures are undertaken following completion of the temporary working platforms to ensure that they have been installed appropriately.

Furthermore, whilst no cobbles or boulders were encountered in either the Glacial Till or Glaciofluvial Sheet Deposits during the formation of the boreholes, their absence beneath the rest of the site should not be assumed.

5.3 Groundwater

Shallow groundwater strikes were encountered across the site; groundwater levels were found to rest within the first 3.00m bgl across the site during monitoring visits.

Consequently, significant groundwater control is likely to be required for excavation works at the site. Excavations are unlikely to be stable in even the short-term, with frequent, rapid, unpredictable and potentially catastrophic collapses likely. Excavation support in accordance with CIRIA R97 will be necessary for any excavations at the site, including those for foundation and drainage purposes. This excavation support must be utilised in conjunction with a groundwater control plan that should take into account neighbouring properties.

5.4 Earthworks and External Areas

5.4.1 CBR Determinations

3 No. CBR determinations were undertaken by DCP at the western edge of the site. These generally provided variable results, though no results were recorded below 2%.

Given the large thicknesses of sub-base recorded beneath the majority of existing hardstanding across the site and the poor quality material beneath it, it is considered likely that the in-situ material is **not** suitable for highways and external areas. The hardstanding on site showed visible signs of distress, likely due to high differential settlement rates of the shallow Glaciofluvial Sheet Deposits, in particular the organic deposits.

It is therefore assessed that significant re-engineering could be required for the proposed development to be suitable for further hardstanding. However, further inspection and testing should be undertaken once demolition works are undertaken.

5.4.2 Earthworks

It is understood that the demolition of the existing structure will produce significant amount of material, intended for use as aggregate. This material should be subject to appropriate chemical and geotechnical screening to ensure its suitability for use.

Assuming the material is chemically and geotechnically appropriate, best practice should be followed with regards an earthworks programme, including the re-engineering of the material to an appropriate specification which is agreed prior to works and validated both during and after works. This earthworks strategy should be detailed in an Earthworks Specification which should include, amongst other things, limits on control of moisture content, re-engineering thickness, and compaction regimes. Consideration should also be given to the presence of underground services (including a water tank) at the site.

5.4.3 Stockpile Management

During the course of the development there will also be areas of stockpiled soils intended for use within the proposed gardens. These will have been subjected to off-

site testing and approved for use on site. It is imperative that the stockpiles are well managed to avoid inadvertent mixing or depositing of surplus or deleterious materials that would compromise the continued use. We would recommend that the site management reviews the proposed positions for placement of stockpiles and places either fencing or warning signs to ensure compliance.

5.4.4 Export of Materials

Any soils to be removed from site must be classified in accordance with WM3 under the definition of waste and chemically tested to determine their destination, i.e. reuse or landfill. Waste ticket records must also be retained as proof of the export of materials from site.

5.5 Drainage

As noted in Letter Report 3866/LM/03-a, infiltration testing via falling head test was completed in DS01, DS03 and DS04 during a gas and groundwater monitoring visit. Testing was not completed in DS02 given the high standing water level. The results are presented below and contained with Appendix 5.

Location	Standing Groundwater Level (m bgl)	Response Zone (m bgl)	Test began at (m bgl)	Test ended at (m bgl)	Infiltration rate, k (m/s^2)
DS01	1.64	1 - 2	1.13	1.66	5.60×10^{-5}
DS03	2.42	2 - 4	0.37	1.79	5.28×10^{-5}
DS04	1.58	1 - 2	0.15	0.80	4.48×10^{-5}

Infiltration rates were recorded between 4.48 and $5.60 \times 10^{-5} m/s^2$, which would ordinarily indicate that the ground conditions were suitable for soakaway drainage. However, consideration must be given to a number of other factors.

Groundwater strikes were recorded during the formation of all exploratory holes on site and shallow groundwater has been recorded in all exploratory holes during each of the completed 4 No. monitoring visits. The depth of groundwater monitored ranged between 0.83 and $2.42m$ bgl; this is indicative of a shallow permanent groundwater body at the site. It is considered likely that this shallow groundwater body may preclude the use of soakaway drainage.

Based upon the existing shallow groundwater and the shallow compressible deposits, the use of soakaways within the proposed commercial scheme is not considered feasible at this stage.

6.0 RECOMMENDATIONS

- Following any variation in a finalised proposed development detailed design including earthworks design, proposed levels and arboricultural survey (tree survey) it is recommended that the above conclusions are re-appraised to determine the suitability.
- The conclusions of this report should be agreed with relevant regulatory authorities prior to the commencement of works.
- No ground gas protection measures are deemed necessary at this stage. Upon completion of the remaining gas monitoring visits, this conclusion should be re-appraised.
- No remedial measures are deemed necessary with respect to soil at the site.
- If any hereto unidentified visual or olfactory evidence of contamination is encountered during earthworks or construction work, then the Local Authority Environmental Health Officer and Environment Agency should be contacted immediately to determine appropriate mitigation measures.
- A detailed earthworks strategy should be prepared for the site.
- It is recommended that the presence and associated constraints of all site services are established prior to significant intrusive works beginning.

APPENDIX 1

LIMITATIONS OF INVESTIGATION WORK AND REPORT

LIMITATIONS OF REPORT

This consultancy report was compiled and carried out by IGE Consulting Limited ('IGE') for the client, as defined in the main report (the 'client'), on the basis of a defined programme and scope of works and the terms of a contract between IGE and the client. IGE undertook this with all reasonable skill and care, taking into account the limits of the scope of works required by the client, the prevailing site conditions, the time scale involved and the resources, including financial and manpower resources, agreed between IGE and the client. IGE cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outwith the agreed scope of works.

Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices. This report may not be relied upon, or transferred to, by any other party without the written agreement of its author. If a third party relies on this report, it does so wholly at its own and sole risk and IGE disclaims any liability to such parties.

It is IGE's understanding that this report is to be used for the purpose described in the 'Brief' section of this report. That purpose was a significant factor in determining the scope and the services to be provided. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without IGE's review and advice shall be at the client's sole and own risk.

The information contained in this report is protected by disclosure under Part 3 of the Environmental Information Regulations 2004 pursuant to the provisions of Regulation 12(5) without the consent in writing of a Director of IGE.

This report is a function of the date it was written and should be read in light of any subsequent changes in legislation, statutory requirements and industry practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of IGE. In the absence of such written advice of IGE, reliance on the report in the future shall be at the client's own and sole risk. Should IGE be requested to review the report in the future, IGE shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between IGE and the client.

The observations and conclusions described in this report are based solely upon the scope of works agreed between the client and IGE. IGE has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report. IGE is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the agreed scope of works. For the avoidance of doubt, this report is strictly limited to the nature of contamination contained within the ground and groundwater at the site. The report does not cover environmental aspects such as air or noise pollution and ground vibrations and the like. In addition, ecological matters relating to wildlife, flora and fauna have not been investigated as part of this report. In particular, the site has not been inspected for the presence or otherwise of invasive species (e.g. Japanese Knotweed). It is recommended that the client appoints a specialist in this subject to carry out a detailed inspection / survey of the site if its presence is suspected. Where mention has been made to the identification of asbestos or asbestos-containing materials this is for indicative purposes only and does not constitute or replace full and proper surveys.

LIMITATIONS OF INVESTIGATION WORK

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations, the potential exists for ground conditions to be encountered which are different to those considered in this report. The explored extent of the site area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried

out for a limited number of parameters, based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Exploratory Holes

Where exploratory holes have been carried out as part of this investigation, the spacing has been determined to provide a reasonable indication of the general ground conditions across the site, but the number has ultimately been limited by commercial constraints. The findings of the exploratory holes relate specifically to the exploratory hole locations and are no absolute guarantee of the ground conditions between such locations. Due allowance should be made for the possibility of variation in conditions between exploratory hole locations.

Extent of Contamination Testing

The extent of contaminated land testing carried out on samples obtained from the site has been determined in accordance with the latest legal guidance issued by the government to provide, with reasonable certainty, the probable general levels of contamination present on site that could pose a significant hazard to human health or waters. The extent of site investigation works including chemical testing has also been limited by reasonable commercial constraints. Although extensive testing of samples has been carried out, the volume of samples taken for testing are a minute fraction of the total volume of soils and groundwater present on site. Therefore, there is a residual risk that undetected pockets of contamination may be present on site, situated between testing locations.

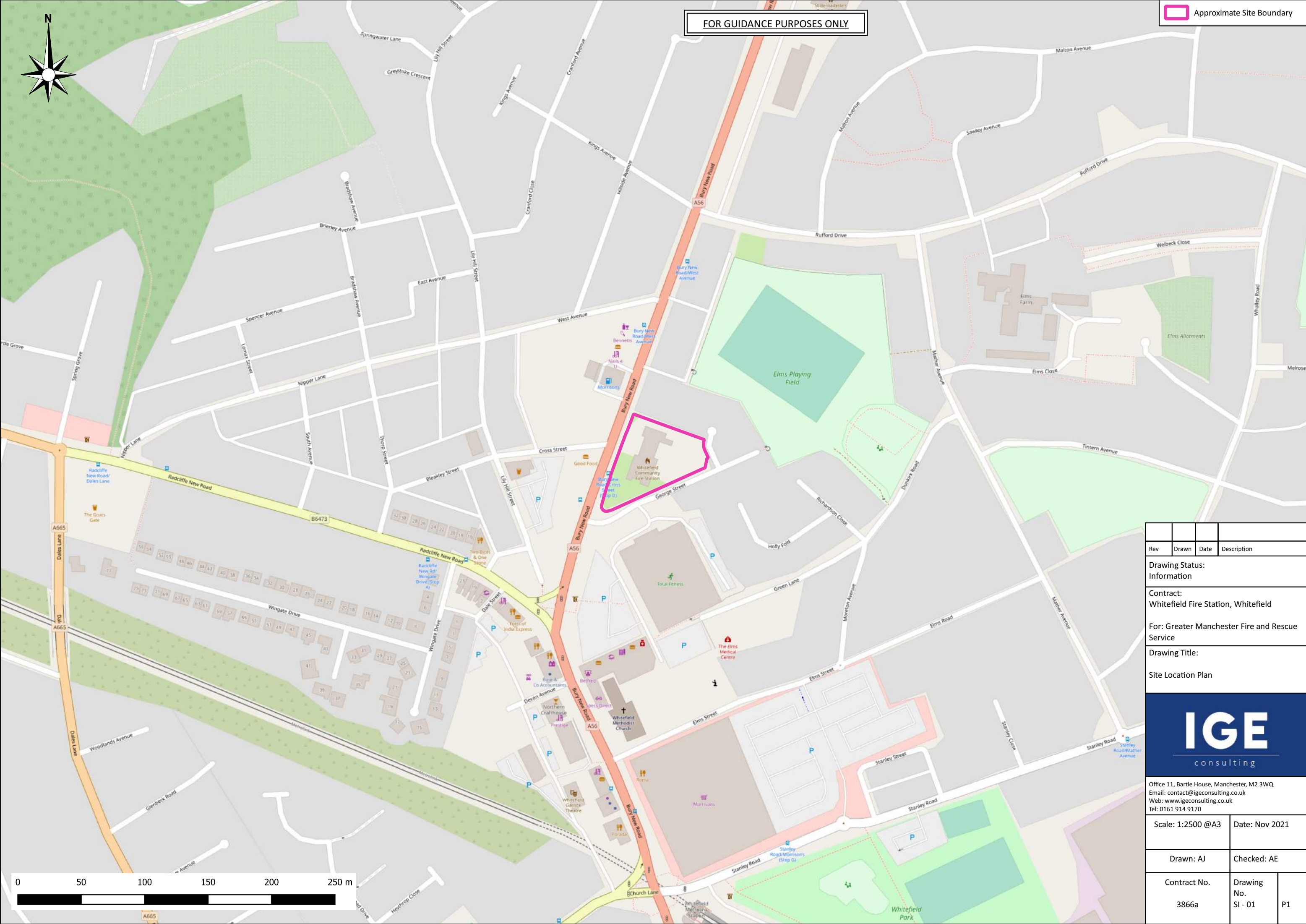
When investigating or developing potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and temporally. The absence of certain ground, ground gas, contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

Extent of Geo-Environmental Studies

This report is strictly limited to the nature of contamination contained within the ground and groundwater at the site. The report does not cover environmental aspects such as air or noise pollution and ground vibrations and the like. In addition, ecological matters relating to wildlife, flora and fauna have not been investigated as part of this report. In particular, the site has not been inspected for the presence or otherwise of invasive species e.g. Japanese Knotweed. It is recommended that the Client appoints a specialist in this subject to carry out a detailed inspection / survey of the site if its presence is suspected. Where mention has been made to the identification asbestos or asbestos-containing materials this is for indicative purposes only and does not constitute or replace a full and proper survey. If an Unexploded Ordnance (UXO) report has been obtained within the report, it has been so on the basis of Health and Safety concerns and no assessment has been made other than transcribing the recommendations of the sub-contractor contained within the report. In terms of a potential contaminative source, unless ordnance has been manufactured / stored on site, UXOs will only be determined as a contaminative source following a positive identification on site.

APPENDIX 2

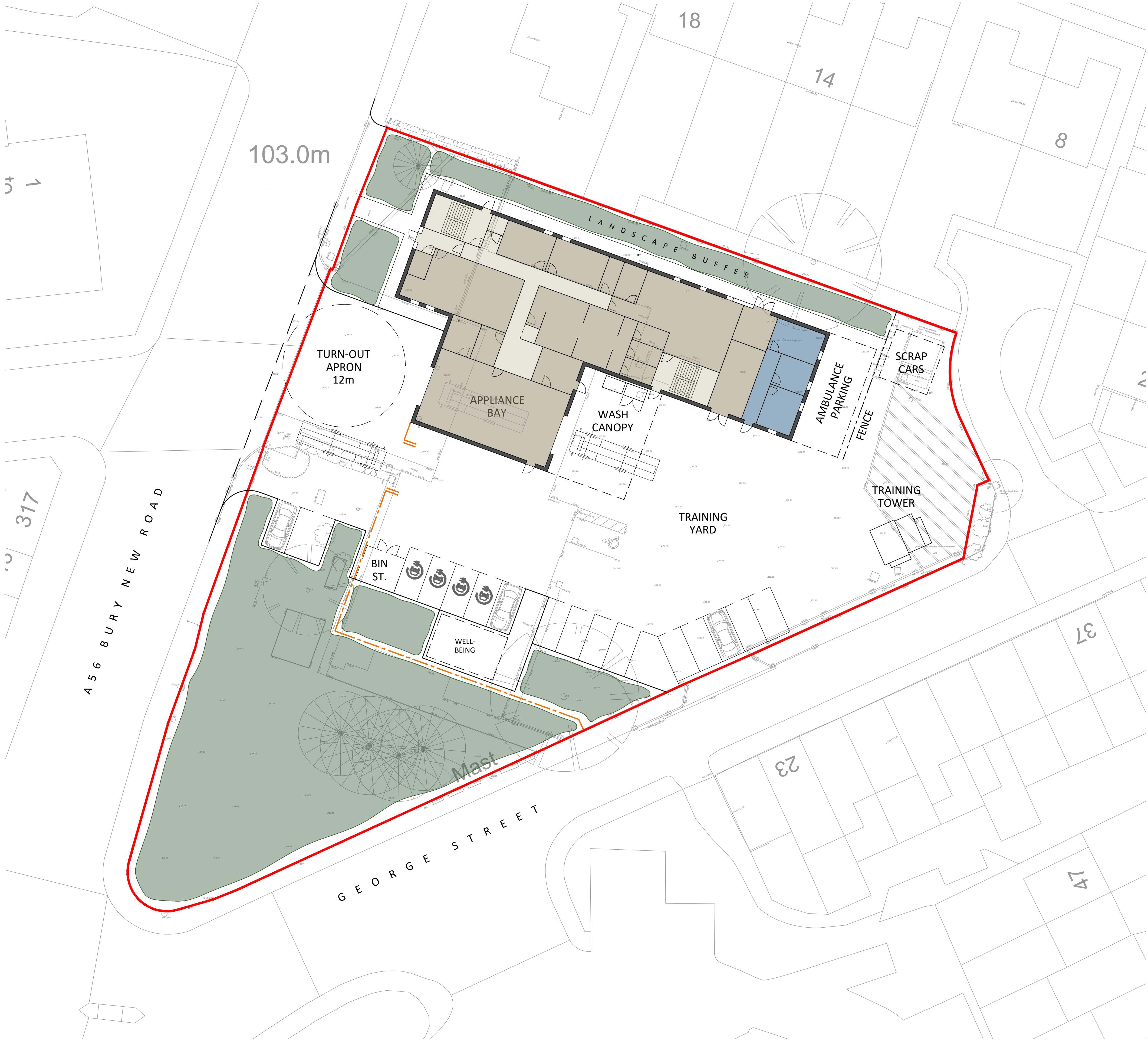
FIGURES AND DRAWINGS



FOR GUIDANCE PURPOSES ONLY

Approximate Site Boundary

Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Whitefield Fire Station, Whitefield			
For: Greater Manchester Fire and Rescue Service			
Drawing Title: Site Location Plan			
			
Office 11, Bartle House, Manchester, M2 3WQ Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170			
Scale: 1:2500 @A3		Date: Nov 2021	
Drawn: AJ		Checked: AE	
Contract No. 3866a	Drawing No. SI - 01	P1	



status

FEASIBILITY

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The originator shall have no responsibility for any liability, loss, cost, damage or expense arising from or relating to any use of this document other than for its intended purpose on this project.

This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work.

All dimensions are to be checked on site by the contractor prior to proceeding with any work.

Hazard Identification

ref

hazard

date

N

P3	UPDATED FOLLOWING REVIEW AT MTG. 02.08.22	ST	22.08.22
P2	BUILDING FOOTPRINT UPDATED. APPLIANCE BAY DELETED.	ST	16.06.22
P1	FIRST ISSUE	ST	06.06.22
ref	revision	by	date

B
&
H

G
&
H

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Bradshaw Gass & Hope LLP

client

GREATER MANCHESTER
COMBINED AUTHORITY

project

NEW FIRE STATIONS
FEASIBILITY STUDIES

drawing

WHITEFIELD FIRE STATION
PROPOSED SITE PLAN

drawn by

ST

date

JUN 22

checked by

date

scale

1:200

rev

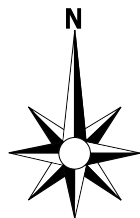
A1

dwg no

1978.35.4203

rev

P3



FOR GUIDANCE PURPOSES ONLY

- Approximate Site Boundary
- Proposed
- Cable Percussive Boreholes
- DCPs
- Dynamic Sample Boreholes
- Hand Dug pit
- Foundation Inspection Pits
- PFAS Cores



A	JH	04/05	oundation Inspection Pits & PFAS Cores	
Rev	Drawn	Date	Description	
Drawing Status: Information				
Contract: Whitefield Fire Station, Whitefield				
For: Greater Manchester Fire and Rescue Service				
Drawing Title: Exploratory Hole Location Plan				
IGE consulting				
Office 16, Bartle House, Manchester, M2 3QW Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170				
Scale: 1:300 @A3			Date: May 2023	
Drawn: JH			Checked: AE	
Contract No. 3866a			Drawing No. SI-05	P2

APPENDIX 3

CABLE PERCUSSION BOREHOLE LOGS

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Borehole Log

ver. 0.5

Borehole No.
BH02

Sheet 1 of 1

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380473E - 406498N

Level (mAOD):102.93

Dates:25/02/2023

Weather:Showers

Project No.:3866a

Rev.:1.0

Logged By:JH

Checked By:LM

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description		
		Depth (m)	Type	Results						
					0.23	102.70		CONCRETE. MADE GROUND		
					0.50	102.43		Light brown, fine to coarse SAND and angular to subangular, fine to coarse GRAVEL of sandstone. MADE GROUND		
		0.80	ES					Soft, dark brownish grey, slightly sandy, gravelly CLAY. Gravel is angular to subangular, fine to coarse of red brick, concrete, sandstone, slate and ceramic. MADE GROUND	1	
								Possible ceramic land drain at 0.60m bgl.		
		1.20	SPT	N=2 (1,1/0,1,0,1)						
		1.80	D			1.70	101.23		Firm, dark brown, pseudo-fibrous PEAT.	
						1.90	101.03		GLACIOFLUVIAL SHEET DEPOSITS	
		2.00	SPT	N=8 (1,1/2,2,2,2)		2.00	100.93		Soft, light grey, slightly sandy, slightly gravelly CLAY. Gravel is subrounded to well rounded, fine to coarse of mixed lithologies.	2
									GLACIOFLUVIAL SHEET DEPOSITS	
		2.40	B						Loose, brown, clayey, fine to coarse SAND.	
		2.40	ES						GLACIOFLUVIAL SHEET DEPOSITS	
						2.80	100.13		Dark brown, plastic, pseudo-fibrous PEAT.	
						2.90	100.03		GLACIOFLUVIAL SHEET DEPOSITS	
		3.00	SPT	N=2 (1,0/0,0,1,1)					Very loose, light grey, gravelly, slightly clayey, fine to coarse SAND. Gravel is rounded to well rounded, fine to coarse of mixed lithologies.	3
		3.20	B						GLACIOFLUVIAL SHEET DEPOSITS	
		3.40				3.40	99.53		Soft to firm, light grey, slightly gravelly, slightly sandy CLAY. Gravel is subrounded to well rounded, fine to coarse of mixed lithologies.	
		3.70	B						GLACIOFLUVIAL SHEET DEPOSITS	
4.00	SPT	N=23 (3,4/4,6,6,7)		4.00	98.93		Medium dense, light grey, sandy, slightly clayey, rounded to well rounded, fine to coarse GRAVEL of mixed lithologies.	4		
							GLACIOFLUVIAL SHEET DEPOSITS			
4.50	B									
5.00	SPT	N=10 (6,3/3,3,2,2)						5		
				5.40	97.53		Soft to firm, greyish brown, slightly gravelly, slightly sandy CLAY. Gravel is rounded to well rounded, fine to coarse of mixed lithologies.			
5.80	B						GLACIOFLUVIAL SHEET DEPOSITS			
6.00	SPT	N=20 (6,7/5,5,5,5)		6.00	96.93		Medium dense, light greyish brown, gravelly, slightly silty, fine to coarse SAND. Gravel is rounded to well rounded, fine to coarse of mixed lithologies.	6		
							GLACIOFLUVIAL SHEET DEPOSITS			
6.50	B									
7.00	SPT	N=18 (4,5/7,4,4,3)						7		
8.00	SPT	N=24 (6,7/7,5,6,6)						8		
8.50	B									
9.00	SPT	N=28 (7,6/6,7,7,8)		8.85	94.08		Firm, brown, slightly gravelly, slightly sandy CLAY. Gravel is rounded to well rounded, fine to coarse of mixed lithologies.	9		
							GLACIAL TILL			
9.45	SPT	N=30 (6,7/7,7,8,8)								
				9.90	93.03			10		
							Borehole terminated at 9.90m.			

Remarks:

Hardstanding cored. Cable percussive borehole terminated at 9.90m bgl due to no recovery.

SPT Energy Ratio:

Casing Details			Chiselling Details		
Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
GL	6.00	110			
Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
3.80					
7.90					

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH03 Sheet 1 of 2										
Project Name: Whitefield Fire Station				Co-ords: 380499E - 406486N		Project No.: 3866a									
Location: Whitefield, Greater Manchester				Level (mAOD): 102.81		Rev.: 1.0									
Client: Greater Manchester Combined Authority				Dates: 30/01/2023 - 31/01/2023		Logged By: AS									
				Weather: Overcast		Checked By:									
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description								
		Depth (m)	Type	Results											
					0.05	102.76	ASPHALT. MADE GROUND	1							
					0.40	102.41	CONCRETE. MADE GROUND Brown, gravelly, slightly clayey, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of concrete (60%) and limestone (40%). MADE GROUND								
		1.20 - 1.65 1.20 - 1.65 1.20	B D SPT	N=8 (4,2/3,2,1,2)	1.20	101.61	Soft to firm, dark brown, mottled black, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mudstone (50%) and quartzite (50%). MADE GROUND	2							
		2.00 - 2.45 2.00 - 2.50 2.00	D B SPT	N=7 (2,3/2,1,2,2)	2.00	100.81	Loose, grey, slightly gravelly, silty, fine to coarse SAND with frequent fragments of black, amorphous PEAT and wood fragments. Gravel is subangular to subrounded, fine to coarse of mudstone (60%) and timber (40%). GLACIOFLUVIAL SHEET DEPOSITS								
		3.00 - 3.45 3.00 - 3.50 3.00	D B SPT	N=1 (1,1/0,0,1,0)	3.00	99.81	Firm, grey, mottled black, slightly gravelly, sandy, silty CLAY with frequent organic fragments and occasional laminations of light brown, slightly clayey, fine to coarse sand. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	3							
		4.00 - 4.45 4.00 - 4.50 4.00	D B SPT	N=9 (1,2/2,2,2,3)			No longer organic from 4.00m bgl.								
		5.00 - 5.45 5.00 - 5.50 5.00	D B SPT	N=9 (1,1/1,2,3,3)				4							
		6.00 - 6.45 6.00 - 6.50 6.00	D B SPT	N=27 (2,3/5,7,7,8)	6.00	96.81	Medium dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS Becoming gravelly from 6.50m bgl.								
		7.50 - 7.95 7.50 - 8.00 7.50	D B SPT	N=22 (6,7/8,8,4,2)	7.50	95.31	Medium dense, brown, mottled dark brown, slightly clayey fine to coarse SAND and subangular to subrounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	5							
		9.00 - 9.45 9.00 - 9.50 9.00	D B SPT	N=18 (2,2/3,4,5,6)	9.00	93.81	Firm to stiff, brown, slightly gravelly, slightly sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL								
Continued on next sheet								10							
Remarks: Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth.				Casing Details			Chiselling Details								
				Depth Top (m)		Depth Base (m)		Diameter (mm)		Depth Top (m)		Depth Base (m)		Duration (hrs)	
				0.00		6.00		200							
				0.00		15.00		150							
SPT Energy Ratio:				Water Strike											
				Depth Strike (m)		Time Elapsed (min)		Water Level (m)							
				3.00		20		2.70							

IGE consulting		Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5				Borehole No. BH03 Sheet 2 of 2	
Project Name: Whitefield Fire Station				Co-ords: 380499E - 406486N		Project No.: 3866a			
Location: Whitefield, Greater Manchester				Level (mAOD): 102.81		Rev.: 1.0			
Client: Greater Manchester Combined Authority				Dates: 30/01/2023 - 31/01/2023		Logged By: AS			
				Weather: Overcast		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
		10.50 - 10.95	U					Firm to stiff, brown, slightly gravelly, slightly sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL	11
		12.00 - 12.45 12.00 - 12.50 12.00	D B SPT	N=40 (5,7/8,10,10,12)	12.00	90.81		Firm, brown, laminated, sandy, silty CLAY. GLACIAL TILL	12
		12.00 - 12.45 12.00 - 12.50 12.00	D B SPT	N=40 (5,7/8,10,10,12)	12.45	90.36		Firm to stiff, brown, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL	13
		13.50 - 13.95 13.50 - 14.00 13.50	D B SPT	N=31 (4,5/7,7,8,9)					14
		15.00 - 15.45 15.00 - 15.50 15.00	D B SPT	N=27 (3,4/6,6,7,8)			Becoming stiff from 15.00m bgl.		15
		16.50 - 16.95 16.50 - 17.00 16.50	D B SPT	N=29 (3,4/5,7,8,9)					16
		18.00 - 18.45	U						17
		19.50 - 19.95 19.50	D SPT	N=35 (3,5/7,8,9,11)				18	
					19.95	82.86			19
Borehole terminated at 19.95m.									20
Remarks: Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth.				Casing Details			Chiselling Details		
				Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
				0.00	6.00	200			
				0.00	15.00	150			
				Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)							
3.00	20	2.70							
SPT Energy Ratio:									

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Borehole Log

ver. 0.5

Borehole No.
BH04

Sheet 1 of 2

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380511E - 406469N

Level (mAOD):102.65

Dates:01/02/2023 - 02/02/2023

Weather:Rain

Project No.:3866a

Rev.:1.0

Logged By:AS

Checked By:

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
					0.05	102.60		ASPHALT. MADE GROUND	
					0.40	102.25		CONCRETE. MADE GROUND	
								Light brown, slightly sandy, subangular to subrounded, fine to coarse GRAVEL of concrete (70%) and limestone (30%). MADE GROUND	1
		1.20 - 1.65 1.20 - 1.65 1.20	B D SPT	N=5 (1,1/2,1,1,1)	1.20	101.45		Dark brown, mottled grey, slightly gravelly, clayey, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of concrete (40%), mudstone (30%) and limestone (30%). MADE GROUND	
		2.00 - 2.45 2.00 - 2.50 2.00	D B SPT	N=3 (1,0/0,1,1,1)	2.00	100.65		Soft to firm, greyish brown, slightly gravelly, sandy, silty CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	2
		3.00 - 3.45 3.00 - 3.50 3.00	D B SPT	N=11 (3,2/1,3,3,4)				Becoming firm from 3.00m bgl.	3
		4.00 - 4.45 4.00 - 4.50 4.00	D B SPT	N=12 (1,2/2,3,3,4)	3.80	98.85		Firm to stiff, brown, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	4
		5.00 - 5.45	U						5
		6.00 - 6.45 6.00 - 6.50 6.00	D B SPT	N=19 (2,2/3,4,5,7)	6.00	96.65		Medium dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	6
		7.50 - 7.95 7.50 - 8.00 7.50	D B SPT	N=8 (5,7/2,1,1,4)	7.50	95.15		Medium dense, brown, silty, fine to coarse SAND and subangular to well rounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	8
9.00 - 9.50	B						9		
								10	

Remarks:

Hardstanding cored. Cable percussive borehole terminated at 16.45m bgl due to refusal.

SPT Energy Ratio:

Continued on next sheet

Casing Details			Chiselling Details		
Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
0.00	4.50	200			
0.00	12.00	150			
Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
6.00	20	3.70			

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH04 Sheet 2 of 2								
Project Name: Whitefield Fire Station				Co-ords: 380511E - 406469N		Project No.: 3866a							
Location: Whitefield, Greater Manchester				Level (mAOD): 102.65		Rev.: 1.0							
Client: Greater Manchester Combined Authority				Dates: 01/02/2023 - 02/02/2023		Logged By: AS							
				Weather: Rain		Checked By:							
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description					
		Depth (m)	Type	Results									
		10.50	SPT	N=27 (3,4/6,6,7,8)		87.65		Medium dense, brown, silty, fine to coarse SAND and subangular to well rounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS					
		12.00 - 12.45 12.00 - 12.50 12.00	D B SPT	N=30 (3,5/7,7,8,8)									
		13.50 - 13.95 13.50 - 14.00 13.50	D B SPT	N=40 (4,6/9,9,10,12)									
		15.00 - 15.45 15.00 - 15.50 15.00	D B SPT	N=50 (6,8/50 for 295mm)									
		16.00 - 16.45 16.00	D SPT	N=50 (7,10/50 for 285mm)									
					16.45	86.20		Dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS					
								Borehole terminated at 16.45m.					
Remarks: Hardstanding cored. Cable percussive borehole terminated at 16.45m bgl due to refusal.								Casing Details		Chiselling Details			
SPT Energy Ratio:								Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
								0.00	4.50	200			
								0.00	12.00	150			
								Water Strike					
								Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
6.00	20	3.70											

APPENDIX 4

DYNAMIC SAMPLE BOREHOLE LOGS



ver. 1,5

Dynamic Sample No.

DS01

Sheet 1 of 1

Project Name: Whitefield Fire Station

Co-ords:	380490E - 406496N
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Project No.
3866a

Location: Whitefield, Greater Manchester

Level (m AOD):	102.95
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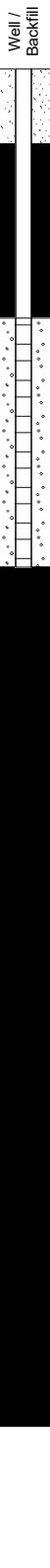
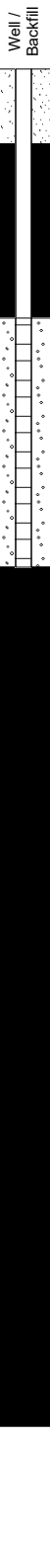
Logged By
LM

Client: Greater Manchester Combined Authority

Date:	15/12/2022
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Checked By

Weather:	Freezing
----------	----------

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.04	102.91		ASPHALT MADE GROUND	-
					0.34	102.61		CONCRETE MADE GROUND	
		0.80 0.80	ES PID	0.00ppm				Light greyish brown clayey sandy angular to subangular fine to coarse GRAVEL of limestone and concrete. MADE GROUND	-
		1.00	SPT(C)	N=2 (2,0/1,0,0,1)					1 -
		1.25				101.70		Soft dark brown mottled light grey sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of concrete, brick fragments, mudstone and sandstone. MADE GROUND	-
		1.50 1.50	ES PID	0.00ppm					-
		2.00 2.00	D SPT(C)	N=5 (4,2/1,1,1,2)					2 -
		2.50 2.50	ES PID	0.00ppm					-
		2.80				100.15		Very soft dark brown pseudofibrous PEAT GLACIOFLUVIAL SHEET DEPOSITS	3 -
		3.00 3.00	D SPT(C)	N=4 (2,1/1,1,1,1)					-
					3.25	99.70		Soft to firm light grey silty CLAY GLACIOFLUVIAL SHEET DEPOSITS	-
		4.00 4.00	D SPT(C)	N=6 (1,1/1,1,2,2)					4 -
		4.50				98.45		Firm light greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. GLACIOFLUVIAL SHEET DEPOSITS	-
		5.00 5.00	D SPT(C)	N=11 (3,3/2,3,3,3)					5 -
		5.45				97.50		Dynamic Sample terminated at 5.45m.	-
									6 -

Remarks:

Hardstanding cored. Dynamic sample progressed to target depth at 5.45m bgl.

Water Strike		Casing Details		Sample Sleeve Runs		
Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)
3.25		4.00	115	0.00	1.00	87mm 100%
				1.00	2.00	87mm 75%
				2.00	3.00	77mm 60%
				3.00	4.00	77mm 90%
				4.00	5.00	67mm 70%

IGE consulting		Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5			Dynamic Sample No. DS02					
Project Name: Whitefield Fire Station				Co-ords: 380501E - 406463N		Project No. 3866a						
Location: Whitefield, Greater Manchester				Level (m AOD): 102.67		Logged By LM						
Client: Greater Manchester Combined Authority				Date: 15/12/2022		Checked By						
Client: Greater Manchester Combined Authority				Weather: Freezing								
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Stratum Description					
		Depth(m)	Type	Results								
		0.05			0.05	102.62	ASPHALT MADE GROUND	1				
		0.50	ES		0.35	102.32	CONCRETE MADE GROUND					
		0.50	PID	0.00ppm			Soft light grey sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of concrete, limestone, brick fragments and timber fragments. MADE GROUND					
		1.00	D		0.85	101.82	Soft dark grey slightly sandy slightly gravelly organic CLAY. Gravel is subangular fine of mudstone and timber fragments. MADE GROUND					
		1.00	ES									
		1.00	SPT(C)	N=2 (1,0/1,0,1,0)								
		1.00	PID	0.00ppm	1.35	101.32	Very soft dark brown pseudofibrous PEAT. GLACIOFLUVIAL SHEET DEPOSITS					
		2.00	D		1.90	100.77	Soft locally very soft light grey mottled dark grey silty organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS					
		2.00	SPT(C)	N=0 (1,0/0,0,0,0)								
		2.70			2.70	99.97	Very soft dark brown pseudofibrous clayey PEAT GLACIOFLUVIAL SHEET DEPOSITS					
		3.00	D		2.90	99.77	Very loose light grey mottled dark brown very silty fine to coarse SAND. GLACIOFLUVIAL SHEET DEPOSITS	3				
		3.00	SPT(C)	N=0 (1,0/0,0,0,0)								
		3.40			3.40	99.27	Soft becoming firm light grey slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of mudstone and sandstone. GLACIOFLUVIAL SHEET DEPOSITS					
		4.00	D									
		4.00	SPT(C)	N=9 (2,2/2,2,2,3)	4.40	98.27	Medium dense dark brown very silty very gravelly fine to coarse SAND. Gravel is subrounded fine or mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS					
		5.00	D									
		5.00	SPT(C)	N=29 (6,7/7,7,7,8)								
		5.45			5.45	97.22	Dynamic Sample terminated at 5.45m.					
		Remarks:				Water Strike			Casing Details		Sample Sleeve Runs	
		Hardstanding cored. Dynamic sample progressed to target depth at 5.45m bgl.				Depth Strike	Remarks		Depth Base	Diameter	Depth Top (m)	Depth Base (m)
2.90						3.00	115	0.00	1.00	87mm 100%		
								1.00	2.00	87mm 90%		
								2.00	3.00	77mm 100%		
								3.00	4.00	77mm 90%		
				4.00	5.00	67mm 100%						



ver. 1.5

Dynamic Sample No.

DS03

Sheet 1 of 1

Project Name: Whitefield Fire Station

Co-ords:	380521E - 406483N
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Project No.
3866a

Location: Whitefield, Greater Manchester

Level (m AOD):	102.62
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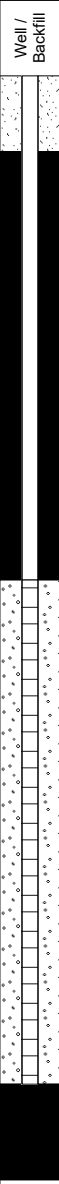
Logged By
LM

Client: Greater Manchester Combined Authority

Date: 15/12/2022

Checked By

Weather:	Freezing
----------	----------

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.05	102.57		ASPHALT MADE GROUND CONCRETE MADE GROUND	
		0.70 0.70	ES PID	0.00ppm	0.36	102.26		Light greyish brown silty gravelly fine to coarse SAND. Gravel is angular fine to medium of limestone and concrete. MADE GROUND	
		1.00 1.20 1.20	SPT(C) ES PID	N=5 (1,1/1,1,2,1) 0.00ppm	0.90	101.72		Soft locally very soft sandy organic CLAY. MADE GROUND	1
		2.00 2.00 2.00 2.00	D ES SPT(C) PID	N=5 (2,1/2,2,1,0) 0.00ppm	1.60	101.02		Soft light greyish brown silty organic CLAY thickly interbedded with clayey SILT. GLACIOFLUVIAL SHEET DEPOSITS	2
		3.00 3.00	D SPT(C)	N=11 (2,2/3,2,3,3)	2.50	100.12		Firm dark brownish grey mottled greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	3
		4.00	SPT(C)	N=50 (2,3/4,8,18,20)	3.70	98.92		Medium dense becoming very dense light brown mottled dark greyish brown gravelly silty fine to coarse SAND. Gravel is subrounded fine of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	4
					4.38	98.24		Dynamic Sample terminated at 4.38m.	5
									6

Remarks:

Hardstanding cored. Dynamic sample progressed to refusal at 4.39m bgl

Water Strike		Casing Details		Sample Sleeve Runs		
Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)
2.20		3.00	115	0.00	1.00	87mm 100%
				1.00	2.00	87mm 75%
				2.00	3.00	77mm 100%
				3.00	4.00	77mm 95%



ver. 1,5

Dynamic Sample No.

DS04

Sheet 1 of 1

Project Name: Whitefield Fire Station

Co-ords:	380456E - 406447N
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Project No.
3866a

Location: Whitefield, Greater Manchester

Level (m AOD):	103.45
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Logged By
LM

Client: Greater Manchester Combined Authority

Date: 15/12/2022

Checked By

Weather:	Freezing
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Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description		
		Depth(m)	Type	Results						
					0.15	103.30		Soft dark brown sandy CLAY with roots and rootlets. TOPSOIL	1	
		0.50 0.50	ES PID	0.00ppm				Soft dark brown sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of brick fragments, clinker, concrete, ceramic and mudstone. MADE GROUND		
		1.00 1.00	D SPT(C)	N=0 (1,0/0,0,0,0)	0.75	102.70		Soft locally very soft dark brown organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS	2	
		1.50 1.50	ES PID	0.00ppm	1.40	102.05		Very soft locally soft light grey mottled dark brownish grey silty sandy CLAY. GLACIOFLUVIAL SHEET DEPOSITS		
		2.00 2.00	D SPT(C)	N=0 (1,0/0,0,0,0)	2.70	100.75		Firm dark brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	3	
		3.00 3.00	D SPT(C)	N=12 (1,0/2,3,3,4)	3.50	99.95		Medium dense dark brown gravelly silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS		
		4.00	SPT(C)	N=10 (1,0/2,3,2,3)				<u>Becomes orangish brown</u>	4	
		5.00	SPT(C)	N=29 (5,5/7,8,7,7)						
						5.50	97.95		Light greyish brown sandy slightly clayey subangular to well rounded fine to coarse GRAVEL of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	5
						6.00	97.45		Dynamic Sample terminated at 6.00m.	
Remarks:										
Dynamic sample progressed to target depth at 5.45m bgl.										

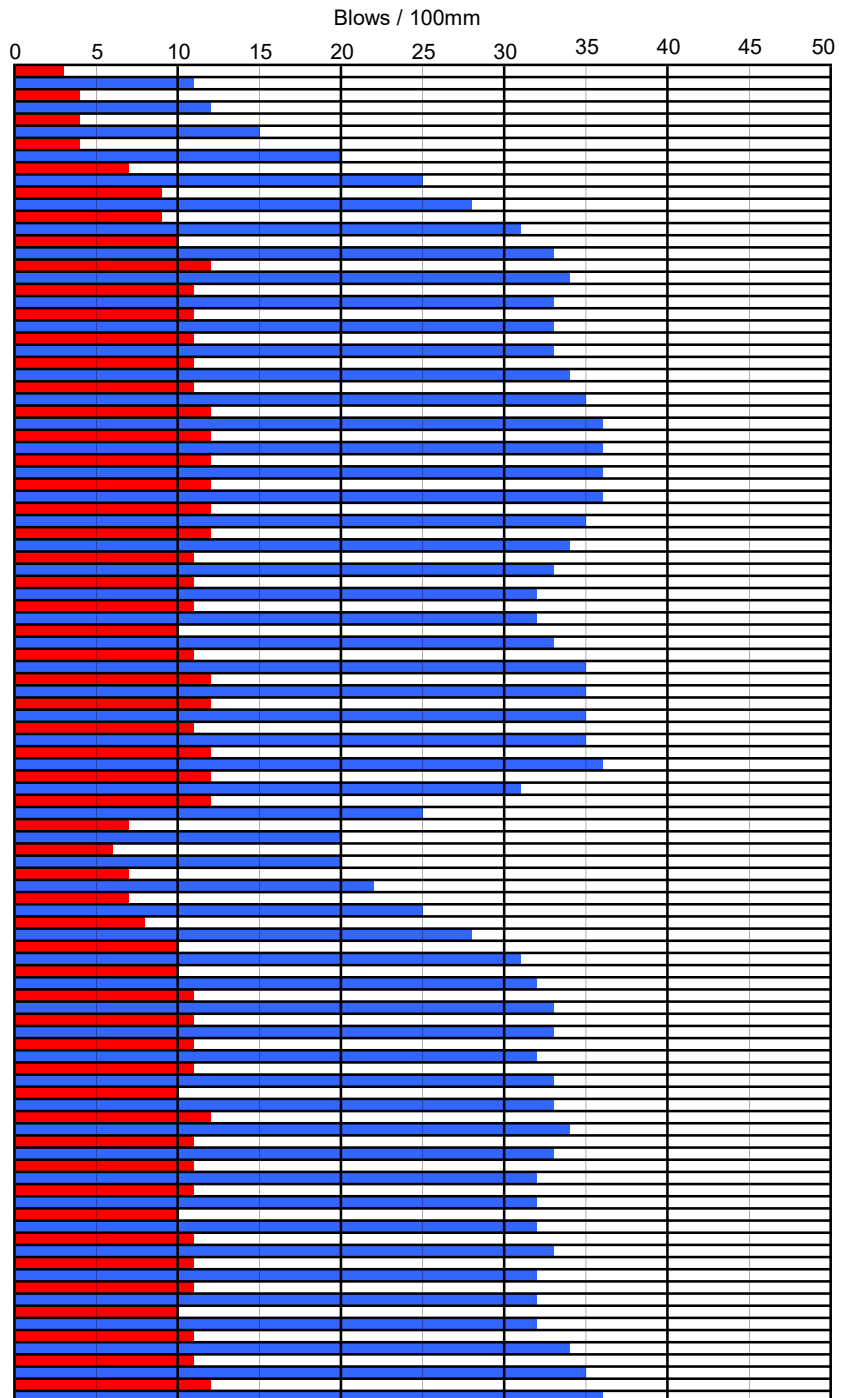


DYNAMIC PROBE TEST RESULTS SHEET

SITE: Whitefield Fire Station
 DRILLER: RP Drilling
 PROBE NUMBER: DS04
 DATE: 26-Jan-23

DPSH IN ACCORDANCE WITH BS 1377: PART 9: CLAUSE 3.2
 PROBE HOLE BACKFILLED: Yes
 REMARKS: Hole commenced at the base of DS04 @ 6.00m bgl

Depth (m)	Blows / 100mm	Approximate SPT 'N' value*
6.0	3	11
6.1	4	12
6.2	4	15
6.3	4	20
6.4	7	25
6.5	9	28
6.6	9	31
6.7	10	33
6.8	12	34
6.9	11	33
7.0	11	33
7.1	11	33
7.2	11	34
7.3	11	35
7.4	12	36
7.5	12	36
7.6	12	36
7.7	12	36
7.8	12	35
7.9	12	34
8.0	11	33
8.1	11	32
8.2	11	32
8.3	10	33
8.4	11	35
8.5	12	35
8.6	12	35
8.7	11	35
8.8	12	36
8.9	12	31
9.0	12	25
9.1	7	20
9.2	6	20
9.3	7	22
9.4	7	25
9.5	8	28
9.6	10	31
9.7	10	32
9.8	11	33
9.9	11	33
10.0	11	32
10.1	11	33
10.2	10	33
10.3	12	34
10.4	11	33
10.5	11	32
10.6	11	32
10.7	10	32
10.8	11	33
10.9	11	32
11.0	11	32
11.1	10	32
11.2	11	34
11.3	11	35
11.4	12	36



Dynamic probe value (Blows/100mm) Approximate SPT 'N' value

* Value is indicative only and must not be relied upon for design purposes



DPSH IN ACCORDANCE WITH BS 1377: PART 9: CLAUSE 3.2
 PROBE HOLE BACKFILLED: Yes
 REMARKS: Hole commenced at the base of DS04 @ 6.00m bgl

[illegible]

 Dynamic probe value (Blows/100mm)
  Approximate SPT 'N' value

* Value is indicative only and must not be relied upon for design purposes

APPENDIX 5

IN-SITU TEST RESULTS

DYNAMIC CONE PENETROMETER TEST RESULTS

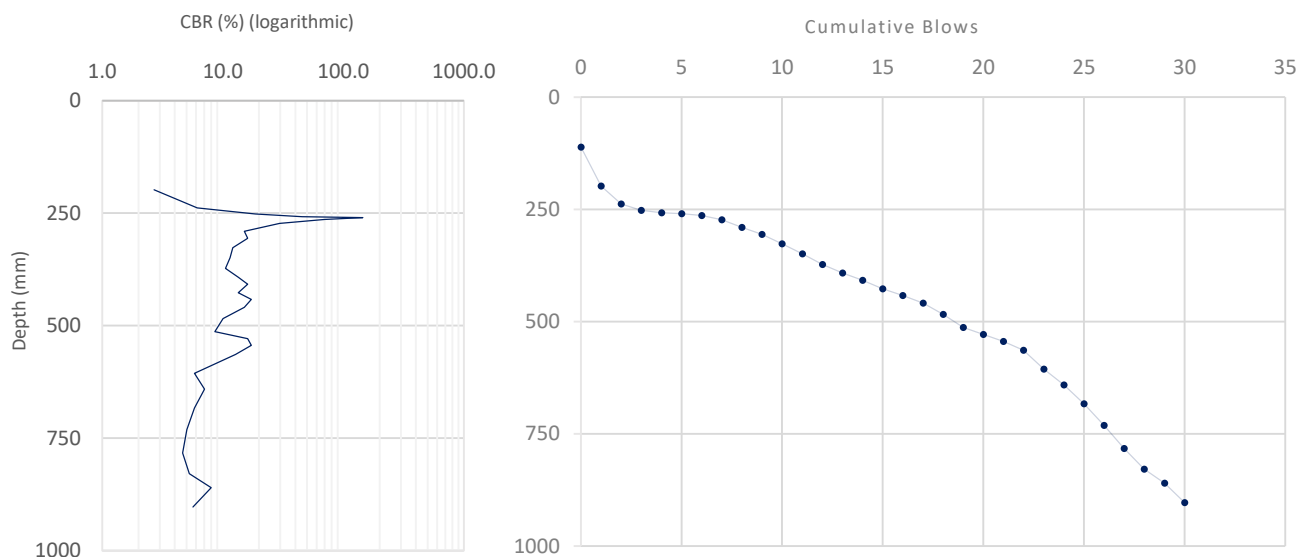
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

Tel: 0161 914 9171
Email: contact@igeconsulting.co.uk
Web: www.igeconsulting.co.uk

Site:	Whitefield Fire Station
Test Date:	25/01/2023
Location:	DCP01
Weather:	Overcast
Surface Covering:	Made Ground Topsoil
Start Depth (mm):	111
Final Depth (mm):	903
Interpretative Method:	TRL Equation: $\log_{10}(\text{CBR}) = 2.480 - 1.057 \times \log_{10}(\text{mm/blow})$
Termination Reason:	Target Depth
Notes	none

Layer	Cumulative Blows	Total Depth (mm)	Layer Thickness * (mm)	CBR Value (%)
1	2	238	127	3.8
2	6	273	35	30.5
3	22	564	291	12.2
4	30	861	297	5.0

* Layers determined by discernible change in CBR % or by each 250mm compacted layer.



Method in line with DTP Interim Advice Note 73/06 (Rev 1) (2009) – Design Guidance For Road Pavement Foundations (Draft 25)

Geo-Environmental Engineering Services

IGE Consulting Ltd
Registered in England No 8270758



DYNAMIC CONE PENETROMETER TEST RESULTS

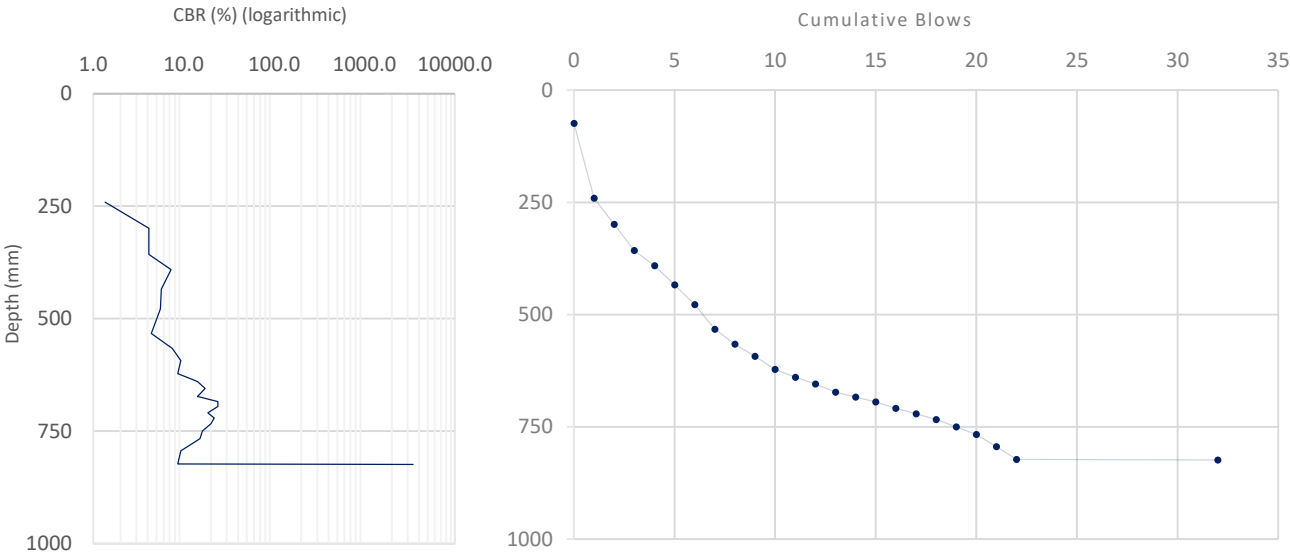
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

Tel: 0161 914 9171
Email: contact@igeconsulting.co.uk
Web: www.igeconsulting.co.uk

Site:	Whitefield Fire Station
Test Date:	25/01/2023
Location:	DCP02
Weather:	Overcast
Surface Covering:	Made Ground
Start Depth (mm):	74
Final Depth (mm):	824
Interpretative Method:	TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$
Termination Reason:	Target Depth
Notes	None

Layer	Cumulative Blows	Total Depth (mm)	Layer Thickness * (mm)	CBR Value (%)
1	10	622	548	4
2	32	806	184	28

* Layers determined by discernible change in CBR % or by each 250mm compacted layer.



Method in line with DTP Interim Advice Note 73/06 (Rev 1) (2009) – Design Guidance For Road Pavement Foundations (Draft 25)

DYNAMIC CONE PENETROMETER TEST RESULTS

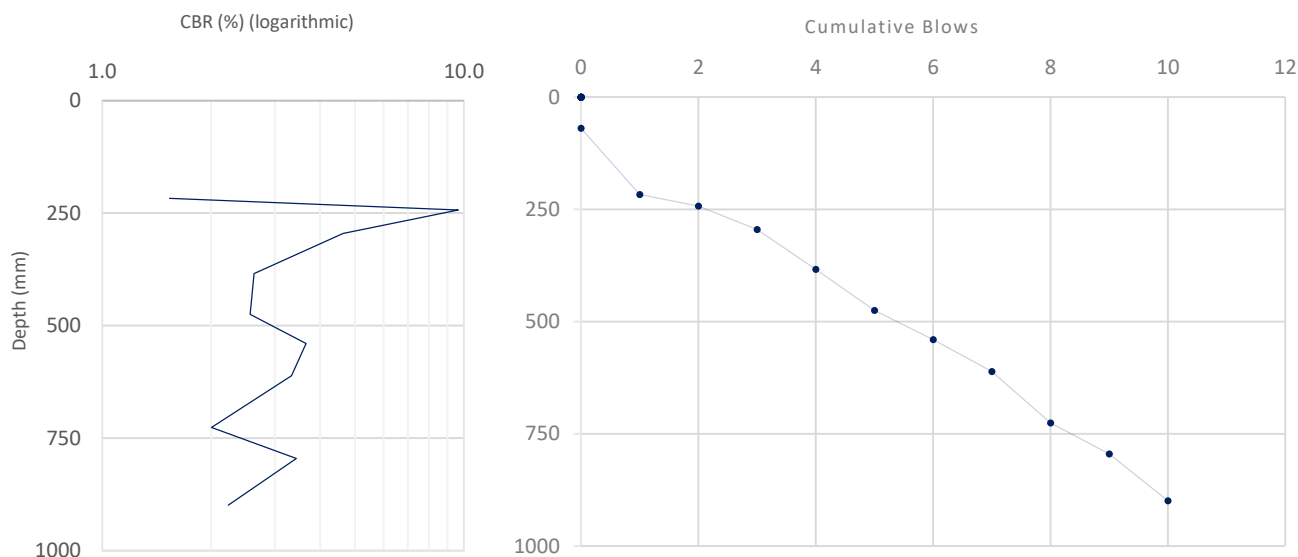
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

Tel: 0161 914 9171
Email: contact@igeconsulting.co.uk
Web: www.igeconsulting.co.uk

Site:	Whitefield Fire Station
Test Date:	25/01/2023
Location:	DCP03
Weather:	Overcast
Surface Covering:	Made Ground Topsoil
Start Depth (mm):	69
Final Depth (mm):	899
Interpretative Method:	TRL Equation: $\log_{10}(\text{CBR}) = 2.480 - 1.057 \times \log_{10}(\text{mm/blow})$
Termination Reason:	Target Depth
Notes	None

Layer	Cumulative Blows	Total Depth (mm)	Layer Thickness * (mm)	CBR Value (%)
1	0	899	830	2.8

* Layers determined by discernible change in CBR % or by each 250mm compacted layer.



Method in line with DTP Interim Advice Note 73/06 (Rev 1) (2009) – Design Guidance For Road Pavement Foundations (Draft 25)

Window Sample Hole Falling Head Test

DS01

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	2.090	m
	0.00	1.130	0.960		Casing Depth	0.000	m
	0.50	1.170	0.920		Difference in Length between bottom of casing/boreholes, L	2.090	m
	1.00	1.250	0.840		Water Depth	1.640	m
	1.50	1.310	0.780		Casing Diameter, D	0.051	m
	2.00	1.420	0.670		Cross Sectional area of casing, A	0.002	m²
	2.50	1.480	0.610		Height of casing above ground level	0.000	m
	3.00	1.540	0.550		Approximate long term water table (or base of BH see rules)	2.090	m
	3.50	1.570	0.520		Borehole End Condition (important to get right)	d	
	4.00	1.600	0.490		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	1.610	0.480		b= Soil flush with bottom in uniform soil	0.140	
	5.00	1.630	0.460		c= Well point or hole extended at impervious boundary	2.848	
	6.00	1.640	0.450		d= Well point or hole extended in uniform soil	0.325	
	7.00	1.650	0.440		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	1.650	0.440		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	1.650	0.440		Intake factor, F (Select correct end condition)	0.325	
	10.00	1.650	0.440		Variable Head, H¹	0.960	m
	12.00	1.650	0.440		Time, T¹	0.000	min
	15.00	1.650	0.440		Variable Head, H²	0.430	m
	20.00	1.650	0.440		Time, T²	90.000	min
	40.00	1.660	0.430	K unsat (m/s)	5.60E-05		
	60.00	1.660	0.430				
	90.00	1.660	0.430	RULES	1. A borehole location MUST be entered to generate <i>k</i> . 2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet. 3. Head is measured to the base of the BH, or use WL if higher. 4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole.</u> 5. If groundwater level is below test, k is not true permeability, but indicative only. 6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times. 7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		

Window Sample Hole Falling Head Test

DS03

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	3.870	m
	0.00	0.370	3.500		Casing Depth	0.000	m
	0.50	0.670	3.200		Difference in Length between bottom of casing/boreholes, L	3.870	m
	1.00	0.830	3.040		Water Depth	2.420	m
	1.50	0.960	2.910		Casing Diameter, D	0.051	m
	2.00	1.100	2.770		Cross Sectional area of casing, A	0.002	m²
	2.50	1.150	2.720		Height of casing above ground level	0.000	m
	3.00	1.190	2.680		Approximate long term water table (or base of BH see rules)	3.870	m
	3.50	1.250	2.620		Borehole End Condition (important to get right)	d	
	4.00	1.270	2.600		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	1.290	2.580		b= Soil flush with bottom in uniform soil	0.140	
	5.00	1.310	2.560		c= Well point or hole extended at impervious boundary	4.653	
	6.00	1.350	2.520		d= Well point or hole extended in uniform soil	0.336	
	7.00	1.400	2.470		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	1.420	2.450		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	1.440	2.430		Intake factor, F (Select correct end condition)	0.336	
	10.00	1.450	2.420		Variable Head, H¹	3.500	m
	12.00	1.480	2.390		Time, T¹	0.000	min
	15.00	1.530	2.340		Variable Head, H²	2.080	m
	20.00	1.600	2.270		Time, T²	60.000	min
	40.00	1.690	2.180	K unsat (m/s)	5.28E-05		
	60.00	1.790	2.080				
				RULES	1. A borehole location MUST be entered to generate <i>k</i> . 2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet. 3. Head is measured to the base of the BH, or use WL if higher. 4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole.</u> 5. If groundwater level is below test, k is not true permeability, but indicative only. 6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times. 7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		

Window Sample Hole Falling Head Test

DS05

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	2.020	m
	0.00	0.150	1.870		Casing Depth	0.000	m
	0.50	0.210	1.810		Difference in Length between bottom of casing/boreholes, L	2.020	m
	1.00	0.250	1.770		Water Depth	1.580	m
	1.50	0.280	1.740		Casing Diameter, D	0.051	m
	2.00	0.330	1.690		Cross Sectional area of casing, A	0.002	m²
	2.50	0.360	1.660		Height of casing above ground level	0.000	m
	3.00	0.390	1.630		Approximate long term water table (or base of BH see rules)	2.020	m
	3.50	0.410	1.610		Borehole End Condition (important to get right)	d	
	4.00	0.440	1.580		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	0.460	1.560		b= Soil flush with bottom in uniform soil	0.140	
	5.00	0.480	1.540		c= Well point or hole extended at impervious boundary	2.774	
	6.00	0.520	1.500		d= Well point or hole extended in uniform soil	0.325	
	7.00	0.540	1.480		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	0.570	1.450		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	0.600	1.420		Intake factor, F (Select correct end condition)	0.325	
	10.00	0.620	1.400		Variable Head, H¹	1.870	m
	12.00	0.660	1.360		Time, T¹	0.000	min
	15.00	0.700	1.320		Variable Head, H²	1.220	m
	20.00	0.730	1.290		Time, T²	60.000	min
	40.00	0.780	1.240	K unsat (m/s)	4.48E-05		
	60.00	0.800	1.220				
				RULES	1. A borehole location MUST be entered to generate <i>k</i> .		
					2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet.		
					3. Head is measured to the base of the BH, or use WL if higher.		
					4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole.</u>		
					5. If groundwater level is below test, k is not true permeability, but indicative only.		
					6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times.		
					7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		



Trial Pit No.

Sheet 1 of 1

ver. 1.0

Project Name: Whitefield Fire Station

Level
(mAOD):

Date: 02/05/2023

Project No.
3866a

Location: Whitefield, Greater Manchester

Weather: Overcast

Logged By
JH

Client: Greater Manchester Combined Authority

Co-ords:

Checked By

1
2
3
4
5

Water Strike

Depth Strike (mbgl)

Remarks

No strike

Stability:

Stable

Remarks:



Trial Pit No.

Sheet 1 of 1

ver. 1.0

Project Name: Whitefield Fire Station

Level
(mAOD):

Date: 02/05/2023

Project No.
3866a

Location: Whitefield, Greater Manchester

Weather: Overcast

Logged By
JH

Client: Greater Manchester Combined Authority

Co-ords:

Checked By

1
2
3
4
5

Water Strike

Depth Strike (mbgl)

Remarks

No strike

Stability:

Frequent moderate collapses

Remarks:

APPENDIX 6

GEOTECHNICAL LABORATORY TEST RESULTS

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

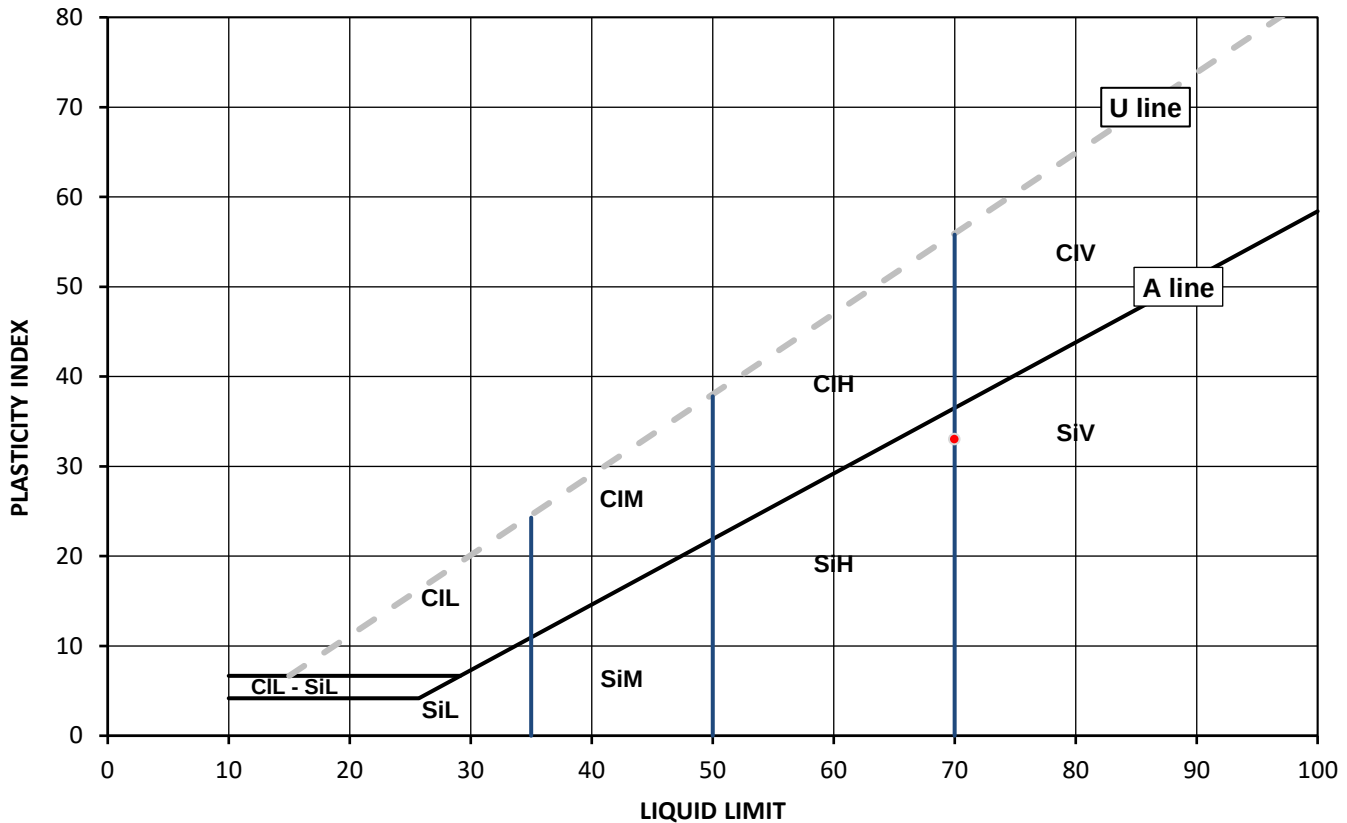
Test Results:

Laboratory Reference: 2543257
Hole No.: DS01
Sample Reference: Not Given
Sample Description: Grey slightly gravelly silty CLAY

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
71	70	37	33	99



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

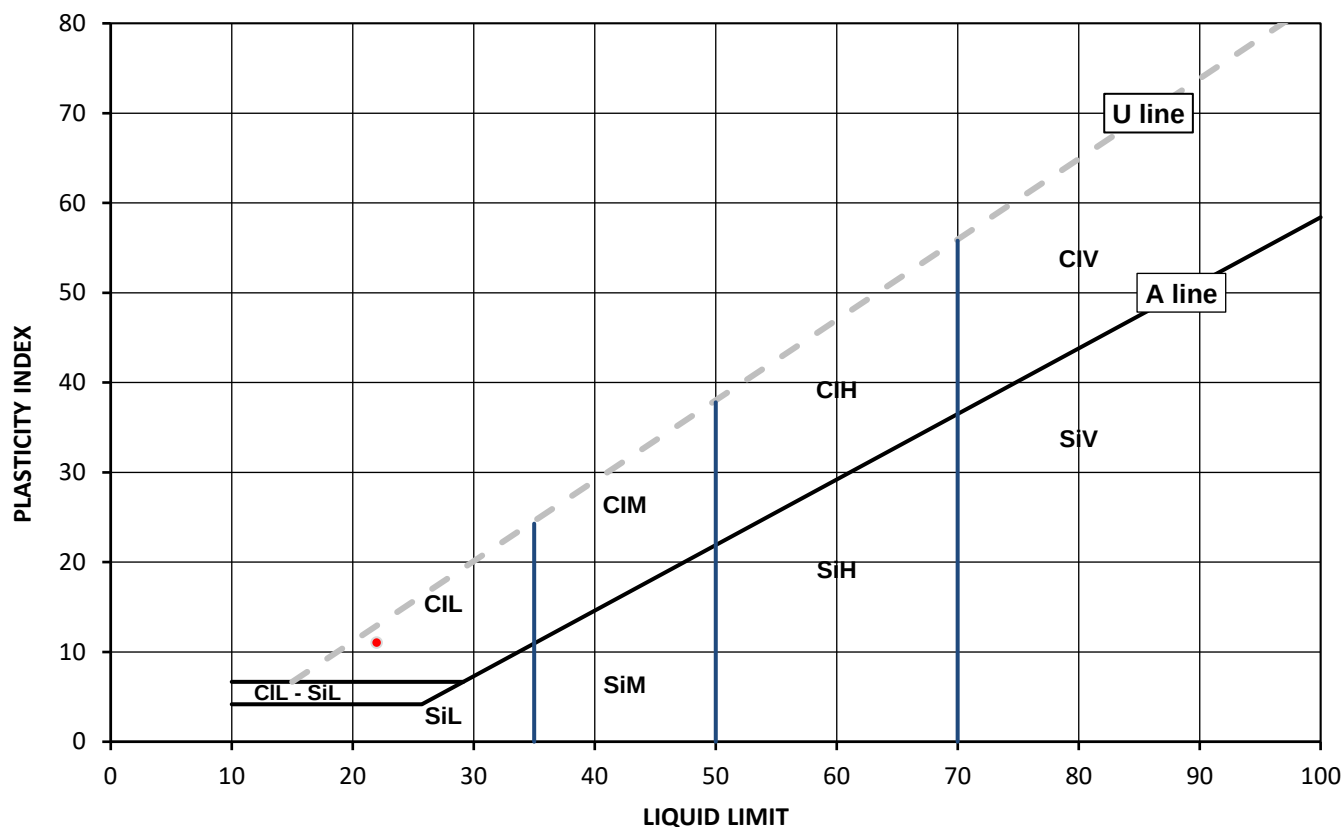
Test Results:

Laboratory Reference: 2543258
Hole No.: DS01
Sample Reference: Not Given
Sample Description: Brown slightly gravelly clayey SAND

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
14	22	11	11	90



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
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Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

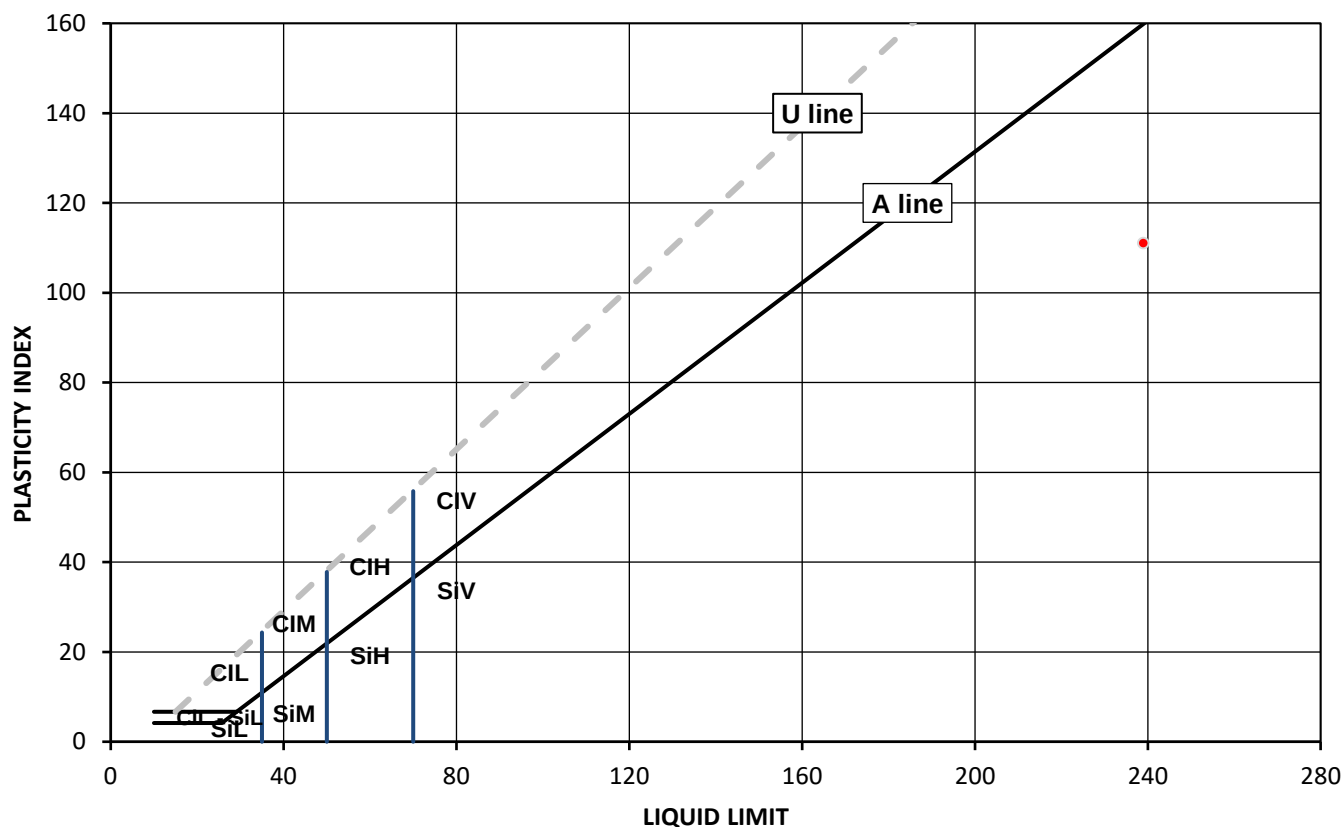
Test Results:

Laboratory Reference: 2543259
Hole No.: DS02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly PEAT

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
286	239	128	111	95



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

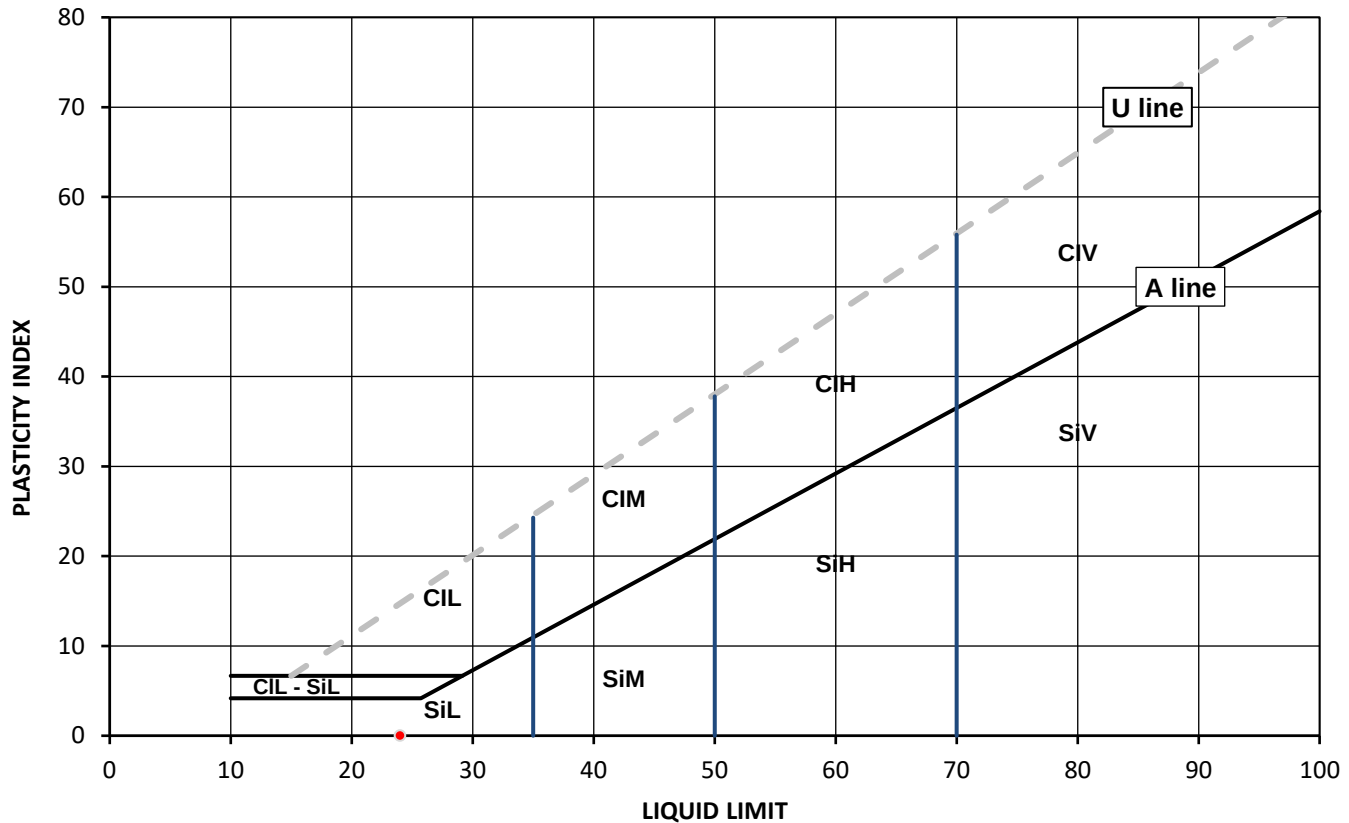
Test Results:

Laboratory Reference: 2543260
Hole No.: DS02
Sample Reference: Not Given
Sample Description: Brownish grey slightly gravelly slightly clayey SAND

Depth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	24	NP	NP	67



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

CI	Clay	Plasticity	Liquid Limit
Si	Silt	L	below 35
		M	35 to 50
		H	50 to 70
		V	exceeding 70
		O	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ

Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

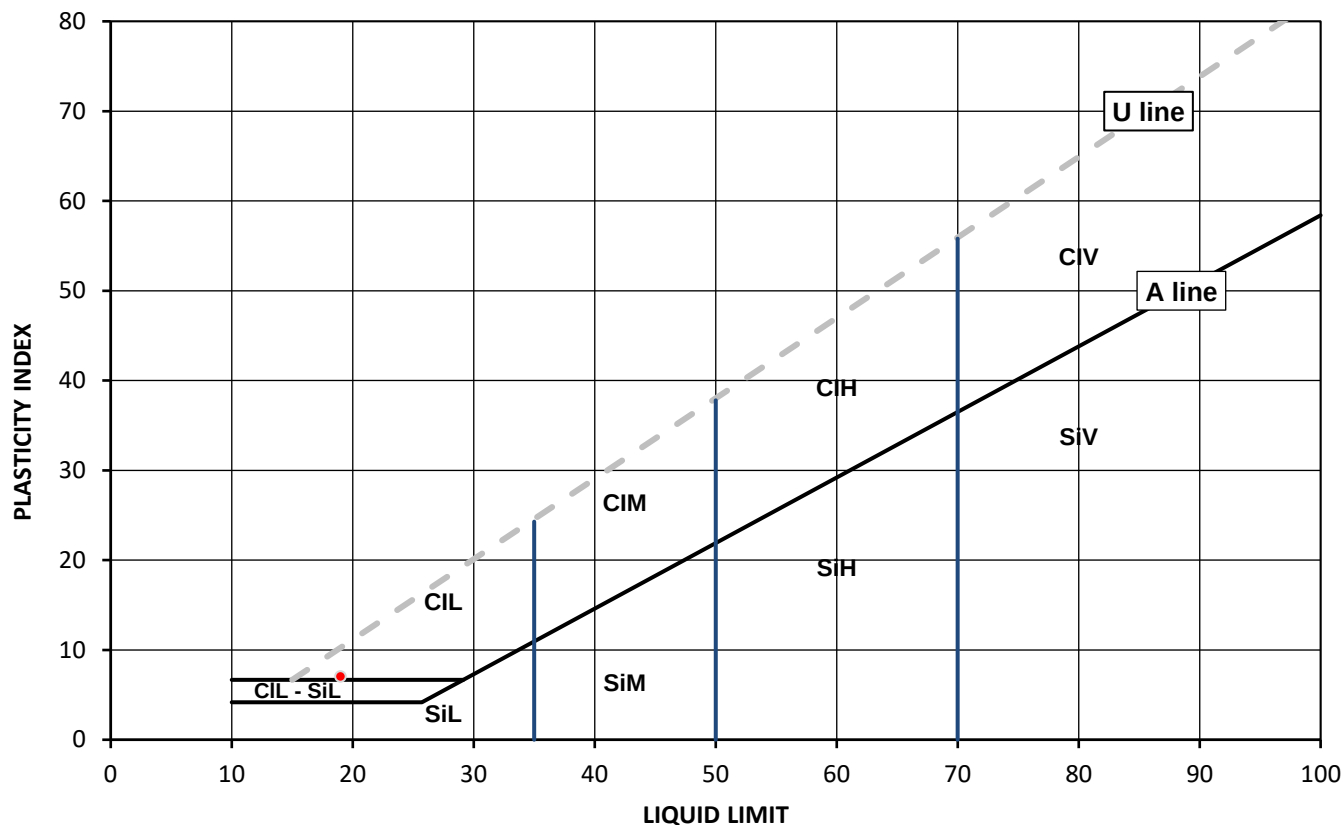
Test Results:

Laboratory Reference: 2543261
Hole No.: DS04
Sample Reference: Not Given
Sample Description: Brown slightly gravelly slightly clayey SAND

Depth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
16	19	12	7	88



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 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

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



4041

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Water Content by BS 1377-2:1990: Clause 3.2; Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2:
1990: Clause 8.2

Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

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

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL	Wp	Ip	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2543257	DS01	Not Given	2.00	Not Given	D	Grey slightly gravelly silty CLAY	Atterberg 1 Point	71		99	70	37	33						
2543258	DS01	Not Given	5.00	Not Given	D	Brown slightly gravelly clayey SAND	Atterberg 1 Point	14		90	22	11	11						
2543259	DS02	Not Given	2.00	Not Given	D	Brown slightly gravelly PEAT	Atterberg 1 Point	286		95	239	128	111						
2543260	DS02	Not Given	3.00	Not Given	D	Brownish grey slightly gravelly slightly clayey SAND	Atterberg 1 Point	18		67	24	NP	NP						
2543261	DS04	Not Given	3.00	Not Given	D	Brown slightly gravelly slightly clayey SAND	Atterberg 1 Point	16		88	19	12	7						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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4041

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M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

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

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

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



Client Reference: 3866A
Job Number: 22-14842
Date Sampled: Not Given
Date Received: 16/12/2022
Date Tested: 10/01/2023
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2543257	DS01	Not Given	2.00	Not Given	D	Grey slightly gravelly silty CLAY		71	Sample was quartered, oven dried at 106.1 °C			
2543258	DS01	Not Given	5.00	Not Given	D	Brown slightly gravelly clayey SAND		14	Sample was quartered, oven dried at 106.1 °C			
2543259	DS02	Not Given	2.00	Not Given	D	Brown slightly gravelly PEAT		286	Sample was quartered, oven dried at 106.1 °C			
2543260	DS02	Not Given	3.00	Not Given	D	Brownish grey slightly gravelly slightly clayey SAND		18	Sample was quartered, oven dried at 106.1 °C			
2543261	DS04	Not Given	3.00	Not Given	D	Brown slightly gravelly slightly clayey SAND		16	Sample was quartered, oven dried at 106.1 °C			

Comments:

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Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

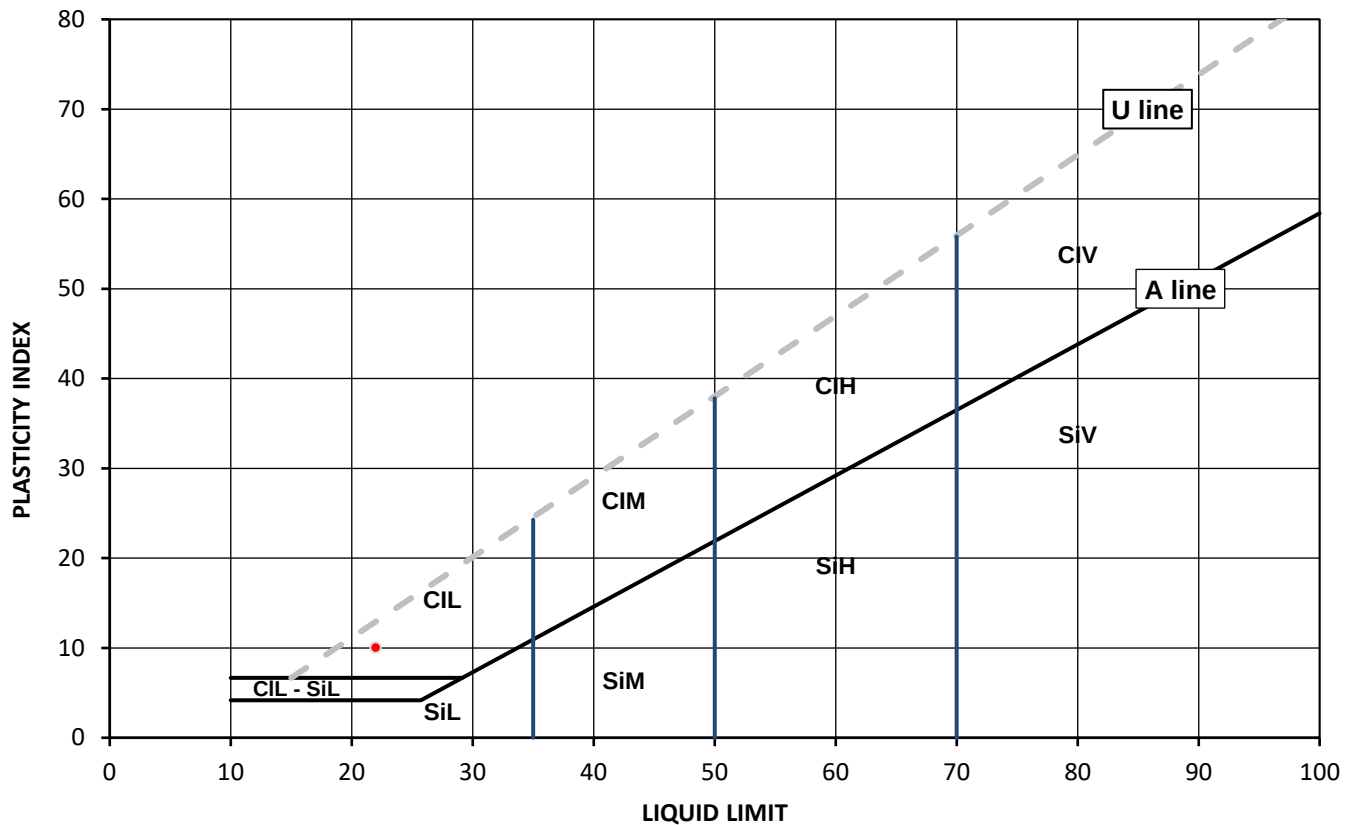
Test Results:

Laboratory Reference: 2579354
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brownish grey slightly gravelly clayey SAND

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	22	12	10	94



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

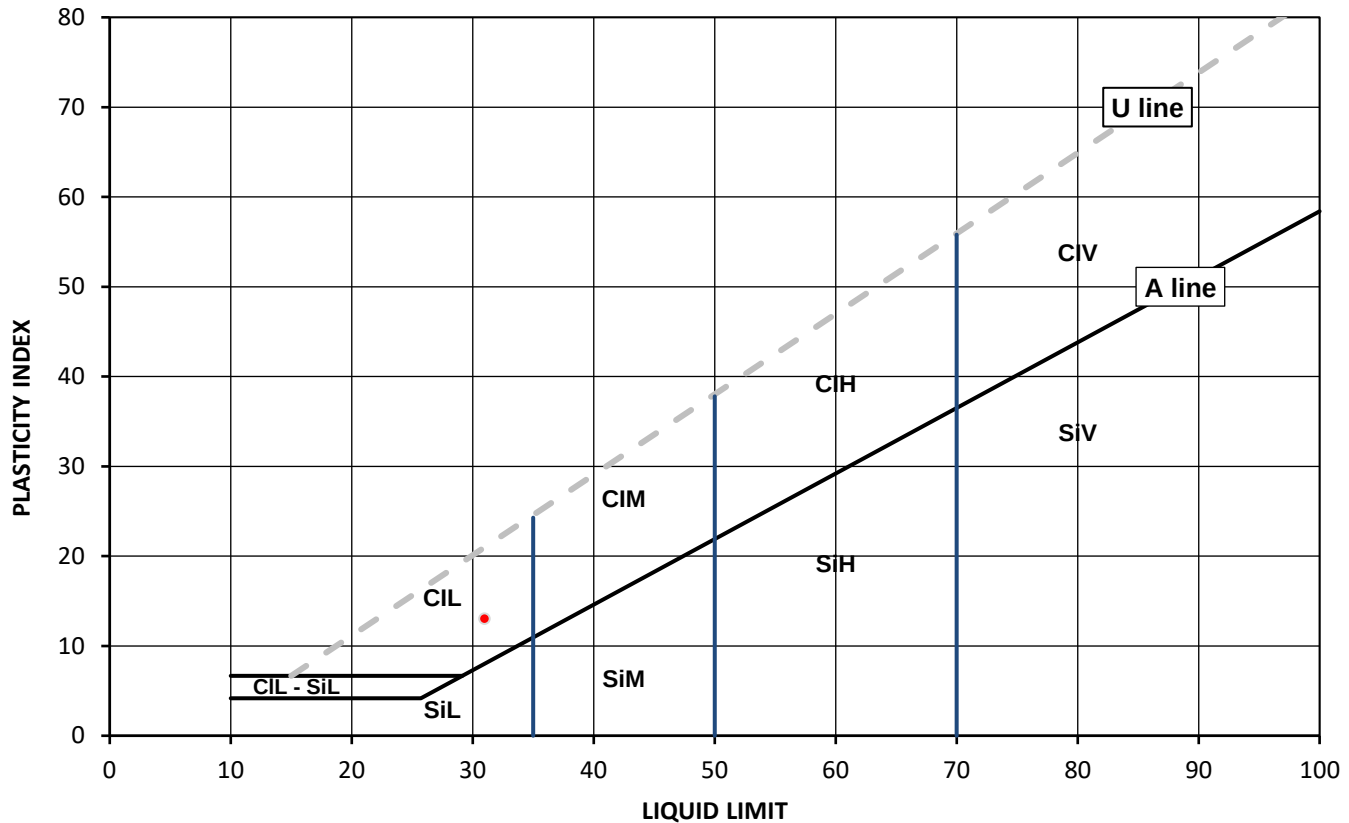
Test Results:

Laboratory Reference: 2579356
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 10.50
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
25	31	18	13	99



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

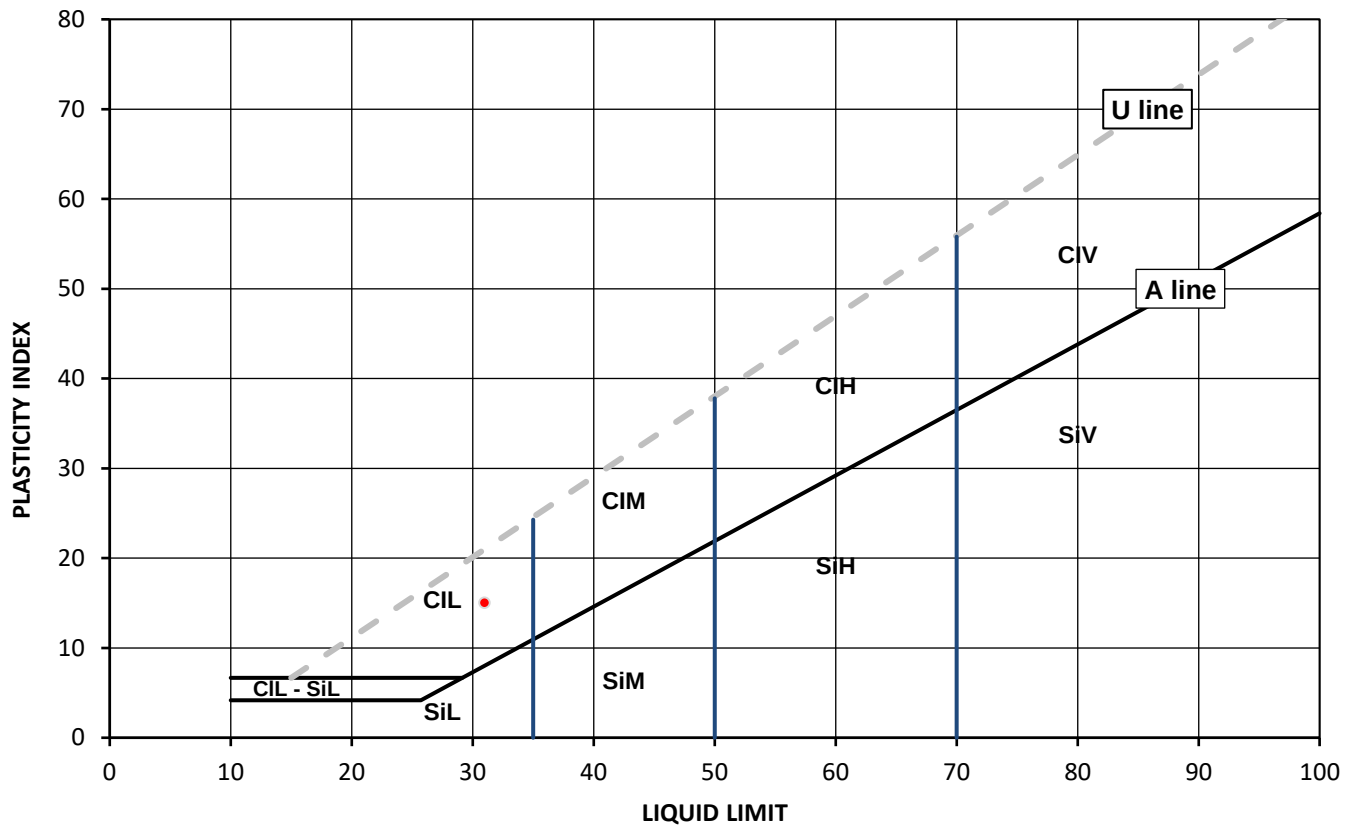
Test Results:

Laboratory Reference: 2579357
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 16.50
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
16	31	16	15	98



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
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Brackmills Industrial Estate
Northampton NN4 7EB

Client: IGE Consulting
Client Address: Office 11, Bartle House,
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Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

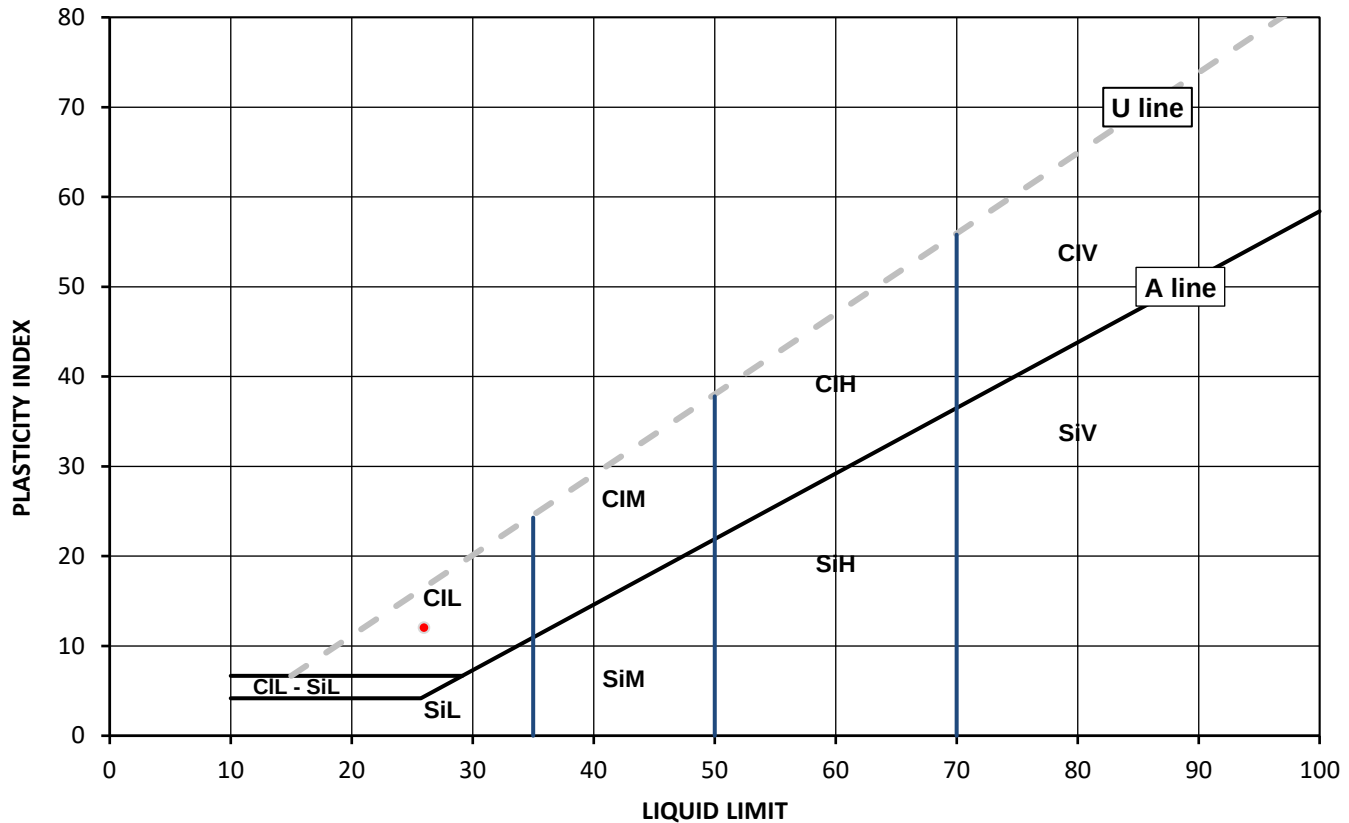
Test Results:

Laboratory Reference: 2579358
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 18.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	26	14	12	90



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 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

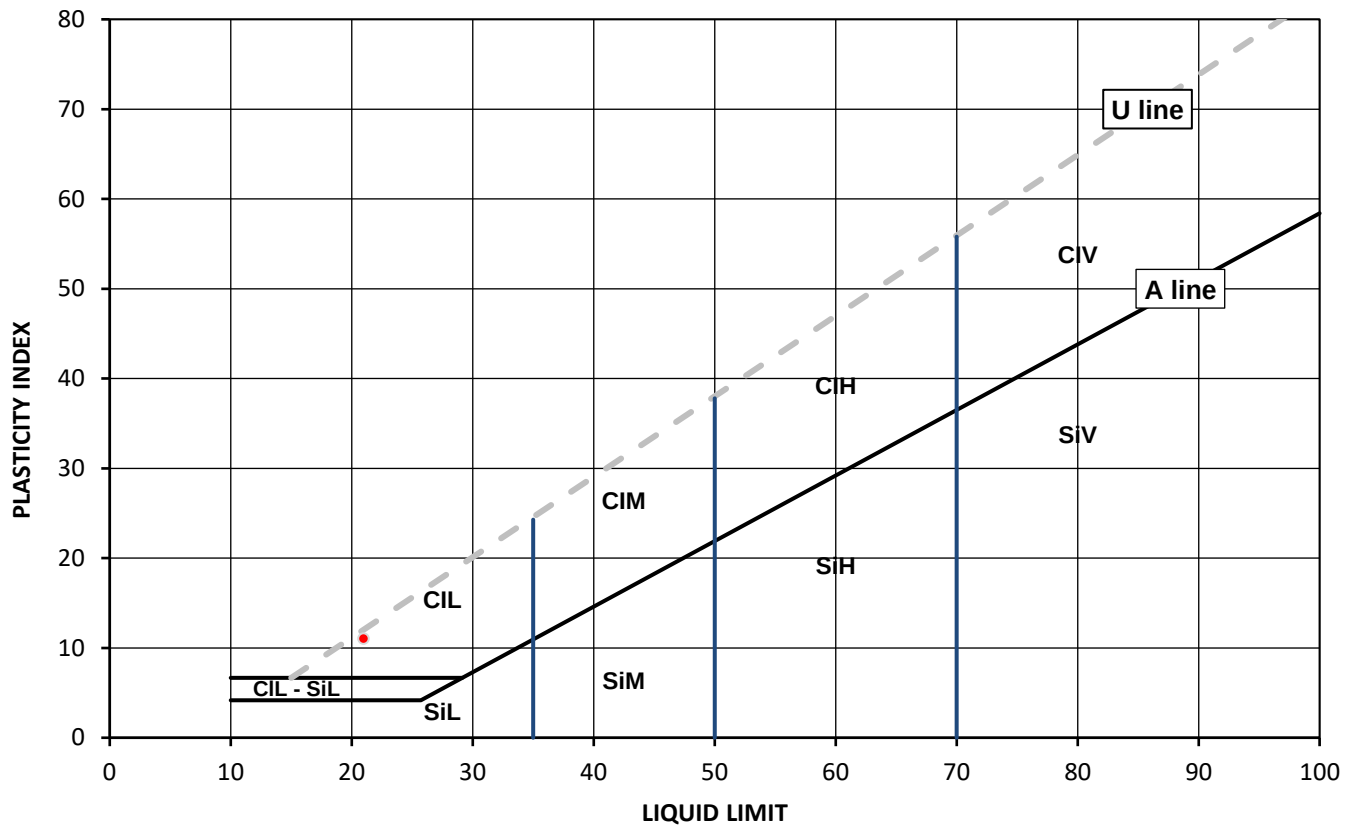
Test Results:

Laboratory Reference: 2579359
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Brown slightly gravelly clayey SAND

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: U

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
12	21	10	11	84



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

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

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

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



4041

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Water Content by BS 1377-2:1990: Clause 3.2
Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02 - 17/02/2023
Sampled By: Client - LM

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

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um %	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2579354	BH03	Not Given	5.00	Not Given	D	Brownish grey slightly gravelly clayey SAND	Atterberg 1 Point	15		94	22	12	10						
2579356	BH03	Not Given	10.50	Not Given	U	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	25		99	31	18	13						
2579357	BH03	Not Given	16.50	Not Given	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	16		98	31	16	15						
2579358	BH03	Not Given	18.00	Not Given	U	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	15		90	26	14	12						
2579359	BH04	Not Given	5.00	Not Given	U	Brown slightly gravelly clayey SAND	Atterberg 1 Point	12		84	21	10	11						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Katarzyna Koziel

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Reporting Specialist
for and on behalf of i2 Analytical Ltd

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4041

Client: IGE Consulting
Client Address: Office 11, Bartle House,
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M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

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

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

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



Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02 - 17/02/2023
Sampled By: Client - LM

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2579354	BH03	Not Given	5.00	Not Given	D	Brownish grey slightly gravelly clayey SAND		15	Sample was quartered, oven dried at 106.6 °C			
2579356	BH03	Not Given	10.50	Not Given	U	Brown slightly gravelly very sandy CLAY		25	Sample was quartered, oven dried at 106.1 °C			
2579357	BH03	Not Given	16.50	Not Given	D	Brown slightly gravelly very sandy CLAY		16	Sample was quartered, oven dried at 106 °C			
2579358	BH03	Not Given	18.00	Not Given	U	Brown slightly gravelly very sandy CLAY		15	Sample was quartered, oven dried at 106.1 °C			
2579359	BH04	Not Given	5.00	Not Given	U	Brown slightly gravelly clayey SAND		12	Sample was quartered, oven dried at 106.1 °C			

Comments:

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Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

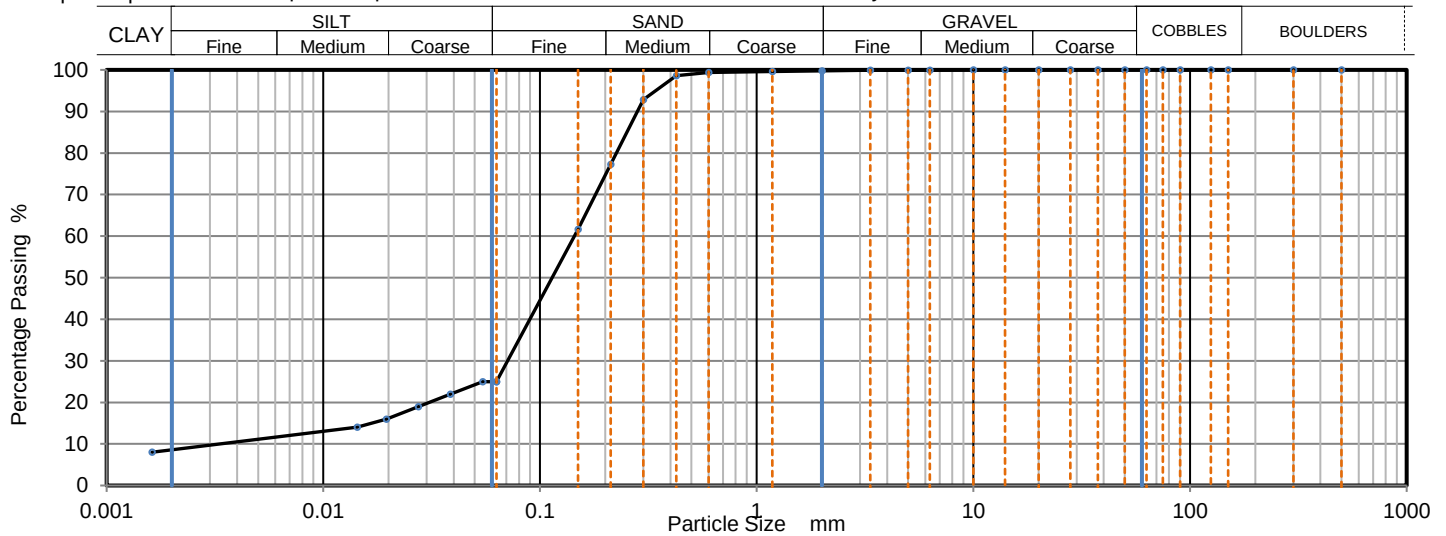
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

Test Results:

Laboratory Reference: 2579355
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 6.00
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0630	25
300	100	0.0543	25
150	100	0.0386	22
125	100	0.0274	19
90	100	0.0195	16
75	100	0.0143	14
63	100	0.0016	8
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100	Particle density (assumed) 2.65 Mg/m3	
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	93		
0.212	77		
0.15	62		
0.063	25		

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	75
Silt	16
Clay	9

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	44
Curvature Coefficient	11

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

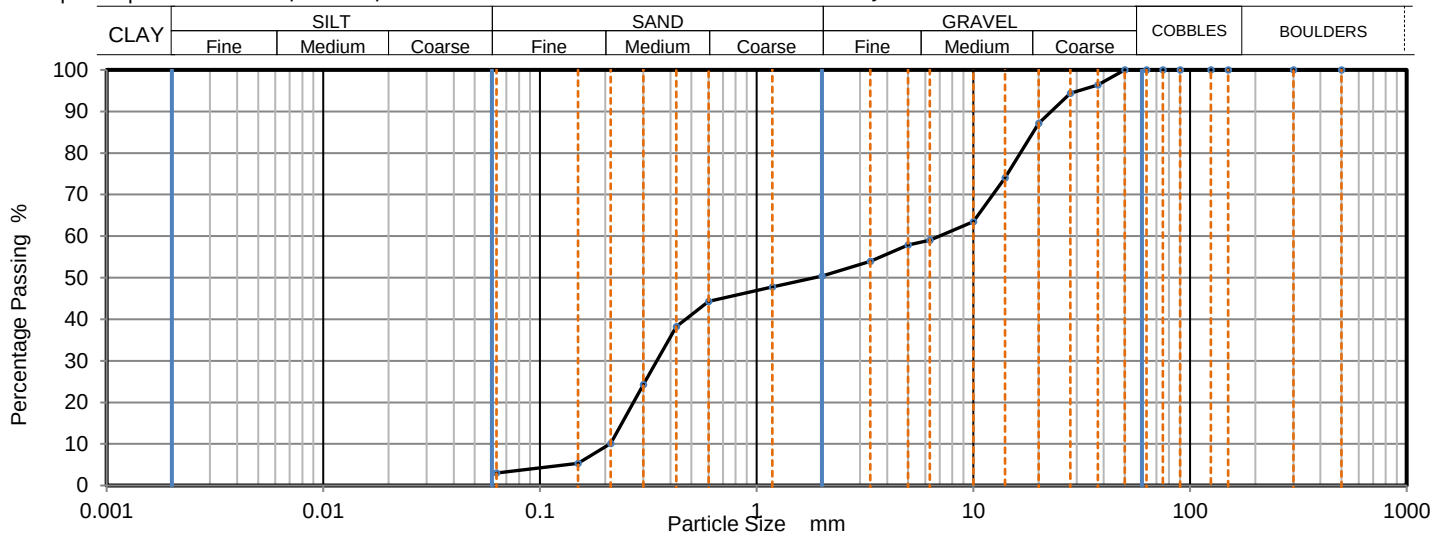
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

Test Results:

Laboratory Reference: 2579360
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Brownish grey sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 108.8 °C and broken down by hand.

Depth Top [m]: 7.50
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	94		
20	87		
14	74		
10	64		
6.3	59		
5	58		
3.35	54		
2	50		
1.18	48		
0.6	44		
0.425	38		
0.3	24		
0.212	10		
0.15	5		
0.063	3		

Sample Proportions	% dry mass
Very coarse	0
Gravel	50
Sand	47
Fines <0.063mm	3

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

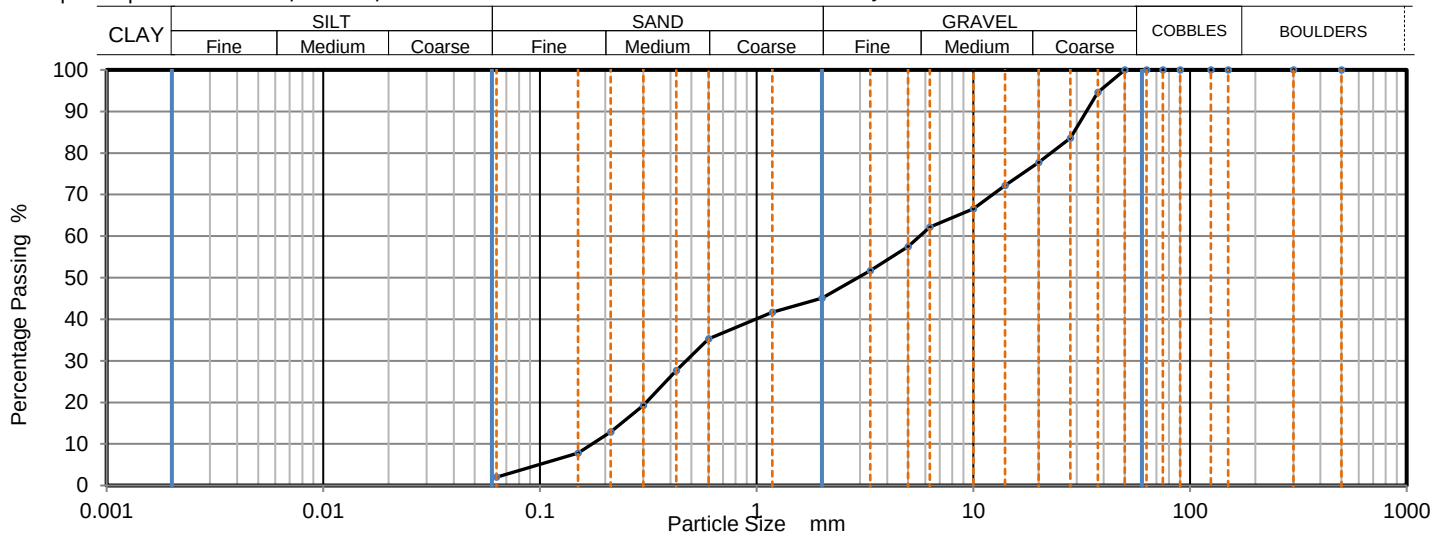
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

Test Results:

Laboratory Reference: 2579361
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Brownish grey sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 106.6 °C and broken down by hand.

Depth Top [m]: 12.00
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	84		
20	78		
14	72		
10	67		
6.3	62		
5	58		
3.35	52		
2	45		
1.18	42		
0.6	35		
0.425	28		
0.3	19		
0.212	13		
0.15	8		
0.063	3		

Sample Proportions	% dry mass
Very coarse	0
Gravel	55
Sand	42
Fines <0.063mm	3

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

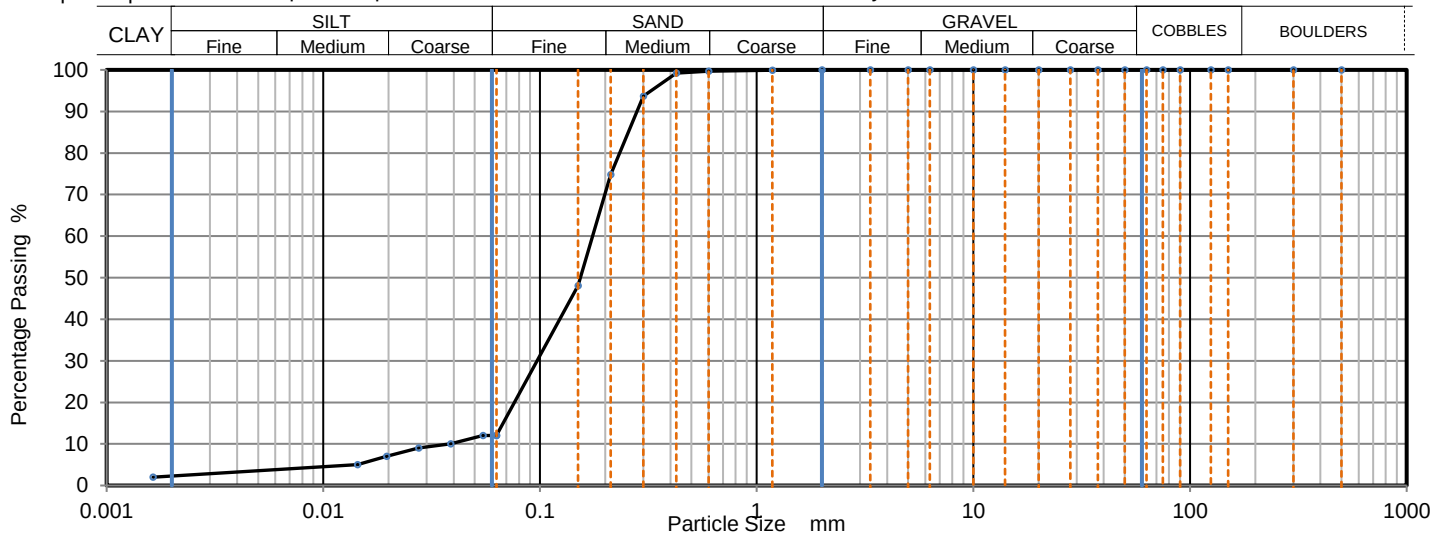
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

Test Results:

Laboratory Reference: 2579362
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Brown SAND
Sample Preparation: Sample was quartered, oven dried at 106.6 °C and broken down by hand.

Depth Top [m]: 15.00
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0630	12
300	100	0.0545	12
150	100	0.0387	10
125	100	0.0275	9
90	100	0.0196	7
75	100	0.0144	5
63	100	0.0016	2
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100	Particle density (assumed) 2.65 Mg/m3	
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	94		
0.212	75		
0.15	48		
0.063	12		

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	88
Silt	10
Clay	2

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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

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

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
Oxford Court, Manchester,
M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

Test Results:

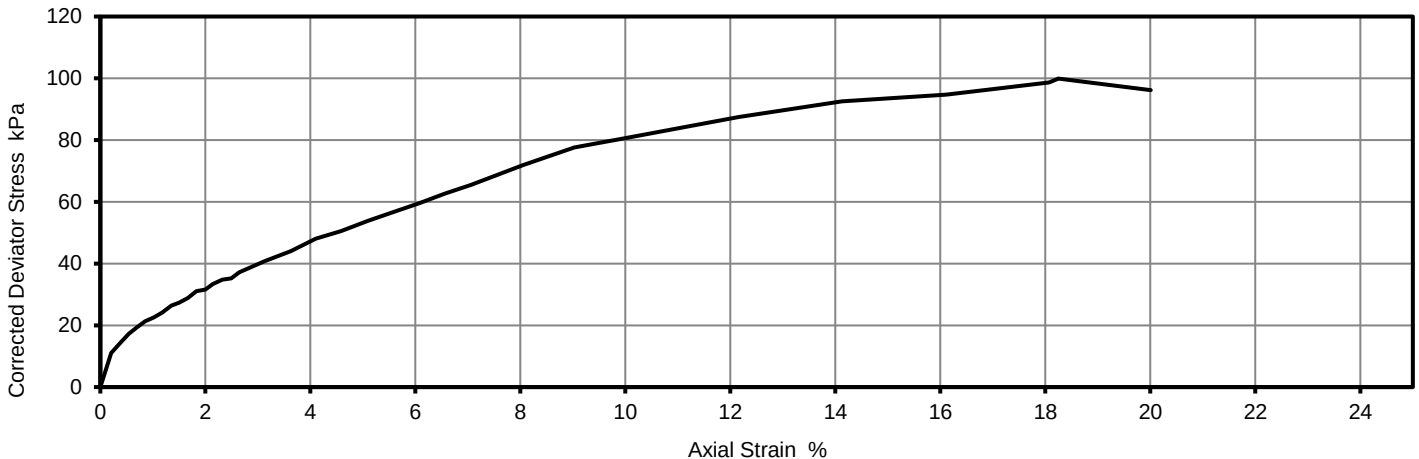
Laboratory Reference: 2579356
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

Depth Top [m]: 10.50
Depth Base [m]: Not Given
Sample Type: U

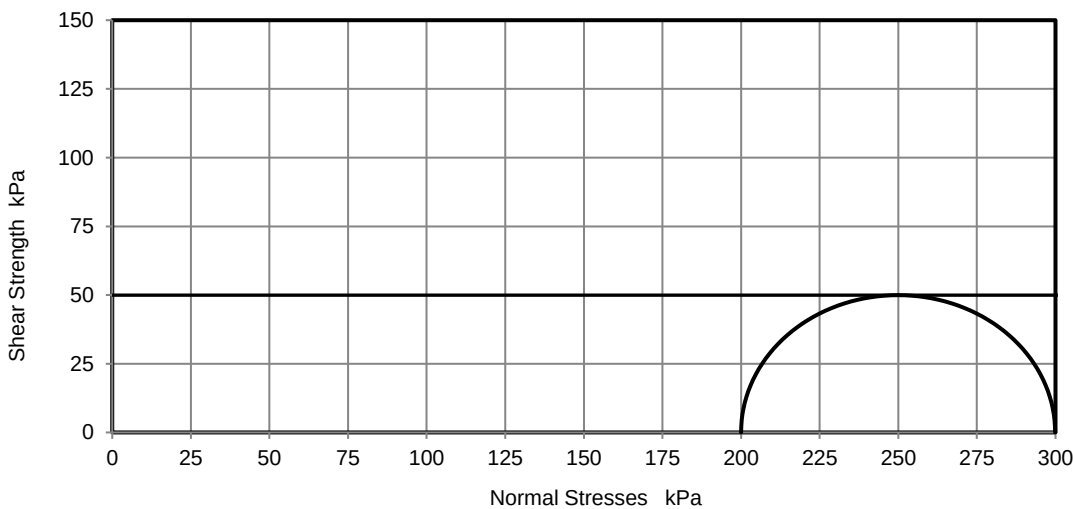
Test Number	1
Length	140.85 mm
Diameter	69.54 mm
Bulk Density	2.00 Mg/m ³
Moisture Content	25 %
Dry Density	1.59 Mg/m ³
Membrane Correction	1.28 kPa

Rate of Strain	2.00 %/min
Cell Pressure	200 kPa
Axial Strain at failure	18.2 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	100 kPa
Undrained Shear Strength, c_u	50 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Latex membrane thickness	0.25 mm

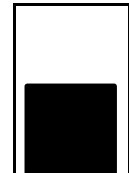
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



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

Remarks:

Signed:

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Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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

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

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

Client: IGE Consulting
Client Address: Office 11, Bartle House,
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M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

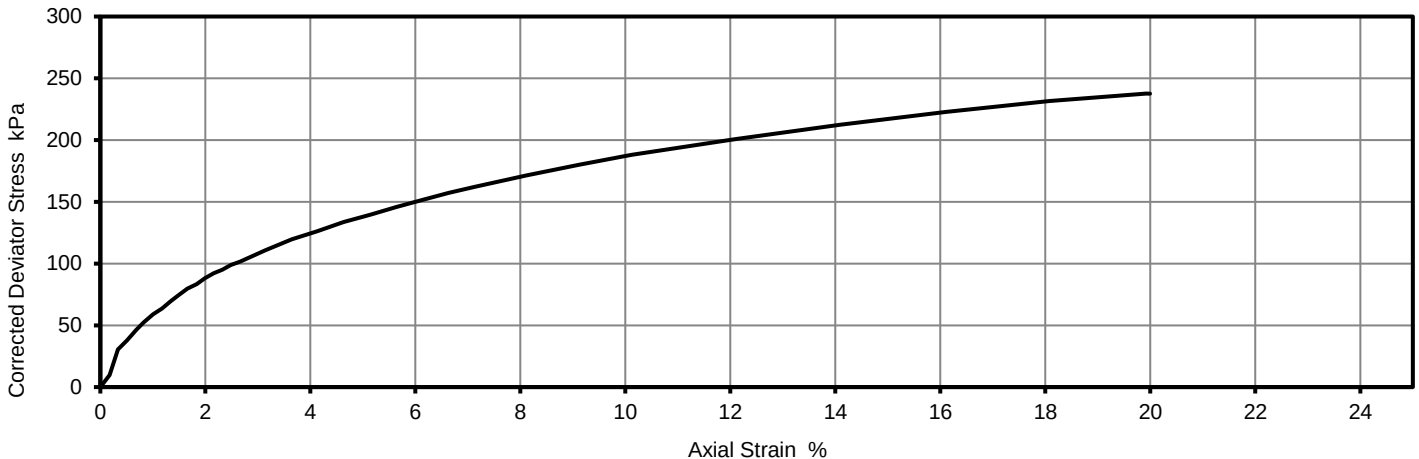
Test Results:

Laboratory Reference: 2579358
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

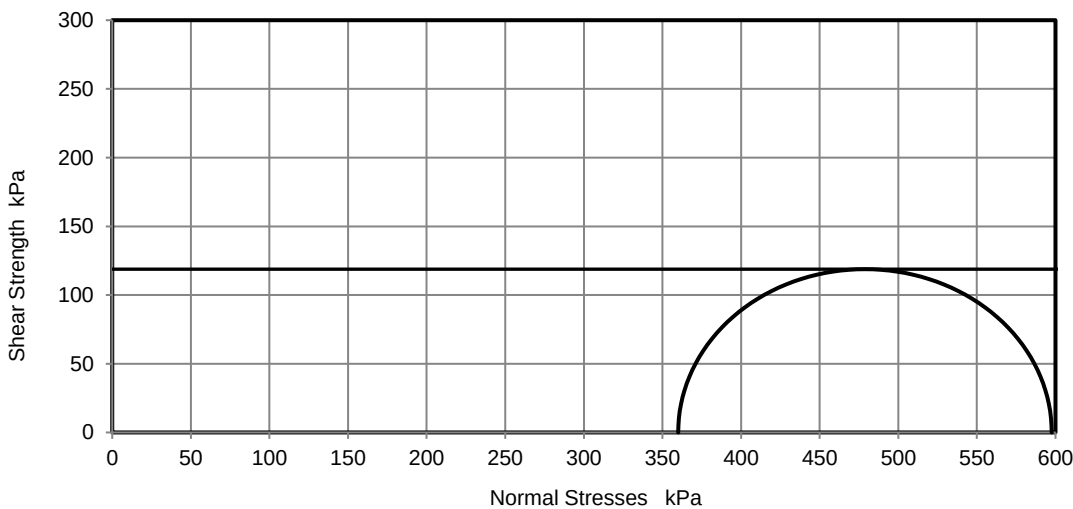
Depth Top [m]: 18.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1	Rate of Strain	2.00	%/min
Length	139.55	Cell Pressure	360	kPa
Diameter	69.87	Axial Strain at failure	19.9	%
Bulk Density	2.21	Deviator Stress, ($\sigma_1 - \sigma_3$) _f	238	kPa
Moisture Content	15	Undrained Shear Strength, c_u	119	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Dry Density	1.93	Mode of Failure	Compound	
Membrane Correction	1.37	Latex membrane thickness	0.25	mm

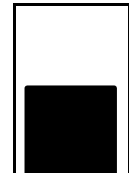
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



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

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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i2 Analytical Ltd
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Tested in Accordance with: BS 1377-7: 1990: Clause 8

Client: IGE Consulting
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M2 3WQ
Contact: Liam McMahon
Site Address: Whitefield Fire Station

Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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

Test Results:

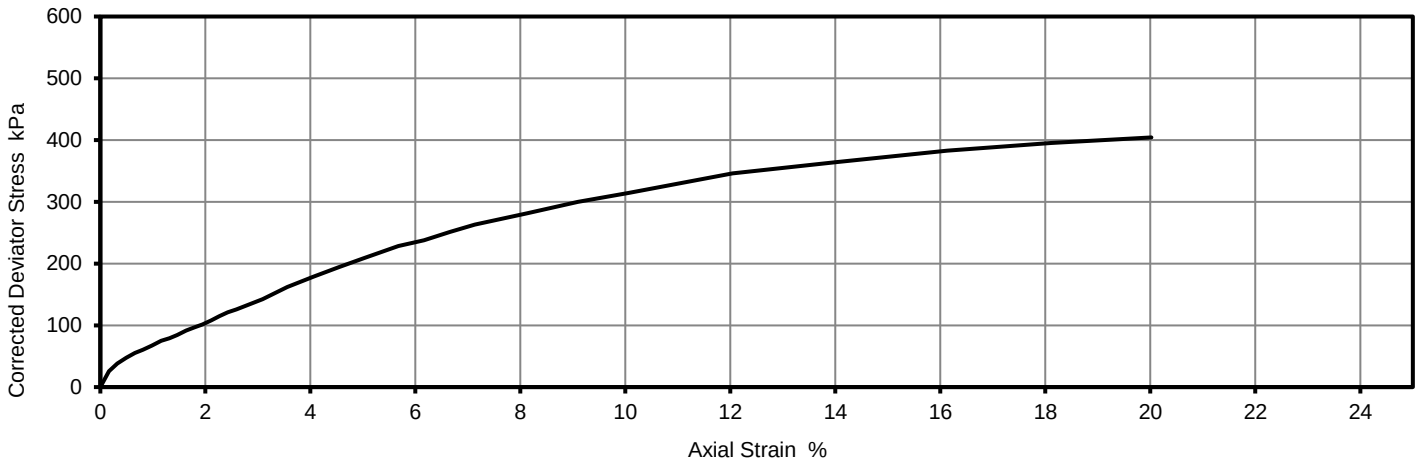
Laboratory Reference: 2579359
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Brown slightly gravelly clayey SAND
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: U

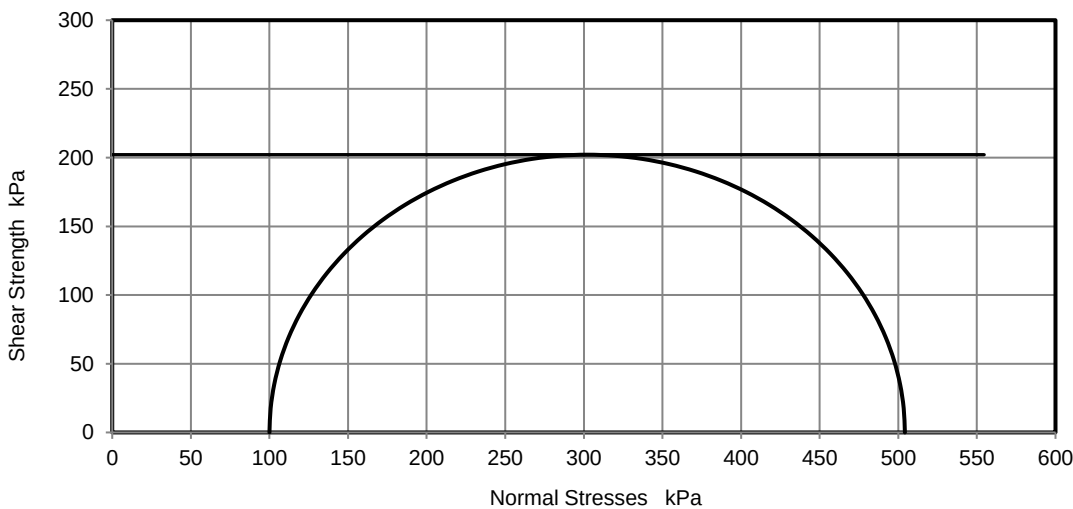
Test Number	1
Length	141.51 mm
Diameter	68.84 mm
Bulk Density	2.29 Mg/m ³
Moisture Content	12 %
Dry Density	2.04 Mg/m ³
Membrane Correction	1.34 kPa

Rate of Strain	2.00 %/min
Cell Pressure	100 kPa
Axial Strain at failure	20.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	404 kPa
Undrained Shear Strength, c_u	202 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Latex membrane thickness	0.24 mm

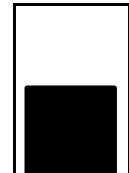
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



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

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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APPENDIX 7

CHEMICAL LABORATORY RESULTS

Liam McMahon
IGE Consulting
Office 11
Bartle House
Oxford Court
Manchester
M2 3WQ

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

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

e: liammcmahon@igeconsulting.co.uk

Analytical Report Number : 22-14159

Project / Site name:	Whitefield Fire Station	Samples received on:	16/12/2022
Your job number:	3866A	Samples instructed on/ Analysis started on:	20/12/2022
Your order number:	3866A 201222	Analysis completed by:	05/01/2023
Report Issue Number:	1	Report issued on:	06/01/2023
Samples Analysed:	11 soil samples		


Signed:

Anna Goc
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

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

Analytical Report Number: 22-14159
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A 201222

Lab Sample Number				2539266	2539267	2539268	2539269	2539270
Sample Reference				DS01	DS01	DS02	DS02	DS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.50	0.50	1.00	1.20
Date Sampled				15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	77	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.5	25	10	28	27
Total mass of sample received	kg	0.001	NONE	0.9	0.9	1	1	1

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.6	6.8	10.1	7.3	7.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	20	28	180	96	110
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.01	0.014	0.092	0.048	0.055
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	10.2	13.8	92.1	48.1	55.2
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	-	-	-	-	-
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	0.3	3	0.7	11	12
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	3	13	< 2.0	3.5	26
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	< 5.0	6.2	< 5.0	< 5.0	13

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.7	0.37
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.07
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	7.7	0.72
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	5.9	0.69
Phenanthrene	mg/kg	0.05	MCERTS	0.09	< 0.05	0.34	38	4.7
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.06*	11*	1.2*
Fluoranthene	mg/kg	0.05	MCERTS	0.17	< 0.05	0.65*	47*	6.3*
Pyrene	mg/kg	0.05	MCERTS	0.16	< 0.05	0.66*	43*	6.2*
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.35	25	3.1
Chrysene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.31*	22*	2.7*
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.07*	< 0.05	0.51*	27*	3.5*
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	0.14	9.5	1.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.06	< 0.05	0.35	21	2.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.24	9.4	1.3
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	3	0.36
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.21	11	1.6

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	3.82	282	36.5
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Analytical Report Number: 22-14159
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A 201222

Lab Sample Number				2539266	2539267	2539268	2539269	2539270
Sample Reference				DS01	DS01	DS02	DS02	DS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.50	0.50	1.00	1.20
Date Sampled				15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	1.9	3	2.6	34	14
Barium (aqua regia extractable)	mg/kg	1	MCERTS	73	50	63	180	110
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.4	0.7	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	6.8	7.5	8.1	21	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	8.2	11	11	88	40
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.7	6.3	15	210	78
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	1.2	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	7	9.2	7.9	27	16
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	7.9	8.7	11	46	23
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	36	21	36	180	83

Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH C10 - C40 EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	12	210	120
TPH2 (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH C6 - C40 EH_CU+HS_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	12	210	120
TPH (C10 - C25) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	120	63
TPH (C25 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	96	61

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

*Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted and the failure justified as having no significant impact on sample data reported.

Analytical Report Number: 22-14159
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A 201222

Lab Sample Number				2539271	2539272	2539273	2539274	2539275
Sample Reference				DS03	DS04	DS04	DS01	DS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	0.50	1.50	3.00	3.00
Date Sampled				15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	13	17	24	37	11
Total mass of sample received	kg	0.001	NONE	1	1	1	0.6	0.6

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	7	7.2	6.5	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	0.034	0.007
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	31	180	45	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.091	0.023	0.03	0.0087
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	15.6	91.2	22.5	30.2	8.7
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	20	12
Total Sulphur	%	0.005	MCERTS	-	-	-	0.059	0.084
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	-	-	-	14	10
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	1.42	1
Organic Matter (automated)	%	0.1	MCERTS	1.9	6.1	2.1	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	12	2.5	30	-	-
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	6	< 5.0	15	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.27	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.95	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.26	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.43	< 0.05	-	-
Phenanthrene	mg/kg	0.05	MCERTS	0.27	4.2	< 0.05	-	-
Anthracene	mg/kg	0.05	MCERTS	0.05*	1.6*	< 0.05	-	-
Fluoranthene	mg/kg	0.05	MCERTS	0.14*	11*	< 0.05	-	-
Pyrene	mg/kg	0.05	MCERTS	0.21*	11*	< 0.05	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.07	6.9	< 0.05	-	-
Chrysene	mg/kg	0.05	MCERTS	0.11*	5*	< 0.05	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.09*	7.7*	< 0.05	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	2.9	< 0.05	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.06	5.8	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	2.7	< 0.05	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.72	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	3	< 0.05	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1	64.3	< 0.80	-	-
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Analytical Report Number: 22-14159
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A 201222

Lab Sample Number				2539271	2539272	2539273	2539274	2539275
Sample Reference				DS03	DS04	DS04	DS01	DS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	0.50	1.50	3.00	3.00
Date Sampled				15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.3	32	1.3	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	59	180	19	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	0.3	0.3	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	25	7	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19	140	7.9	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	11	310	5	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.7	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	31	5.8	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	18	41	7.9	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	45	210	17	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	12	12
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	6	5.8
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	-	-
TPH C10 - C40 EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	84	< 10	-	-
TPH2 (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	-	-
TPH C6 - C40 EH_CU+HS_CU_ID_TOTAL	mg/kg	10	NONE	< 10	84	< 10	-	-
TPH (C10 - C25) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	38	< 10	-	-
TPH (C25 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	45	< 10	-	-

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

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Analytical Report Number: 22-14159
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A 201222

Lab Sample Number				2539276
Sample Reference				DS02
Sample Number				None Supplied
Depth (m)				5.00
Date Sampled				15/12/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	14
Total mass of sample received	kg	0.001	NONE	0.6

Asbestos in Soil	Type	N/A	ISO 17025	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3
Total Cyanide	mg/kg	1	MCERTS	-
Free Cyanide	mg/kg	1	MCERTS	-
Total Sulphate as SO ₄	%	0.005	MCERTS	0.006
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.01
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	10.4
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	51
Total Sulphur	%	0.005	MCERTS	0.01
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	8.1
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	0.81
Organic Matter (automated)	%	0.1	MCERTS	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	-
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	-

Speciated PAHs

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

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	-
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Analytical Report Number: 22-14159
Project / Site name: Whitefield Fire Station
Your Order No: 3866A 201222

Lab Sample Number	2539276
Sample Reference	DS02
Sample Number	None Supplied
Depth (m)	5.00
Date Sampled	15/12/2022
Time Taken	None Supplied

Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-
Chromium (hexavalent)	mg/kg	1.2	NONE	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-

Magnesium (water soluble)	mg/kg	5	NONE	9.2
Magnesium (leachate equivalent)	mg/l	2.5	NONE	4.6

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	-
TPH C10 - C40 EH_CU_ID_TOTAL	mg/kg	10	MCERTS	-
TPH2 (C6 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	-
TPH C6 - C40 EH_CU+HS_CU_ID_TOTAL	mg/kg	10	NONE	-
TPH (C10 - C25) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	-
TPH (C25 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	-

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

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Analytical Report Number : 22-14159

Project / Site name: Whitefield Fire Station

* 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 *
2539266	DS01	None Supplied	0.8	Brown sand with gravel and stones.
2539267	DS01	None Supplied	1.5	Brown clay and sand.
2539268	DS02	None Supplied	0.5	Brown gravelly sand.
2539269	DS02	None Supplied	1	Brown clay and sand with gravel.
2539270	DS03	None Supplied	1.2	Brown clay and loam with gravel and vegetation.
2539271	DS03	None Supplied	2	Grey clay with gravel.
2539272	DS04	None Supplied	0.5	Brown loam and sand with gravel and vegetation.
2539273	DS04	None Supplied	1.5	Brown clay.
2539274	DS01	None Supplied	3	Brown clay with gravel.
2539275	DS03	None Supplied	3	Brown clay.
2539276	DS02	None Supplied	5	Light brown sand.

Analytical Report Number : 22-14159

Project / Site name: Whitefield Fire Station

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
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
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
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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	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
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS

Analytical Report Number : 22-14159

Project / Site name: Whitefield Fire Station

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
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
TPH C6 - C40 (soil)	Determination of TPH bands by HS-GC-MS/GC-FID	TPH > C10 Dry soil n-house method with silica gel split/clean up. TPH < C10 by Wet by HS-GC-MS	L088/L076		NONE
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

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

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

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

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

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

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

Analytical Report Number : 22-14159

Project / Site name: Whitefield Fire Station

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
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				



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Analytical Report Number : 23-25397

Project / Site name:	Whitefield Fire Station	Samples received on:	27/03/2023
Your job number:	3866A	Samples instructed on/ Analysis started on:	28/03/2023
Your order number:	3866A-310323	Analysis completed by:	03/04/2023
Report Issue Number:	1	Report issued on:	03/04/2023
Samples Analysed:	1 soil sample		

Signed:

Elżbieta Suchy
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: 23-25397
Project / Site name: Whitefield Fire Station
Your Order No: 3866A-310323

Lab Sample Number				2631979
Sample Reference				HDP01
Sample Number				None Supplied
Depth (m)				0.40
Date Sampled				26/01/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	21
Total mass of sample received	kg	0.001	NONE	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001
Asbestos Analyst ID	N/A	N/A	N/A	DSA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2
Total Cyanide	mg/kg	1	MCERTS	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	68
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.034
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	34
Organic Matter (automated)	%	0.1	MCERTS	8.4
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	61
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	31

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.85
Fluorene	mg/kg	0.05	MCERTS	0.52
Phenanthrene	mg/kg	0.05	MCERTS	5.6
Anthracene	mg/kg	0.05	MCERTS	1.1
Fluoranthene	mg/kg	0.05	MCERTS	8.9
Pyrene	mg/kg	0.05	MCERTS	8.4
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.7
Chrysene	mg/kg	0.05	MCERTS	4
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	4.6
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.8
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.9
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.4

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	47.6
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Analytical Report Number: 23-25397
 Project / Site name: Whitefield Fire Station
 Your Order No: 3866A-310323

Lab Sample Number				2631979
Sample Reference				HDP01
Sample Number				None Supplied
Depth (m)				0.40
Date Sampled				26/01/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18
Barium (aqua regia extractable)	mg/kg	1	MCERTS	140
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	42
Lead (aqua regia extractable)	mg/kg	1	MCERTS	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	93

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	55
TPH2 (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1
TPH C6 - C40 EH_CU+HS_CU_1D_TOTAL	mg/kg	10	NONE	55
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	37
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	17

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



Analytical Report Number: 23-25397
Project / Site name: Whitefield Fire Station
Your Order No: 3866A-310323

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2631979	HDP01	0.40	116	Loose Fibres	Chrysotile	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 23-25397

Project / Site name: Whitefield Fire Station

* 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 *
2631979	HDP01	None Supplied	0.4	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 23-25397

Project / Site name: Whitefield Fire Station

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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	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
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

Analytical Report Number : 23-25397

Project / Site name: Whitefield Fire Station

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
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
TPH C6 - C40 (soil)	Determination of TPH bands by HS-GC-MS/GC-FID	TPH> C10 Dry soil n-house method with silica gel split/clean up. TPH <C10 by Wet by HS-GC-MS	L088/L076		NONE
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

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

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

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

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

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

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 : 23-25397

Project / Site name: Whitefield Fire Station

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.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
HDP01	None Supplied	S	2631979	c	Free cyanide in soil	L080-PL	c
HDP01	None Supplied	S	2631979	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
HDP01	None Supplied	S	2631979	c	DRO (Soil)	L076-PL	c
HDP01	None Supplied	S	2631979	c	Nitrate, water soluble, in soil	L078-PL	c
HDP01	None Supplied	S	2631979	c	Organic matter (Automated) in soil	L009-PL	c
HDP01	None Supplied	S	2631979	c	PRO (Soil)	L088-PL	c
HDP01	None Supplied	S	2631979	c	Speciated EPA-16 PAHs in soil	L064-PL	c
HDP01	None Supplied	S	2631979	c	TPH Banding in Soil by FID	L076-PL	c
HDP01	None Supplied	S	2631979	c	TPH C6 - C40 (soil)	L088/L076	c
HDP01	None Supplied	S	2631979	c	TPH Oils (Soils)	L076-PL	c
HDP01	None Supplied	S	2631979	c	TPH2 (Soil)	L088-PL	c
HDP01	None Supplied	S	2631979	c	Total cyanide in soil	L080-PL	c
HDP01	None Supplied	S	2631979	c	Water Soluble Nitrate (2:1) as N in soil	L078-PL	c
HDP01	None Supplied	S	2631979	c	Water Soluble Nitrate (leachate equivalent)	L078-PL	c
HDP01	None Supplied	S	2631979	c	pH in soil (automated)	L099-PL	c



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IGE Consulting
14-32 Hewitt Street
Manchester
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Attention: Liam McMahon

CERTIFICATE OF ANALYSIS

Date of report Generation:	24 April 2023
Customer:	IGE Consulting
Sample Delivery Group (SDG):	230407-55
Your Reference:	3866A
Location:	Whitefield Fire Station
Report No:	686655
Order Number:	3866A-060423

We received 6 samples on Friday April 07, 2023 and 6 of these samples were scheduled for analysis which was completed on Monday April 24, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager



CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
27814277	DUP A			05/04/2023
27814279	FIELD BLANK			05/04/2023
27814274	PFC 01			05/04/2023
27814275	PFC 02			05/04/2023
27814276	PFC 03			05/04/2023
27814278	SITE BLANK			05/04/2023

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Results Legend



Test



No Determination
Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			27814277	27814279	27814274	27814275	27814276	27814278
Customer Sample Reference			DUPA	FIELD BLANK	PFC 01	PFC 02	PFC 03	SITE BLANK
AGS Reference								
Depth (m)								
Container			1kg TUB with Handle (ALE260)	1kg TUB with Handle (ALE260)	1kg TUB with Handle (ALE260)	1kg TUB with Handle (ALE260)	1kg TUB with Handle (ALE260)	1kg TUB with Handle (ALE260)
Sample Type			S	UNL	S	S	S	UNL
PFAS Liquids	All	NDPs: 0 Tests: 2		X				X
PFAS Solids	All	NDPs: 0 Tests: 4	X		X	X	X	
Sample description	All	NDPs: 0 Tests: 4	X		X	X	X	



CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
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Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
27814277	DUP A		Light Brown	Loamy Sand	Stones	None
27814274	PFC 01		Dark Brown	Sand	Stones	None
27814275	PFC 02		Dark Brown	Sand	Stones	None
27814276	PFC 03		Grey	Loamy Sand	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Results Legend		Customer Sample Ref.	DUP A	FIELD BLANK	PFC 01	PFC 02	PFC 03	SITE BLANK
# ISO17025 accredited. M mCERES accredited. aq Aqueous / settled sample. diss.fltr Dissolved / filtered sample. tot.unfltr Total / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery (F) Trigger breach confirmed 1-4*§@ Sample deviation (see appendix)	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference		Soil/Solid (S) 05/04/2023 07/04/2023 230407-55 27814277	Unspecified Liquid (UNL) 05/04/2023 07/04/2023 230407-55 27814279	Soil/Solid (S) 05/04/2023 07/04/2023 230407-55 27814274	Soil/Solid (S) 05/04/2023 07/04/2023 230407-55 27814275	Soil/Solid (S) 05/04/2023 07/04/2023 230407-55 27814276	Unspecified Liquid (UNL) 05/04/2023 07/04/2023 230407-55 27814278
Component	LOD/Units		Method					
PFBA (375-22-4)	<2 ng/l		TM434		<2			<2
PFMOPrA (377-73-1)	<1 ng/l		TM434		<1			<1
3:3 FTCA (356-02-5)	<2 ng/l		TM434		<2			<2
PFFPA (2706-90-3)	<1 ng/l		TM434		<1			<1
PFMOBA (863090-89-5)	<1 ng/l		TM434		<1			<1
4:2 FTS (757124-72-4)	<1 ng/l		TM434		<1			<1
NFDHA (151772-58-6)	<3 ng/l		TM434		<3			<3
PFBS (375-73-5)	<1 ng/l	TM434		<1			<1	
PFHxA (307-24-4)	<1 ng/l	TM434		<1			<1	
HFPO-DA (13252-13-6)	<2 ng/l	TM434		<2			<2	
PFEESA (113507-82-7)	<1 ng/l	TM434		<1			<1	
PFHpA (375-85-9)	<1 ng/l	TM434		<1			<1	
PFPeS (2706-91-4)	<1 ng/l	TM434		<1			<1	
5:3 FTCA (914637-49-3)	<5 ng/l	TM434		<5			<5	
ADONA (919005-14-4)	<1 ng/l	TM434		<1			<1	
6:2 FTS (27619-97-2)	<1 ng/l	TM434		<1			<1	
FBSA (30334-69-1)	<1 ng/l	TM434		<1			<1	
PFOA (335-67-1)	<0.65 ng/l	TM434		<0.65			1.03	
PFHxS (355-46-4)	<1 ng/l	TM434		<1			<1	
PFNA (375-95-1)	<1 ng/l	TM434		<1			<1	
PFecHS (133201-07-7)	<1 ng/l	TM434		<1			<1	
PFHpS (375-92-8)	<1 ng/l	TM434		<1			<1	
8:2 FTS (39108-34-4)	<2 ng/l	TM434		<2			<2	
HFPO-TA (13252-14-7)	<5 ng/l	TM434		<5			<5	
PFDA (335-76-2)	<2 ng/l	TM434		<2			<2	
MeFOSAA (2355-31-9)	<2 ng/l	TM434		<2			<2	
7:3 FTCA (812-70-4)	<5 ng/l	TM434		<5			<5	
Linear PFOS (1763-23-1)	<0.65 ng/l	TM434		<0.65			<0.65	
Branched PFOS	<0.65 ng/l	TM434		<0.65			<0.65	
EtFOSAA (2991-50-6)	<2 ng/l	TM434		<2			<2	
PFUnA (2058-94-8)	<2 ng/l	TM434		<2			<2	
9CI-PF3ONS (756426-58-1)	<1 ng/l	TM434		<1			<1	
PFNS (68259-12-1)	<1 ng/l	TM434		<1			<1	



CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866AReport Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Results Legend		Customer Sample Ref.	DUP A	FIELD BLANK	PFC 01	PFC 02	PFC 03	SITE BLANK
# ISO17025 accredited. M mCERTS accredited. aq Aqueous / settled sample. dis.filt Dissolved / filtered sample. tot.unfilt Total / unfiltered sample. * Subcontracted - refer to subcontractor report for accreditation status. ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery (F) Trigger breach confirmed 1-4-§@ Sample deviation (see appendix)		Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	Soil/Solid (S) 05/04/2023	Unspecified Liquid (UNL) 05/04/2023	Soil/Solid (S) 05/04/2023	Soil/Solid (S) 05/04/2023	Soil/Solid (S) 05/04/2023	Unspecified Liquid (UNL) 05/04/2023
			07/04/2023 230407-55 27814277	07/04/2023 230407-55 27814279	07/04/2023 230407-55 27814274	07/04/2023 230407-55 27814275	07/04/2023 230407-55 27814276	07/04/2023 230407-55 27814278
Component	LOD/Units	Method						
FHxSA (41997-13-1)	<1 ng/l	TM434		<1				<1
PFDaA (307-55-1)	<2 ng/l	TM434		<2				<2
PFDS (335-77-3)	<2 ng/l	TM434		<2				<2
PFTrDA (72629-94-8)	<3 ng/l	TM434		<3				<3
11Cl-PF3OUdS (763051-92-9)	<2 ng/l	TM434		<2				<2
PFUnDS (749786-16-1)	<2 ng/l	TM434		<2				<2
PFTeA (376-06-7)	<1 ng/l	TM434		<1				<1
PFOSA (754-91-6)	<2 ng/l	TM434		<2				<2
PFDoS (79780-39-5)	<2 ng/l	TM434		<2				<2
PFTrDS (174675-49-1)	<1 ng/l	TM434		<1				<1
PFHxDA (67905-19-5)	<1 ng/l	TM434		<1				<1
MeFOSE (24448-09-7)	<10 ng/l	TM434		<10				<10
N-MeFOSA (31506-32-8)	<1 ng/l	TM434		<1				<1
EtFOSE (1691-99-2)	<10 ng/l	TM434		<10				<10
PFODA (16517-11-6)	<1 ng/l	TM434		<1				<1
N-EtFOSA (4151-50-2)	<1 ng/l	TM434		<1				<1
Total PFOS	<0.65 ng/l	TM434		<0.65				<0.65
Moisture Content Ratio (% of as received sample)	%	PM024	11		12	9.9	6.5	
PFBA (375-22-4) Perfluoro-n-butanoic acid	<3 µg/kg	TM338	<3		<3	<3	<3	
PFPA (2706-90-3) Perfluoro-n-pentanoic acid	<3 µg/kg	TM338	<3		<3	<3	<3	
PFHxA (307-24-4) Perfluoro-n-hexanoic acid	<2 µg/kg	TM338	<2		<2	<2	<2	
PFBS (375-73-5) Perfluoro-1-butanedisulfonate	<1 µg/kg	TM338	<1		<1	<1	<1	
PFHpA (375-85-9) Perfluoro-n-heptanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
PFOA (335-67-1) Perfluoro-n-octanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
PFHxS (355-46-4) Perfluoro-1-hexadisulfonate	<1 µg/kg	TM338	<1		<1	<1	<1	
PFNA (375-95-1) Perfluoro-n-nonanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
PFHpS (375-92-8) Perfluoro-1-heptadisulfonate	<1 µg/kg	TM338	<1		<1	<1	<1	
PFDA (335-76-2) Perfluoro-n-decanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
Linear PFOS(1763-23-1) Perfluoro-1-octadisulfonate	<1 µg/kg	TM338	<1		<1	<1	<1	
Branched PFOS	<1 µg/kg	TM338	<1		<1	<1	<1	
PFUnA (2058-94-8) Perfluoro-n-undecanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
PFDaA (307-55-1) Perfluoro-n-dodecanoic acid	<1 µg/kg	TM338	<1		<1	<1	<1	
PFOSA (754-91-6) Perfluoro-octanesulfonamide	<1 µg/kg	TM338	<1		<1	<1	<1	



Superseded Report:

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CERTIFICATE OF ANALYSIS

Validated

SDG: 230407-55
Client Ref.: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Table of Results - Appendix

Method No	Description
PM024	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM338	Analysis of perfluoroalkylsulfonates and perfluorocarboxylic acids in Solids
TM434	Analysis of PFAS

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

SDG: 230407-55
Client Ref.: 3866AReport Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Test Completion Dates

Lab Sample No(s)	27814277	27814279	27814274	27814275	27814276	27814278
Customer Sample Ref.	DUP A	FIELD BLANK	PFC 01	PFC 02	PFC 03	SITE BLANK
AGS Ref.						
Depth						
Type	Soil/Solid (S)	Unspecified Liq	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Unspecified Liq
PFAS Liquids		24-Apr-2023				24-Apr-2023
PFAS Solids	21-Apr-2023		14-Apr-2023	21-Apr-2023	14-Apr-2023	
Sample description	12-Apr-2023		12-Apr-2023	12-Apr-2023	12-Apr-2023	

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right solutions.
right partner.

To:
IGE Consulting
Oxford Court
M2 3WQ

Non-routine Analysis Report

Date: 2 May 2023

Our Reference: 23-046 (SDG: 230426-51)
Quote Reference: NRW851
Your Reference: NRW851
Location: 3866A

One swab sample was received on the 26th of April with a request for quantitative analysis of per- and polyfluorinated alkyl substances (PFAS).

We are pleased to enclose our non-routine analysis report.

Signed

Adam Gower
Technical Specialist



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2. Sample Analysis	3
3. Results.....	4
Table 1: Sample References	3
Table 2: Results for PFAS in swab samples, in ng/swab	4



1. Summary

One swab sample was requested to be analysed for PFAS.

SDG	Sample Event	Customer ID
230426-51	27898880	3866A

Table 1: Sample References

All analyses within this report are outside our accreditation status and were conducted on the "As received" sample.

2. Sample Analysis

The received swabs were extracted and analysed by LC/MS/MS with electrospray ionisation (ESI).

Identification of analytes was performed via retention time and qualifier match against a purchased standard. Quantification was performed against a multi-point calibration curve generated using standards of known concentration, using the internal standard method.



3. Results

Customer ID	3866A
Sample	27898880
PFBA	<10.0
PFPA	<10.0
PFBS	<10.0
PFHxA	<10.0
PFHpA	<10.0
PFPeS	<10.0
6:2 FTS	<10.0
PFOA	<10.0
PFHxS	<10.0
PFNA	<10.0
PFHpS	<10.0
PFDA	<10.0
L-PFOS	<10.0
Bran PFOS	<10.0
PFUnA	<10.0
PFDoA	<10.0
PFOSA	<10.0
PFTTrDA	<10.0
PFTeA	<10.0

Table 2: Results for PFAS in swab samples, in ng/swab



CERTIFICATE OF ANALYSIS

SDG: 230407-55
Client Ref: 3866A

Report Number: 686655
Location: Whitefield Fire Station

Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX 8

CHEMICAL LABORATORY SCREENING TABLES

IGE CONSULTING			Project: Whitefield Fire Station																									
			Job No: 3866a																									
Lab Sample Number			2539266	2539267	2539268	2539269	2539270	2539271	2539272	2539273	2631979						GAC - S4UL unless stated											
Sample Reference			DS01	DS01	DS02	DS02	DS03	DS03	DS04	DS04	HDP01	Statistical Analysis					Statistical Results											
Sample Number			None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	Count	Standard Deviation	Minimum	Maximum	Average	Maximum	2.5% Commercial	Pass/ Fail	Exceedances								
Depth (m)			0.80	1.50	0.50	1.00	1.20	2.00	0.50	1.50	0.40																	
Date Sampled			15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022	15/12/2022	26/01/2023																	
Analytical Parameter (Soil Analysis)		Units	LoD																									
Stone Content		%	0.1	77	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	25.63	0.1	77.0	8.6	77.0											
Moisture Content		%	0.01	5.5	25	10	28	27	13	17	24	9	8.01	5.50	28.00	18.94	28.00											
Total mass of sample received		kg	0.001	0.9	0.9	1	1	1	1	1	1	9	0.04	0.900	1.000	0.978	1.000											
Asbestos in Soil Screen		Type	N/A	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Chrysotile	8	-	-	-	-	-											
Asbestos Quantification		%	0.001	-	-	-	-	-	-	-	0.001	1	-	-	-	-	-											
General Inorganics																												
pH - Automated		pH Units	N/A	8.6	6.8	10.1	7.3	7.3	7.4	7	7.2	9	1.05	6.80	10.10	7.66												
Total Cyanide		mg/kg	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00	1.00	60	Pass	0								
Free Cyanide		mg/kg	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00	1.00	60	Pass	0								
Water Soluble Sulphate as SO4 16hr extraction (2:1)		mg/kg	2.50	20	28	180	96	110	31	180	45	9	62.32	20.00	180.00	84.22												
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)		g/l	0.00125	0.01	0.014	0.092	0.048	0.055	0.016	0.091	0.023	9	0.03165	0.01000	0.09200	0.04256												
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)		mg/l	1.25	10.2	13.8	92.1	48.1	55.2	15.6	91.2	22.5	9	31.79	10.20	92.10	42.52												
Organic Matter (automated)		%	0.1	0.3	3	0.7	11	12	1.9	6.1	2.1	9	4.48	0.30	12.00	5.06												
Water Soluble Nitrate (2:1) as NO3		mg/kg	2	3	13	2	3.5	26	12	2.5	30	9	19.50	2.00	61.00	17.00												
Water Soluble Nitrate (2:1) as NO3 (leachate equivalent)		mg/l	5	5	6.2	5	5	13	6	5	15	9	8.70	5.00	31.00	10.13												
Speciated PAHs																												
Naphthalene		mg/kg	0.05	0.05	0.05	1.7	0.37	0.05	0.27	0.05	0.05	9	0.54	0.05	1.70	0.29	1.70	460.00	Pass	0								
Acenaphthylene		mg/kg	0.05	0.05	0.05	0.05	0.07	0.05	0.95	0.05	0.05	9	0.30	0.05	0.95	0.15	0.95	97000	Pass	0								
Acenaphthene		mg/kg	0.05	0.05	0.05	0.05	7.7	0.72	0.05	0.26	0.05	9	2.50	0.05	7.70	1.09	7.70	97000	Pass	0								
Fluorene		mg/kg	0.05	0.05	0.05	5.9	0.69	0.05	0.43	0.05	0.52	9	1.90	0.05	5.90	0.87	5.90	68000	Pass	0								
Phenanthrene		mg/kg	0.05	0.09	0.05	0.34	38	4.7	0.27	4.2	0.05	9	12.25	0.05	38.00	5.92	38.00	22000	Pass	0								
Anthracene		mg/kg	0.05	0.05	0.05	0.06	11	1.2	0.05	1.6	0.05	9	3.55	0.05	11.00	1.68	11.00	540000	Pass	0								
Fluoranthene		mg/kg	0.05	0.17	0.05	0.65	47	6.3	0.14	11	0.05	9	15.15	0.05	47.00	8.25	47.00	23000	Pass	0								
Pyrene		mg/kg	0.05	0.16	0.05	0.66	43	6.2	0.21	11	0.05	9	13.87	0.05	43.00	7.75	43.00	54000	Pass	0								
Benzo(a)anthracene		mg/kg	0.05	0.07	0.05	0.35	25	3.1	0.07	6.9	0.05	9	8.10	0.05	25.00	4.37	25.00	170.00	Pass	0								
Chrysene		mg/kg	0.05	0.07	0.05	0.31	22	2.7	0.11	5	0.05	9	7.09	0.05	22.00	3.81	22.00	350	Pass	0								
Benzo(b)fluoranthene		mg/kg	0.05	0.07	0.05	0.51	27	3.5	0.09	7.7	0.05	9	8.74	0.05	27.00	4.84	27.00	44.00	Pass	0								
Benzo(k)fluoranthene		mg/kg	0.05	0.05	0.05	0.14	9.5	1.1	0.05	2.9	0.05	9	3.08	0.05	9.50	1.74	9.50	1200	Pass	0								
Benzo(a)pyrene		mg/kg	0.05	0.06	0.05	0.35	21	2.6	0.06	5.8	0.05	9	6.79	0.05	21.00	3.75	21.00	35.00	Pass	0								
Indeno(1,2,3-cd)pyrene		mg/kg	0.05	0.05	0.05	0.24	9.4	1.3	0.05	2.7	0.05	9	3.03	0.05	9.40	1.75	9.40	510	Pass	0								
Dibenz(a,h)anthracene		mg/kg	0.05	0.05	0.05	0.05	3	0.36	0.05	0.72	0.05	9	0.97	0.05	3.00	0.49	3.00	3.60	Pass	0								
Benzo(ghi)perylene		mg/kg	0.05	0.05	0.05	0.21	11	1.6	0.05	3	0.05	9	3.55	0.05	11.00	2.05	11.00	4000	Pass	0								
Total PAH																												
Speciated Total EPA-16 PAHs		mg/kg	0.8	0.8	3.82	282	36.5	1	64.3	0.8	47.6	9	90.83	0.80	282.00	48.62												
Heavy Metals / Metalloids																												
Arsenic (aqua regia extractable)		mg/kg	1	1.9	3	2.6	34	14	5.3	32	1.3	9	13.00	1.30	34.00	12.46	34.00	640	Pass	0								
Barium (aqua regia extractable)		mg/kg	1	73	50	63	180	110	59	180	19	9	58.38	19.00	180.00	97.11	180.00	22000.00	Pass	0								
Boron (water soluble)		mg/kg	0.2	0.2	0.2	0.4	0.7	0.7	0.4	0.3	0.3	9	0.19	0.20	0.70	0.39	0.70	240000	Pass	0								
Cadmium (aqua regia extractable)		mg/kg	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	9	0.03	0.20	0.30	0.21	0.30	190	Pass	0								
Chromium (hexavalent)		mg/kg	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	9	0.00	1.20	1.20	1.20	1.20	33	Pass	0								
Chromium (aqua regia extractable)		mg/kg	1	6.8	7.5	8.1	21	12	14	25	7	9	6.50	6.80	25.00	12.71	25.00	8600	Pass	0								
Copper (aqua regia extractable)		mg/kg	1	8.2	11	11	88	40	19	140	7.9	9	45.37	7.90	140.00	40.79	140.00	68000	Pass	0								
Lead (aqua regia extractable)		mg/kg	1	7.7	6.3	15	210	78	11	310	5	9	110.81	5.00	310.00	87.00	310.00	2330	Pass	0								
Mercury (aqua regia extractable)		mg/kg	0.3	0.3	0.3	1.2	0.5	0.3	0.3	0.7	0.3	9	0.31	0.30	1.20	0.47	1.20	1100	Pass	0								
Nickel (aqua regia extractable)		mg/kg	1	7	9.2	7.9	27	16	21	31	5.8	9	9.13	5.80	31.00	15.54	31.00	980	Pass	0								
Selenium (aqua regia extractable)		mg/kg	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00	1.00	12000	Pass	0								
Vanadium (aqua regia extractable)		mg/kg	1	7.9	8.7	11	46	23	18	41	7.9	9	14.39	7.90	46.00	21.06	46.00	9000	Pass	0								
Zinc (aqua regia extractable)		mg/kg	1	36	21	36	180	83	45	210	17	9	70.38	17.00	210.00	80.11	210.00	730000	Pass	0								
Petroleum Hydrocarbons																												
Petroleum Range Organics (C6 - C10)		mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.10	0.10	0.10												
TPH C10 - C40			mg/kg	10	10	12	210	120	10	84	10	9	69.79	10.00	210.00	57.89												
TPH2 (C6 - C10)			mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.10	0.10	0.10												
TPH C6 - C40			mg/kg	10	10	12	210	120	10	84	10	9	69.79	10.00	210.00	57.89												
TPH (C10 - C25)			mg/kg	10	10	10	120	63	10	38	10	9	37.32	10.00	120.00	34.22												
TPH (C25 - C40)			mg/kg	10	10	10	96	61	10	45	10	9	31.05	10.00	96.00	29.89												
GAC used: LQM/CIEH Suitable 4 Use Levels for Human Health Risk Assessment (3rd edition, 2015)																												
Category 4 Screening Levels (March 2014) used for Arsenic																												
In-house methodology used for Cyanide - no GAC currently available																												
Exceeded GAC & C4SL																												
Exceeded GAC but not C4SL																												
Recorded below laboratory detection limit																												
This spreadsheet has been developed by IGE Consulting Ltd																												

APPENDIX 9

GROUND GAS AND GROUNDWATER MONITORING

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Overcast Precipitation: Light rain 2hr pre-visit pressure: 1009

Job No.: 3866a Date: 04.01.2023 Air temperature: 11°C Ground condition: Damp

Engineer: AS Start time: 13:30 Cloud cover: 60% Pressure trend: Rising 2hr post-visit pressure: 1011

Visit No.: 1 End time: 14:37 Wind: 11.3 km/h SE On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	13:30	1.00 - 2.00	1.65	2.08	999	<0.1	<0.1	<0.1	<0.1	0.006	0.006	0.0	0.0	20.7	20.4	20.4	<1	<1	<1	<1	0.2	<0.1	1.0	<0.1	<0.1
DS02	14:02	2.00 - 4.00	0.88	3.47	997	3.1	1.6	71.6	36.6	0.140	0.065	1.2	1.2	20.1	18.6	17.4	25	25	148	97	1.0	0.4	2.7	-2.7	<0.1
DS03	14:20	2.00 - 4.00	1.82	3.90	997	12.6	12.3	>>>	>>>	0.335	0.317	0.3	0.3	20.3	14.4	14.0	<1	<1	15	15	0.6	0.5	>>>	<0.1	<0.1
DS04	13:47	1.00 - 2.00	1.33	2.00	997	<0.1	<0.1	<0.1	<0.1	0.006	0.006	2.0	1.2	20.0	19.3	18.7	<1	<1	<1	<1	0.2	0.1	1.0	<0.1	<0.1

Comments: DS02 bailed to 3.06m bgl. DS03 bailed to 3.37m bgl. DS04 bailed to 1.87m bgl.

- Values recorded below instrument detection level.
- Response zone flooded. Results unreliable.

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Rain Precipitation: None 2hr pre-visit pressure: 988

Job No.: 3866a Date: 16.01.2023 Air temperature: 2°C Ground condition: Damp

Engineer: AS Start time: 09:18 Cloud cover: 70% Pressure trend: Rising 2hr post-visit pressure: 990

Visit No.: 2 End time: 10:20 Wind: 1.6 km/h SE On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	09:18	1.00 - 2.00	1.65	2.09	978	<0.1	<0.1	<0.1	<0.1	0.007	0.007	0.0	0.0	20.2	20.1	20.1	<1	<1	<1	<1	0.1	<0.1	1.0	<0.1	<0.1
DS02	WELL INACCESSIBLE																								
DS03	09:39	2.00 - 4.00	2.06	3.87	977	4.8	4.8	>>>	>>>	0.186	0.185	1.4	1.4	20.0	17.1	17.1	<1	<1	<1	<1	0.2	<0.1	3.8	-4.4	<0.1
DS04	09:55	1.00 - 2.00	1.06	2.02	976	<0.1	<0.1	<0.1	<0.1	0.009	0.007	0.8	0.8	20.0	19.5	19.5	<1	<1	<1	<1	0.3	0.2	1.0	<0.1	<0.1

Comments: DS02 not accessible due to a vehicle parked over the well. DS02 not bailed due to limited space - a vehicle parked near the well. DS04 bailed to 1.60m bgl.

- Values recorded below instrument detection level.
- Response zone flooded. Results unreliable.

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Rain Precipitation: None 2hr pre-visit pressure: 1025

Job No.: 3866a Date: 02.02.2023 Air temperature: 9°C Ground condition: Damp

Engineer: AS Start time: 10:00 Cloud cover: 90% Pressure trend: Steady 2hr post-visit pressure: 1025

Visit No.: 3 End time: 11:00 Wind 00.0 km/h NE On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	10:15	1.00 - 2.00	1.64	2.09	1013	<0.1	<0.1	<0.1	<0.1	0.012	0.012	<0.1	<0.1	20.1	20.1	20.1	<1	<1	<1	<1	0.1	<0.1	1.0	<0.1	<0.1
DS02	10:30	2.00 - 4.00	0.87	3.64	1013	5.3	5.3	>>>	>>>	0.203	0.203	8.7	8.7	20.0	14.9	14.9	90	90	611	611	<0.1	<0.1	4.5	0.1	0.1
DS03	10:00	2.00 - 4.00	2.38	3.88	1014	4.3	4.3	>>>	98.5	0.166	0.166	2.0	2.0	20.2	14.1	14.1	<1	<1	10	10	0.1	<0.1	3.7	<0.1	<0.1
DS04	10:45	1.00 - 2.00	1.70	2.01	1013	<0.1	<0.1	<0.1	<0.1	0.014	0.011	1.3	1.2	19.8	18.8	18.6	<1	<1	<1	<1	0.1	<0.1	1.0	<0.1	<0.1

Comments: DS02 not bailed due to limited space - a vehicle parked near the well. DS03 bailed to 3.18m bgl.

- Values recorded below instrument detection level.
- Response zone flooded. Results unreliable.

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Rain Precipitation: None 2hr pre-visit pressure: 1018

Job No.: 3866a Date: 21.02.2023 Air temperature: 7°C Ground condition: Damp

Engineer: AS Start time: 08:00 Cloud cover: 80% Pressure trend: Falling 2hr post-visit pressure: 1016

Visit No.: 4 End time: 09:10 Wind: 3.15 km/h NW On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	08:00	1.00 - 2.00	1.64	2.09	1007	<0.1	<0.1	<0.1	<0.1	0.012	0.011	<0.1	<0.1	20.4	20.4	20.4	<1	<1	<1	<1	0.2	<0.1	1.0	0.3	<0.1
DS02	08:29	2.00 - 4.00	0.83	3.65	1005	2.6	2.3	60.4	54.5	0.107	0.107	4.4	4.4	20.0	17.7	17.7	<1	<1	98	98	0.1	<0.1	2.4	<0.1	<0.1
DS03	08:16	2.00 - 4.00	2.42	3.87	1006	1.7	1.6	39.2	38.5	0.070	0.070	2.2	2.2	20.3	10.3	10.3	<1	<1	10	10	0.1	<0.1	1.8	<0.1	<0.1
DS04	08:55	1.00 - 2.00	1.58	2.02	1005	<0.1	<0.1	<0.1	<0.1	0.013	0.011	4.5	4.5	20.2	14.6	14.6	<1	<1	19	10	0.2	0.1	1.0	<0.1	<0.1
BH03	08:42	6.00 - 10.00	2.69	8.90	1006	<0.1	<0.1	<0.1	<0.1	0.013	0.012	0.6	0.5	20.0	20.0	20.0	<1	<1	10	10	0.9	0.8	1.0	<0.1	<0.1

Comments: DS02 not bailed due to limited space - a vehicle parked over the well.

- Values recorded below instrument detection level.

- Response zone flooded. Results unreliable.

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Showers Precipitation: None 2hr pre-visit pressure: 988

Job No.: 3866a Date: 31.03.2023 Air temperature: 11°C Ground condition: Damp

Engineer: TP Start time: 13:30 Cloud cover: 100% Pressure trend: Rising 2hr post-visit pressure: 992

Visit No.: 5 End time: 15:10 Wind: 7 km/h SW On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	14:30	1.00 - 2.00	1.69	2.10	979	<0.1	<0.1	<0.1	<0.1	0.018	0.018	<0.1	<0.1	20.5	20.4	20.4	1	1	1	1	0.1	<0.1	1.0	<0.1	<0.1
DS02	13:45	2.00 - 4.00	0.84	3.60	978	1.5	1.5	34.3	33.5	0.058	0.058	1.1	1.1	20.1	19.6	19.6	1	1	10	10	2.1	1.9	1.7	<0.1	<0.1
DS03	14:00	2.00 - 4.00	1.91	3.82	976	<0.1	<0.1	<0.1	<0.1	0.020	0.020	0.3	<0.1	20.3	20.2	20.2	1	1	1	1	1.2	1.0	1.0	<0.1	<0.1
DS04	14:45	1.00 - 2.00	0.87	1.97	979	0.0	0.0	0.0	0.0	0.017	0.017	0.7	0.5	20.6	20.0	20.0	1	1	1	1	0.3	0.1	1.0	<0.1	<0.1
BH03	14:15	6.00 - 10.00	1.64	9.10	976	0.0	0.0	0.0	0.0	0.018	0.018	0.0	0.0	20.4	20.4	20.4	1	1	1	1	0.7	0.6	1.0	<0.1	<0.1

Comments: DS01 bailed to 3.20mbgl at 13:55, redipped at 14:57 measuring 2.24m bgl. DS03 bailed to 3.42m bgl at 14:12, redipped at 14:55 measuring 2.43m bgl. BH03 bailed to 2.41m bgl at 14:24, redipped at 14:52 measuring 2.38m bgl. DS01 bailed to 1.94m bgl at 14:35, redipped at 14:4 at 14:49 measuring 1.68m bgl. DS04 bailed to 1.82m bgl at 14:44, redipped ta 15:04 measuring 1.71m bgl.

- Values recorded below instrument detection level.
- Response zone flooded. Results unreliable.

Gas Monitoring

Site: Whitefield Fire Station Recent weather: Rain Precipitation: None 2hr pre-visit pressure: 1031

Job No.: 3866a Date: 19.04.2023 Air temperature: 14°C Ground condition: Damp

Engineer: AS Start time: 12:02 Cloud cover: 80% Pressure trend: Falling 2hr post-visit pressure: 1029

Visit No.: 6 End time: 13:15 Wind: 21 km/h E On-site activities (e.g.construction): Fire station



Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH ₄		LEL		Hex		CO ₂		O ₂			H ₂ S		CO		Total Volatiles (PID)		PID CF	Flow	
		(m bgl)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)		(%)			(ppm)		(ppm)		(ppm)			(l/hr)	
						peak	steady	peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady	peak	steady		peak	steady
DS01	12:49	1.00 - 2.00	1.68	2.09	1017	<0.1	<0.1	<0.1	<0.1	0.020	0.017	<0.1	<0.1	20.8	20.8	20.8	<1	<1	<1	<1	0.3	0.2	1.0	2.4	<0.1
DS02	12:02	2.00 - 4.00	1.12	3.64	1020	2.2	2.2	51.7	50.1	0.100	0.098	5.2	5.2	19.9	18.5	18.5	<1	<1	<1	<1	0.1	<0.1	2.3	15.7	<0.1
DS03	14:00	2.00 - 4.00	2.30	3.88	1019	8.5	7.8	>>>	>>>	0.251	0.240	2.0	1.9	20.5	13.6	13.4	<1	<1	<1	<1	0.3	<0.1	7.0	<0.1	<0.1
DS04	14:45	1.00 - 2.00	1.20	2.00	1017	<0.1	<0.1	<0.1	<0.1	0.017	0.016	1.1	1.0	20.6	19.8	19.8	<1	<1	<1	<1	0.2	<0.1	1.0	<0.1	<0.1
BH03	14:15	6.00 - 10.00	2.54	8.75	1020	<0.1	<0.1	<0.1	<0.1	0.017	0.017	0.1	0.1	20.7	20.7	20.7	<1	<1	<1	<1	0.2	<0.1	1.0	<0.1	<0.1

Comments: BH03 bailed to 3.50m bgl, unable to bail further due to recharge. DS02 bailed to 2.71m bgl. DS04 bailed to 182m bgl. Unable to bail DS03 due to a parked vehicle.

- Values recorded below instrument detection level.
- Response zone flooded. Results unreliable.