



1978.35-4
Greater Manchester Fire and Rescue

Whitefield Fire Station Outline Drainage Strategy

April 2023

Report Details:

Prepared By: B Howarth

Checked By: BGH

Revisions: Initial Issue - 13/04/2023

Contents

1. Introduction
2. Site Setting and Description
3. Surface Water Management Principles
4. Surface Water Run-Off Destination
5. Below Ground Network Design Principles
6. SuDS Feasibility
7. Water Quality / Pollutants
8. Foul Water Drainage Design
9. Operation and Maintenance

Appendices

- | | |
|------------|-----------------------------|
| Appendix A | Proposed Site Plan |
| Appendix B | Topographical Survey Plan |
| Appendix C | United Utilities Asset Plan |
| Appendix D | Indicative Drainage Plan |
| Appendix E | Geotechnical Phase 2 Report |

1.0 Introduction

Bradshaw Gass & Hope LLP have produced this outline drainage strategy in support of the below ground drainage design for the proposed Whitefield Fire Station on Bury New Rd, Whitefield, Manchester, M45 7SY.

This report has been produced by Brendan Howarth who has over 20 years' experience in Civil and Structural engineering, and has qualifications including: MStructE, BEng (Hons) Civil Engineering (2004); and ONC Civil Engineering (2001).

This report will demonstrate that the surface water run-off rate and volume for the post development site is managed so it adheres to current regulations, and local authority requirements, and has been prepared to the requirements of the:

- National Planning Policy Framework (NPPF) 2019;
- National Planning Practice Guidance (NPPG);
- Principles of Sustainable drainage systems (SuDS) set out by DEFRA (2011);
- Ciria SuDS Manual C753 (2015);
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015);

Bury County Council will need to be satisfied that the design and drainage principles of the proposed development will address the risk of flooding to the development site; Greater Manchester Fire and Rescue service will ensure that the drainage is maintained to prevent flooding; and in turn not to increase the risk of flooding to neighbouring land and property.

2. Site Setting and Description

2.1 GENERAL DESCRIPTION:

The site on and accessed by the A56 Bury New Road A680, which runs north east to south west to the west boundary of the site.

The houses an existing fire station which has exceeded its current design life. The existing station is a single storey building, featuring appliance bays, offices, accommodation facilities...etc. Externally there features a large hardstanding yard and some training facilities such as a multi storey training tower.

To the north lies residential dwellings accessed via George Street. To the east lies George Street and a number of residential dwellings, beyond this lies Elms Playing Field.

The site it generally flat.

2.2 ADDRESS:

Fire Station, Bury New Rd, Whitefield, Manchester M45 7SY

2.3 OS MAPS:

OS Grid Ref: SD 80480 06485

What3Words: needed.funded.perky

Indicates site altitude as 103m.

2.4 FLOOD ZONE MAP INFORMATION

The site is located within flood zone 1 as such it has a low probability of flooding.

2.5 GROUND CONDITIONS

A geo-environmental Phase 2 investigation is being produced by IGE Consulting, a draft version of this report is included as an appendix to this report (appendix E).

2.6 WATERBODIES / RIVERS / CANALS

Centre of the Site is approx. 740m from the River Irwell

Centre of the Site is approx. 2.27km from the Heaton Park Reservoir

Centre of the Site is approx. 50km to the nearest Coastline

2.7 ON-SITE DRAINAGE / PUBLIC SEWERS

The United Utilities asset plan (Appendix C) shows the closest UU asset being the 375mm diameter clay drain in Bury New Road.

The topographic survey (Appendix B) shows an existing combined drainage network serves the existing fire station.

This flows to a manhole in the North East corner of the site and appears to discharge towards George Street.

2.8 DEVELOPMENT AREAS

The surface water run-off from the existing fire station building and associated yard/hardstanding of the pre-development site discharges to a below ground drainage network and equates to approximately 2657m² / 0.2657ha.

The surface water run-off from the new building and hard-standing areas of the post development site will also discharge to a below ground drainage network, but with the surface water from the wash down area discharging to the foul network.

The area discharging to the surface water network equates to 2387m^2 / 0.2387ha, with the new Fire station building area equating to approximately 570m^2 / 0.057ha. Please refer to appendix A Proposed Site Plan.

The surface water run-off discharging to the surface water network is to be managed only, therefore in terms of the surface water management calculations, the area of **2387m^2 / 0.2387ha** is to be used.

3. Surface Water Management Principles

The surface water for the development site is to be managed so that it adheres to the current national regulations and local authority requirements.

3.1 RUN-OFF DESTINATION

Surface water run-off is to discharge to one or more of the following in the order of priority shown: Discharge into the ground (infiltration); Discharge to a surface water body; Discharge to a surface water sewer, highway drain or other drain; Discharge to combined sewer.

3.2 THE MANAGEMENT TRAIN

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are: Prevention - Prevention of run-off by good site design and reduction of impermeable areas; Source Control - Dealing with water where and when it falls (e.g. infiltration techniques); Site Control - Management of water in the local area (e.g. swales, detention basins); Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

3.3 DESIGN PRINCIPLES

The design principles for the surface water management of the development will be to: Ensure that people, property and critical infrastructure are protected from flooding; Ensure that the development does not increase flood risk off site; Ensure that SuDS can be economically maintained for the development.

3.4 PEAK SURFACE WATER FLOW

To adhere to national and local guidance / policies, the peak surface water run-off from the post development site is to be reduced to as low as possible, with the aim to reduce the rates to the equivalent greenfield rates.

3.5 FLOOD RISK

The drainage system will be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

The drainage system will also be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur during a 1 in 100-year rainfall event in any part of a building (including a basement) or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development. The design of the site will ensure that flows resulting from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

4. Surface Water Run-Off Destination

The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

Run-Off Destination	Feasible	Description
Discharge to Ground	No	On-site ground investigation found the ground to consist of 0.75m to 2.75m of Made Ground and peat over predominantly cohesive natural deposits of SOFT CLAY, to depths in excess of 15.00mbg. Based on the on-site investigation, and as the ground predominantly consists of clay (which is known to have very low, or no infiltration value), discharge of surface water to ground is not feasible.
Discharge to Surface Water Body	No	There are no know waterbodies directly adjacent to the development site, with the nearest water body being the River Irwell approximately 740m to the west. Therefore, the discharge to a surface waterbody is not feasible.
Discharge to Surface Water Sewer	No	There is no surface water sewer within the vicinity of the site
Discharge to Highway Drain or Other	No	There is no Highway Drain within the vicinity of the site
Discharge to Combined Water Sewer	Yes	As the surface water cannot discharge to ground to due inadequate conditions, and there are no known water bodies or surface water drains near the site, the only alternative is to discharge the surface water to a combined water sewer.

5. Below Ground Network Design Principles

5.1 CLIMATE CHANGE:

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance (Table 2) summarised in Table 4 below.

Applies across all of England	Total change anticipated for the 2020's	Total change anticipated for the 2050's	Total change anticipated for the 2080's
Upper End	10%	20%	40%
Central	5%	10%	20%

The baseline year is 1961 to 1990. It is anticipated the life span of the proposed building will be approximately 80 years, and therefore will fall at least into the 2080's and will have rainfall intensity increase of **40%**.

5.2 SURFACE WATER DRAINAGE NETWORK AND MANAGEMENT

As shown on the below ground drainage layout drawing in Appendix D, the proposed surface water network will consist of 150mm and 300mm diameter pipes; 100mm diameter perforated pipes; 1200mm and 1500mm diameter manholes; a flow control chamber containing a hydro-brake; channel drains and gullies; a below ground attenuation tank in the form of cellular units; and a petrol interceptor.

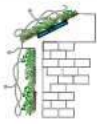
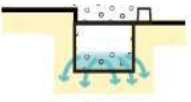
The surface water run-off from the roof areas will discharge to the main network via rainwater pipes; the surface water run-off from vehicle yard and footpaths around the perimeter will discharge to the main network via channel drains; and the surface water run-off from the footpath to the south of the site will discharge to the main drainage via a filter drain / perforated pipe system.

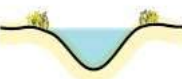
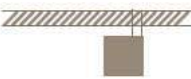
The surface water network will flow to the north of the development, where it will pass through the flow control and petrol interceptor, prior to connection / discharge to the combined sewer system. The restricted water will back flow and fill the network and attenuation tank (below vehicle yard), where the water will be stored during the storm event to prevent flooding.

6. SuDS Feasibility

To reduce the surface water run-off to the greenfield rate, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
 Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenance typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table overleaf:

SuDS Method	Feasible Use	Description
Green Roofs	Yes	The new fire station building is intended to have a green roof.
Rainwater Harvesting	Potential	Rainwater harvesting for water re-use has not been considered for the development due to the cost of a dual pipe network. However, water butts or rainwater harvesting tanks could potentially be installed at several rainwater pipes and re-used for irrigation, or for training purposes.
Soakaway	No	As stated in Section 4, on-site ground investigation found the ground to consist of 0.2-1.4m of Made Ground, over predominantly cohesive natural deposits of CLAY, to depths in excess of 15.05mbg. Clay is known to have very low, or no infiltration value. Therefore, the use of soakaways is not feasible.
Filter Strips	Yes	Filter strips can be built within the soft landscaping area to the south of the site, where the surface water run-off from the footpath area will discharge to the filter rain, and will be conveyed via a perforated pipe to the main drainage network.
Permeable Paving	No	Due to the weight of fire rescue vehicles occupying the site much of the site is to be concrete hardstanding.
Swale	No	There are limited soft landscaped areas within the development site, with the area to the south being higher than the building level. Therefore, the use of swales is not a feasible SuDS method.
Pond / Basin	No	There are limited soft landscaped areas within the development site, with the area to the south being higher than the building level. Therefore, the use of ponds / basins are not a feasible SuDS method.
Underground Storage	Yes	The surface water run-off from the development site will be restricted. The restricted rate will be lower than the surface water run-off rate, therefore there will be a requirement to have underground storage to prevent flooding in the form of cellular units.

7. Water Quality / Pollutants

The source of any potential pollutants will be from the surface water run-off from the building roof, footpath, and vehicle yard areas.

The pollutants from the roof and footpath areas are deemed to be low with no pollutant control requirements.

8. Foul Water Drainage Design

The foul water drainage network will be designed to achieve a self-cleansing flow of no less than 0.75 m/s up to the connection into the local United Utilities asset.

The total foul water discharge rate will be calculated in-line with Sewers for Adoption guidance domestic flows calculated in accordance with BS EN 752 and BS EN 12056-2.

A predevelopment enquiry was submitted to United Utilities. The response from United Utilities indicated that the foul water can flow to the combined sewer in Bury New Road at an unrestricted rate.

9. Operation and Maintenance

The extent of the drainage network and SuDS features for the development site are shown on the below ground drainage layout drawings in Appendix D.

Details of the maintenance required, and the parties to carry out the maintenance of all drainage aspects, to ensure that the SuDS methods are working affectively, and subsequently reducing the risk of flooding on the site are as follows:

The management and maintenance of the surface water drainage networks and SuDS features will be by the estate's management team of the existing training centre area. The required maintenance and management of the drainage and SuDS will be as follows:

9.1 Surface Water Drainage Network

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

9.2 Cellular Units and Flow Control

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from tank and flow control chamber (where may cause risk performance)	Monthly
Where rainfall into tank and flow control manhole from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year

Remove sediment from upstream surface water network by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure good condition and operating as designed	Annually and after large storms

9.3 LINKED AND FURTHER MAINTENANCE ACTIVITIES

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas. A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

Appendix A – Proposed Site Plan

Appendix B – Topographical Survey Plan



KEY FOR UNDERGROUND SERVICES

Scale: 1:100

Legend:

- Water
- Gas
- Electricity
- Telecommunications
- Other

When character marks are significantly greater than the lower dia, that appropriate marks are shown here.

ABBREVIATION KEY

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

UTILITY SURVEY NOTES

1. All underground services shown on this plan are the result of a detailed survey carried out on the 10th of October 2022. The survey was carried out using a combination of ground penetrating radar (GPR) and direct reading methods. The results of the survey are shown on this plan.

2. The plan shows the location and depth of all underground services found. The depth of the services is shown in meters below ground level (mbgl).

3. The plan also shows the location of all manholes and other access points. The location of the manholes is shown in meters from the top left corner of the plan.

4. The plan is a true and correct copy of the original survey data. It is not to be used for any other purpose without the written consent of the surveyor.

Disclaimer

Only manholes that were accessible on site during survey other manholes may be present but covered. All invert levels taken where possible at main channel. Main Entry to sewers has not been undertaken. Depths, Pipelines etc are measured from the ground. All sewers and inverts to be checked prior to any works commencing on site. The CAD Room Ltd are not responsible for manholes, services, information not surveyed which may have an impact on site development. Boundaries shown are physical and may not represent legally conveyed.

THE CAD ROOM

Unit 1 Arden Business Centre
Horsfield Way
Bredbury Ind. Estate
Bredbury
M16 9JL
T: 0161 427 0348
E: www.thecadroom.com

Client: GMCA
Location: Whitefield Fire Station

Comments:

Drawing Number: 01-S-1072-GM Fire Stations	Revision: A
Date: 10.02.2022	Scale: 1:100 @ A0
Drawn By: LK	Checked By: CG

Appendix C – United Utilities Asset Plans

Brendan Howarth

21
Silverwell Street,
Bolton,
BL1 1PR

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: 1978.35 Whitefield FS
Our Ref: UUPS-ORD-450105
Date: 30/11/2022**

Dear Sirs

**Location: GREATER MANCHESTER FIRE & RESCUE SERVICE FIRE STATION BURY NEW ROAD,
WHITEFIELD, MANCHESTER, M45 7SY**

I acknowledge with thanks your request dated 29/11/2022 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



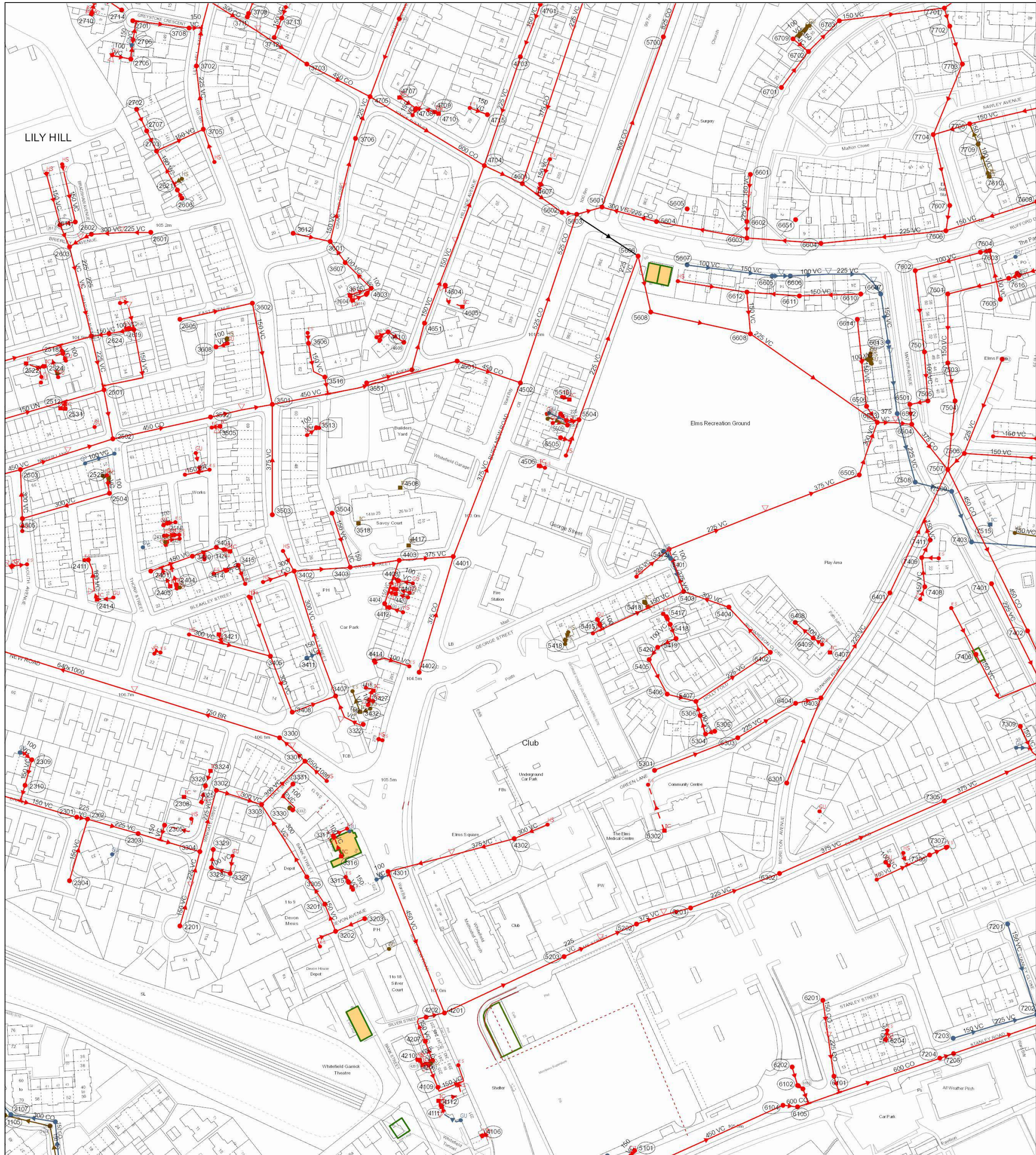
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

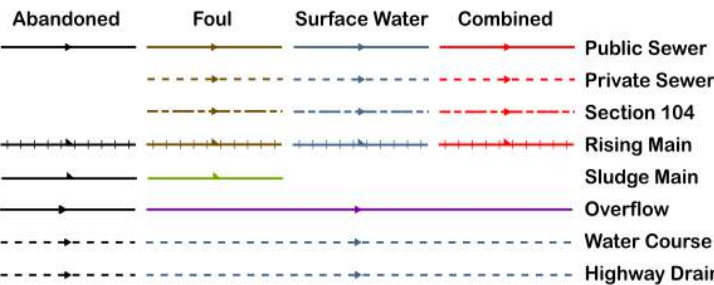
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

Crown copyright and database rights 2017 Ordnance Survey 100022432. Unauthorised reproduction will infringe these copyrights.

LEGEND



All point assets follow the standard colour convention:
red - combined
brown - foul
blue - surface water
purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Valve Chamber
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

- FO Foul
- SW Surface Water
- CO Combined
- OV Overflow

SEWER SHAPE

- CI Circular
- TR Trapezoidal
- EG Egg
- AR Arch
- OV Oval
- BA Barrel
- FT Flat Top
- HO Horse Shoe
- RE Rectangular
- UN Unspecified
- SQ Square

SEWER MATERIAL

- AC Asbestos Cement
- BR Brick
- PE Polyethylene
- RP Reinforced Plastic Matrix
- CO Concrete
- CSB Concrete Segment Bolted
- CCU Concrete Segment Unbolted
- CS Concrete Box Culverted
- PSC Plastic / Steel Composite
- GRC Glass Reinforced Plastic
- DI Ductile Iron
- PVC Polyvinyl Chloride
- CI Cast Iron
- SI Spun Iron
- ST Steel
- VC Vitrified Clay
- PP Polypropylene
- PF Pitch Fibre
- MAC Masonry, Coursed
- MAR Masonry, Random
- U Unspecified

Address or Site Reference:

GREATER MANCHESTER FIRE & RESCUE SERVICE
FIRE STATION BURY NEW ROAD,
WHITEFIELD,
MANCHESTER,
M45 7SY

Scale: 1:1250

Date: 30/11/2022

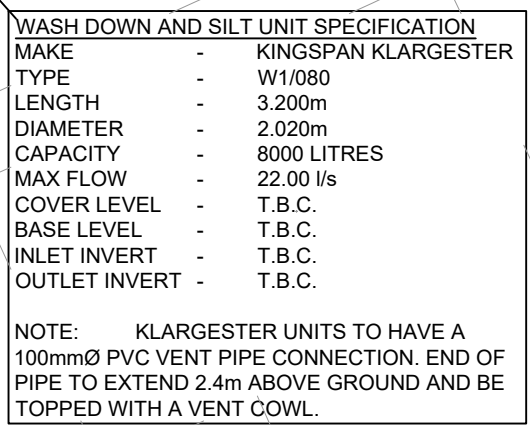
Sheet: 1 of 1

Printed by: Property Searches

SEWER
RECORDS



Appendix D – Indicative Drainage Plan



BGH Architects
Consulting Engineers
Quantity Surveyors

21 Silverwell Street
Bolton
BL1 1PR
t: 01204 525321
email@bghbolton.co.uk
www.bghbolton.co.uk

1978.35.4 DRAINAGE	P1
--------------------	----

1978.35.4 DRAINAGE P1

Appendix E – Geotechnical Phase 2 Report



Whitefield Fire Station, Whitefield

Phase 2 Geo-Environmental Investigation Report

For: Greater Manchester Combined Authority (GMCA)

Geo-Environmental Engineering Services

IGE Consulting
Office 16
Bartle House
Oxford Court
Manchester
M2 3WQ

Tel 0161-914-9170
Email contact@igeconsulting.co.uk

Ref: 3866a-02
Job: 3866a
Rev: -
By: LM

Date: Mar 2023

REVISIONS

Revision	Date	Prepared By	Checked By	Authorised By	Remarks
First Issue	31 st March 2023	 Liam McMahon MSc, FGS	 Angharad Jones BSc (Hons), FGS	 Andrew Edwards MSc, PIEMA, MIEEnvSoc, FGS, CEnv	-



CONTENTS

1.0 INTRODUCTION

- 1.1 Brief
- 1.2 Third Parties

2.0 SCOPE OF INVESTIGATION WORK

- 2.1 Cable Percussion Boreholes
- 2.2 Dynamic Sampling Boreholes
- 2.3 California Bearing Ratio Testing
- 2.4 Site Testing and Sampling
- 2.5 Laboratory Testing

3.0 FINDINGS

- 3.1 Ground Conditions
- 3.2 Visual and Olfactory Contamination Findings
- 3.3 Water Strikes
- 3.4 Obstructions
- 3.5 Geotechnical Site Testing
- 3.6 Geotechnical Laboratory Testing
- 3.7 Environmental Laboratory Test Results
- 3.8 Ground Gas Monitoring Results
- 3.9 Groundwater Depth Monitoring Results

4.0 ENVIRONMENTAL CONCLUSIONS

- 4.1 Assessment of Environmental Results
- 4.2 Revised Conceptual Models

5.0 GEOTECHNICAL CONCLUSIONS

- 5.1 Geotechnical Assessment of Ground Conditions
- 5.2 Foundations
- 5.3 Groundwater
- 5.4 Earthworks and External Areas
- 5.5 Drainage

6.0 RECOMMENDATIONS

APPENDICES

APPENDIX 1	LIMITATIONS OF INVESTIGATION WORK AND REPORT
-------------------	--

APPENDIX 2	FIGURES AND DRAWINGS
-------------------	----------------------

- SI-01 Site Location Plan
- Proposed Development Plan
- SI-05 Exploratory Hole Location Plan

APPENDIX 3	CABLE PERCUSSION BOREHOLE LOGS
-------------------	--------------------------------

APPENDIX 4	DYNAMIC SAMPLE BOREHOLE LOGS
-------------------	------------------------------

APPENDIX 5	IN-SITU TEST RESULTS
-------------------	----------------------

APPENDIX 6	GEOTECHNICAL LABORATORY TEST RESULTS
-------------------	--------------------------------------

APPENDIX 7	CHEMICAL LABORATORY TEST RESULTS
-------------------	----------------------------------

APPENDIX 8	CHEMICAL LABORATORY SCREENING TABLES
-------------------	--------------------------------------

APPENDIX 9	GROUND GAS AND GROUNDWATER MONITORING
-------------------	---------------------------------------

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

This report has been prepared for the sole use of Greater Manchester Combined Authority (GMCA). The report must not be copied or passed onto any third party or used for any purpose other than which it was prepared without the permission of the author. This report is copyright.

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 two 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.

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 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.

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 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.

2.4 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) 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.
- c) Undisturbed thick-wall 100mm diameter (U100) samples were recovered from cable percussion boreholes where ground conditions allowed.
- d) CBR determinations via dynamic cone penetrometer tests were undertaken at DCP01, DCP02 and DCP03.
- e) DS04 was extended by dynamic probing (DPSH) to 11.90m bgl (91.55m AOD)
- f) Infiltration testing via falling head test method was completed at DS01, DS03 and DS04.

2.5 Laboratory Testing

2.5.1 Chemical Laboratory Testing

8 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.

2.5.2 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 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.

3.3 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)

3.4 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.

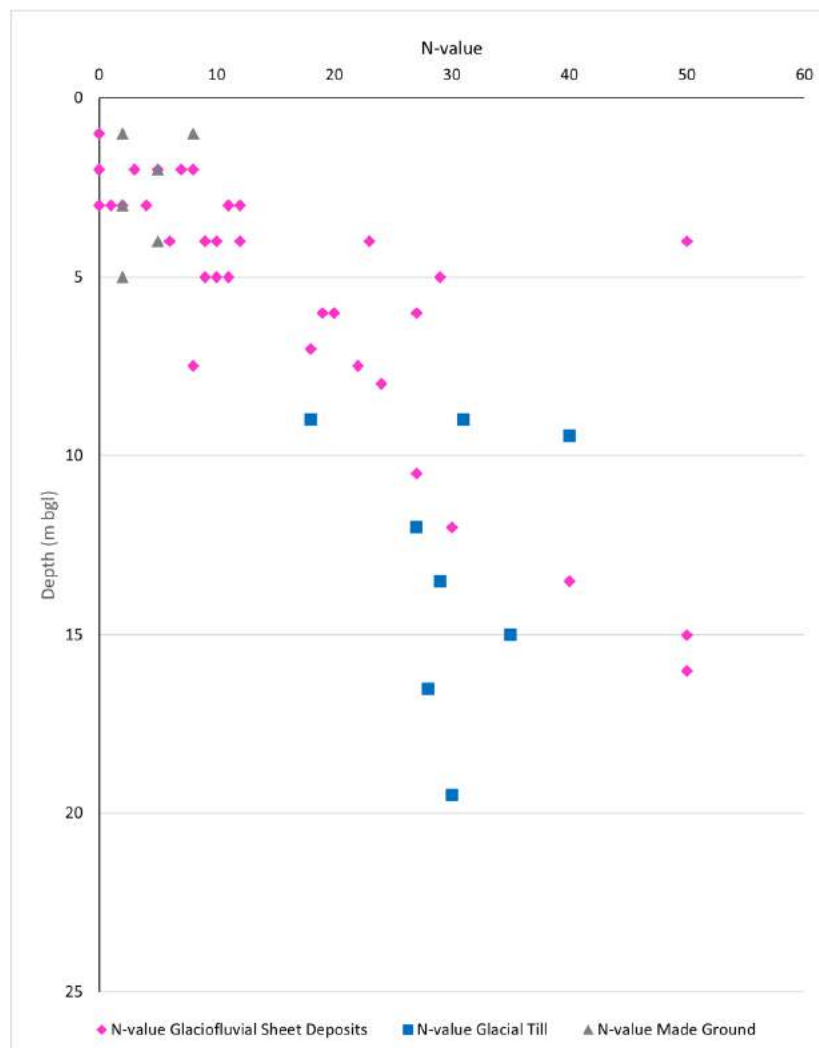
3.5 Geotechnical Site Testing

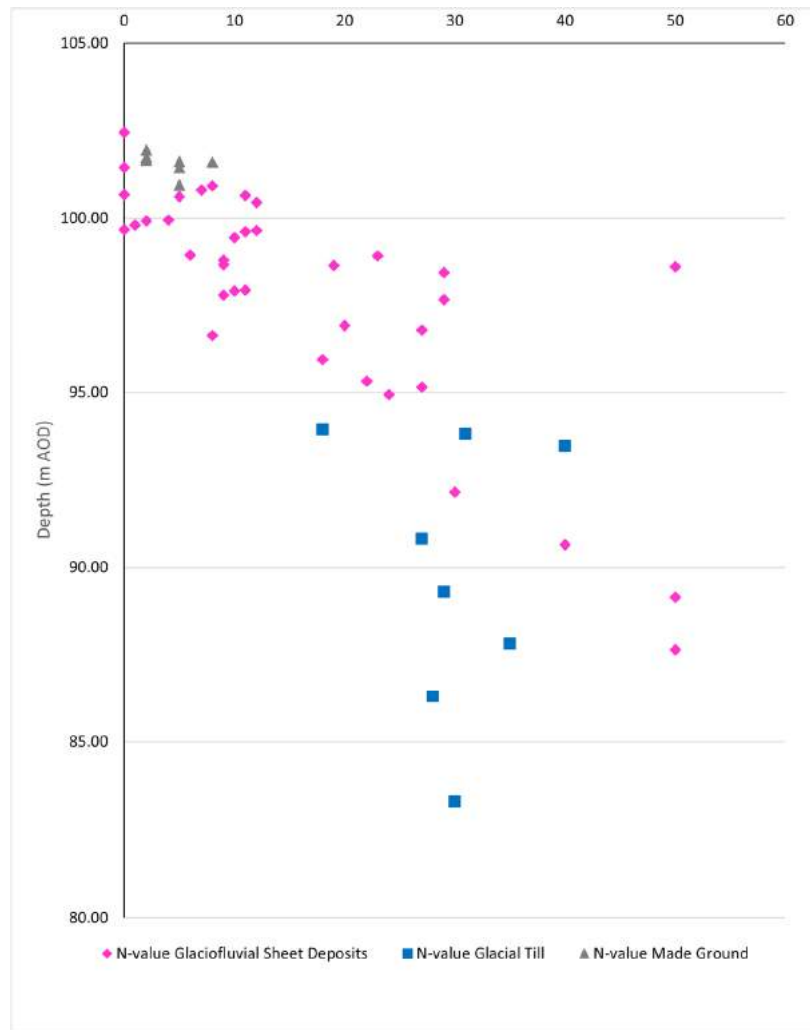
The results of the geotechnical testing undertaken during the ground investigation are summarised below.

3.5.1 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.

3.5.2 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.

3.6 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.

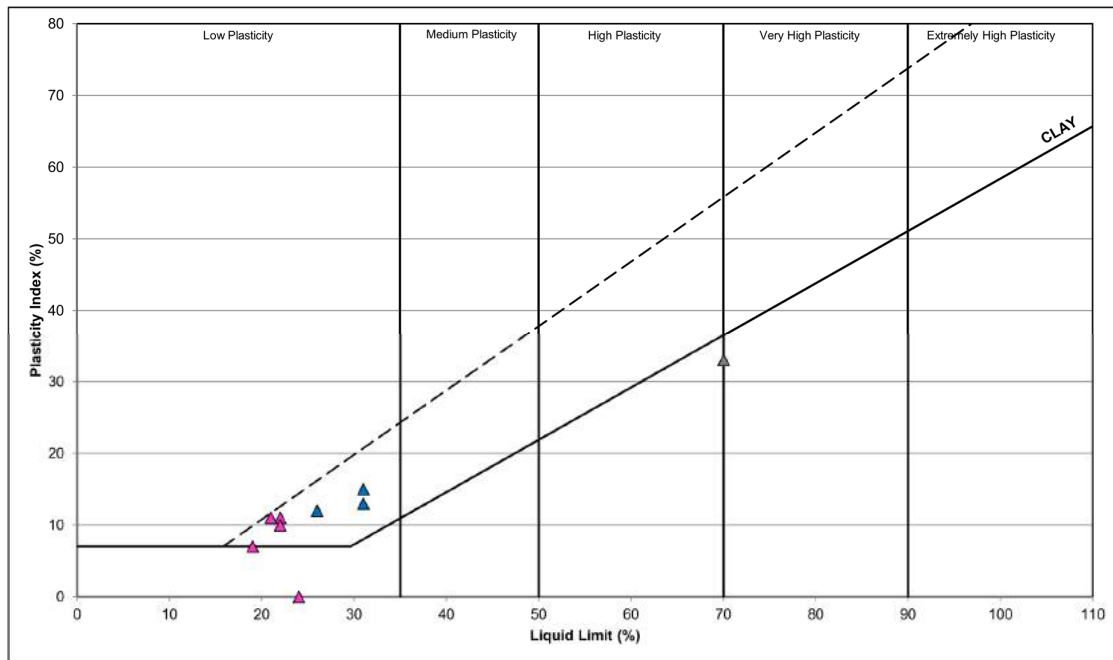
3.6.1 Atterberg Limit Tests

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.

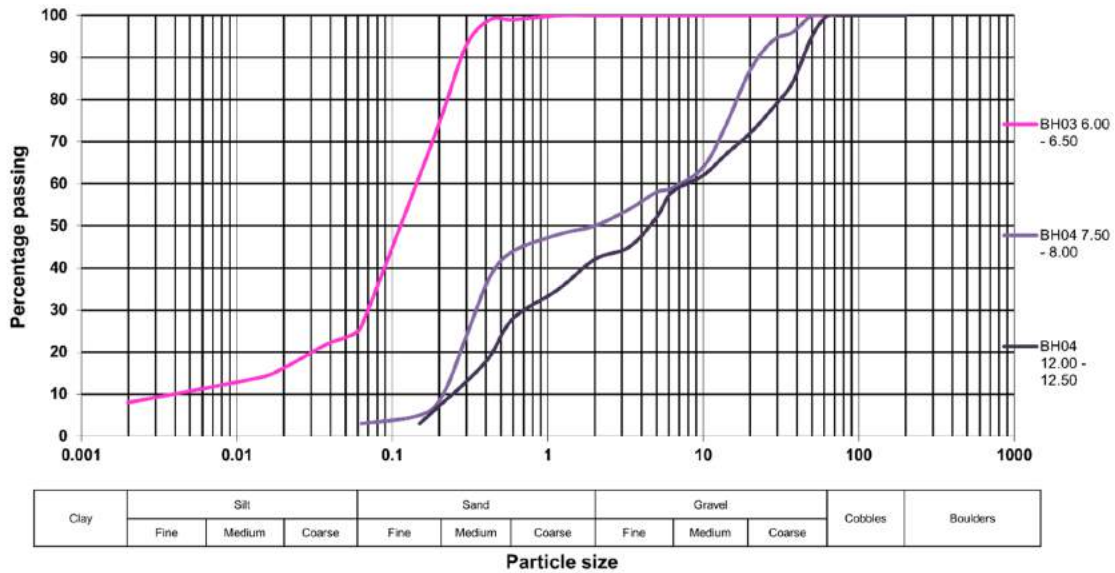
The Atterberg Limit tests indicate that both the Glacial Till and Glaciofluvial Sheet Deposits are generally of low plasticity in-line with BS14688 Part 2 and low volume change potential in-line with NHBC Chapter 4.2 guidance.

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.

3.6.2 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.

3.6.3 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'.

3.6.4 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

3.7 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 6 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 and DS04 at 0.50m 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%**.

3.7.1 Asbestos

An asbestos screen was performed on all samples. No asbestos was found to be present within any of the samples tested.

3.7.2 Polycyclic aromatic hydrocarbons (PAHs)

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

3.7.3 Metals and metalloids

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

3.7.4 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 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.

Gas monitoring is ongoing, however, following 4 No. visits over 7 No. weeks, the results have been summarised below. It should be noted that BH03 has only been monitored once given its installation as part of a later stage of investigation. DS02 has been monitored three 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 – 20.4	<0.1	<0.1	<1	978 – 1013	<0.1
DS02	14.9 – 18.6	1.2 – 8.7	2.6 – 5.3	1 - 90	997 – 1013	<0.1
DS03	10.3 - 17.1	0.3 – 2.0	1.7 – 12.6	<1	977 – 1014	<0.1
DS04	14.6 – 19.3	0.8 – 4.5	<0.1	<1	976 – 1013	<0.1
BH03	20.0	0.6	<0.1	<1	1006	<0.1

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

The ground gas monitoring results are included in Appendix 9.

3.9 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 – 1.65
DS02	2.00 – 4.00	0.83 – 0.88
DS03	2.00 – 4.00	1.82 – 2.42
DS04	1.00 – 2.00	1.06 – 1.70
BH03	6.00 – 10.00	2.69

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 asbestos was detected in any of the samples tested.

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.

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. 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.

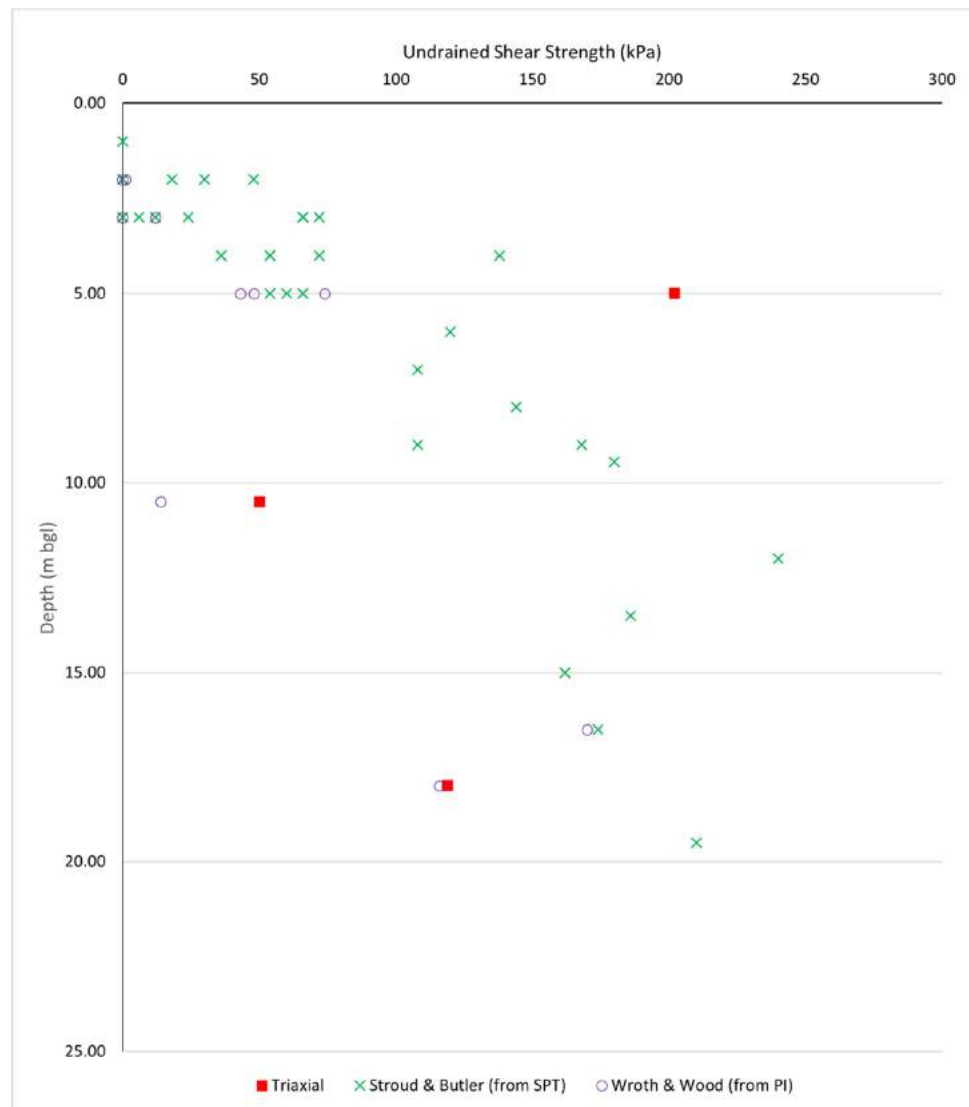
5.2 **Foundations**

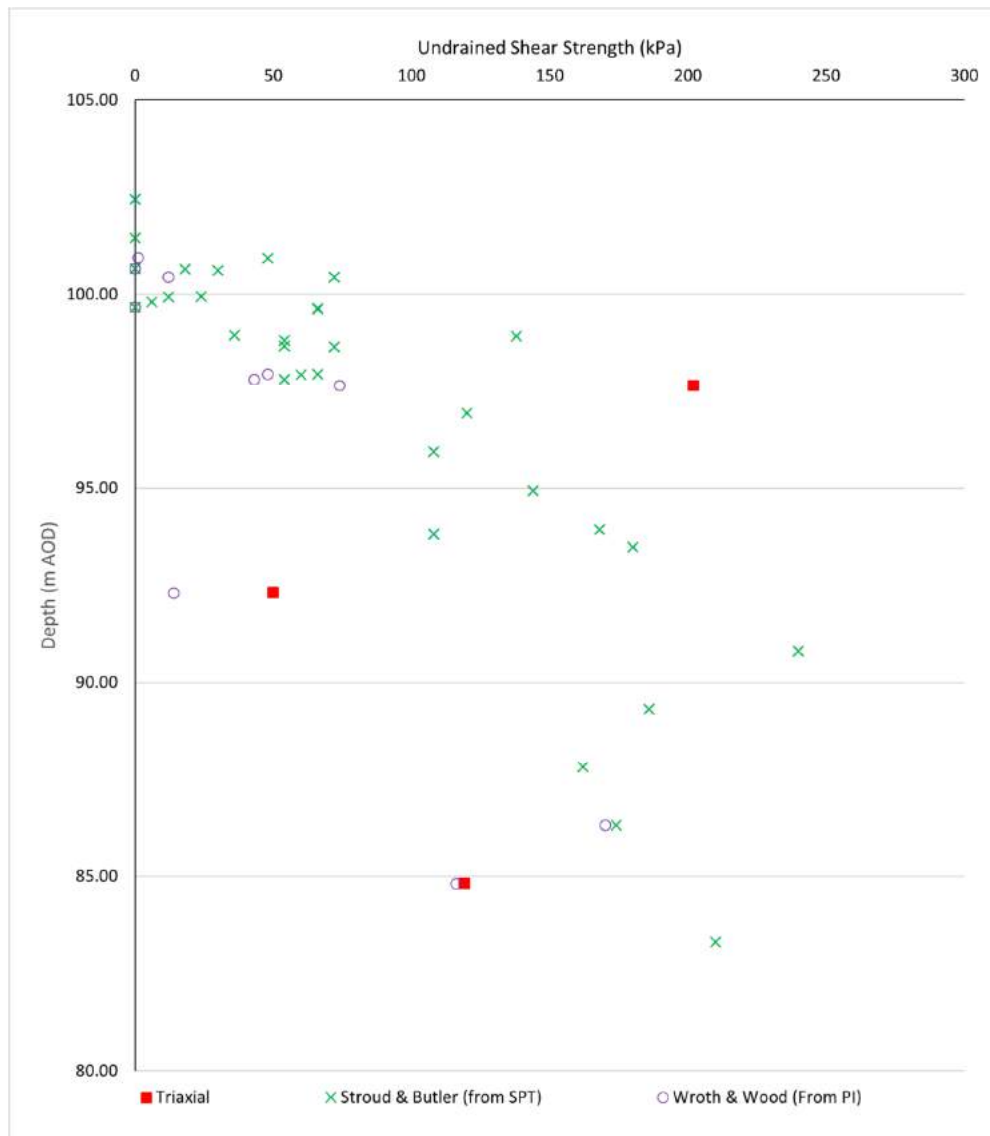
Given the presence of low strength, variable material and shallow groundwater from existing ground level to 5.00m bgl the use of traditional shallow foundations are not envisaged to be suitable. Consequently, it is envisaged that deep (piled) foundations will be necessary at the site, particularly for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

The Phase 1 investigation identified the possibility of firefighting foam having been used at the site historically. Firefighting foam is a source of PFAS compounds which can be persistent, bio-accumulative and toxic (PBT). If firefighting foam, or vehicles that carried firefighting foam were ever used on site, there is the potential for PFAS to be present on the surface hardstanding and within any shallow Made Ground at the site. The potential presence of PFAS at the site is currently being investigated. This report will be updated upon completion of that investigation.

The influx of large amounts of water through soakaway drainage would give rise to the possibility of mobilising and transporting these contaminants both laterally and vertically. The Phase 1 report indicated the presence of a Secondary (A) Aquifer within the superficial deposits in the eastern site section, and a Principal Aquifer within the bedrock. Therefore, it is assessed that the historical contamination of the site with PFAS is likely to preclude the use of soakaway drainage.

Based upon the potential widespread presence of PFAS compounds and the existing shallow groundwater, 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.
- **Following the completion of further ground investigation works to assess the risk from PFAS compounds at the site, the risk to controlled waters should be reassessed.**
- 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.

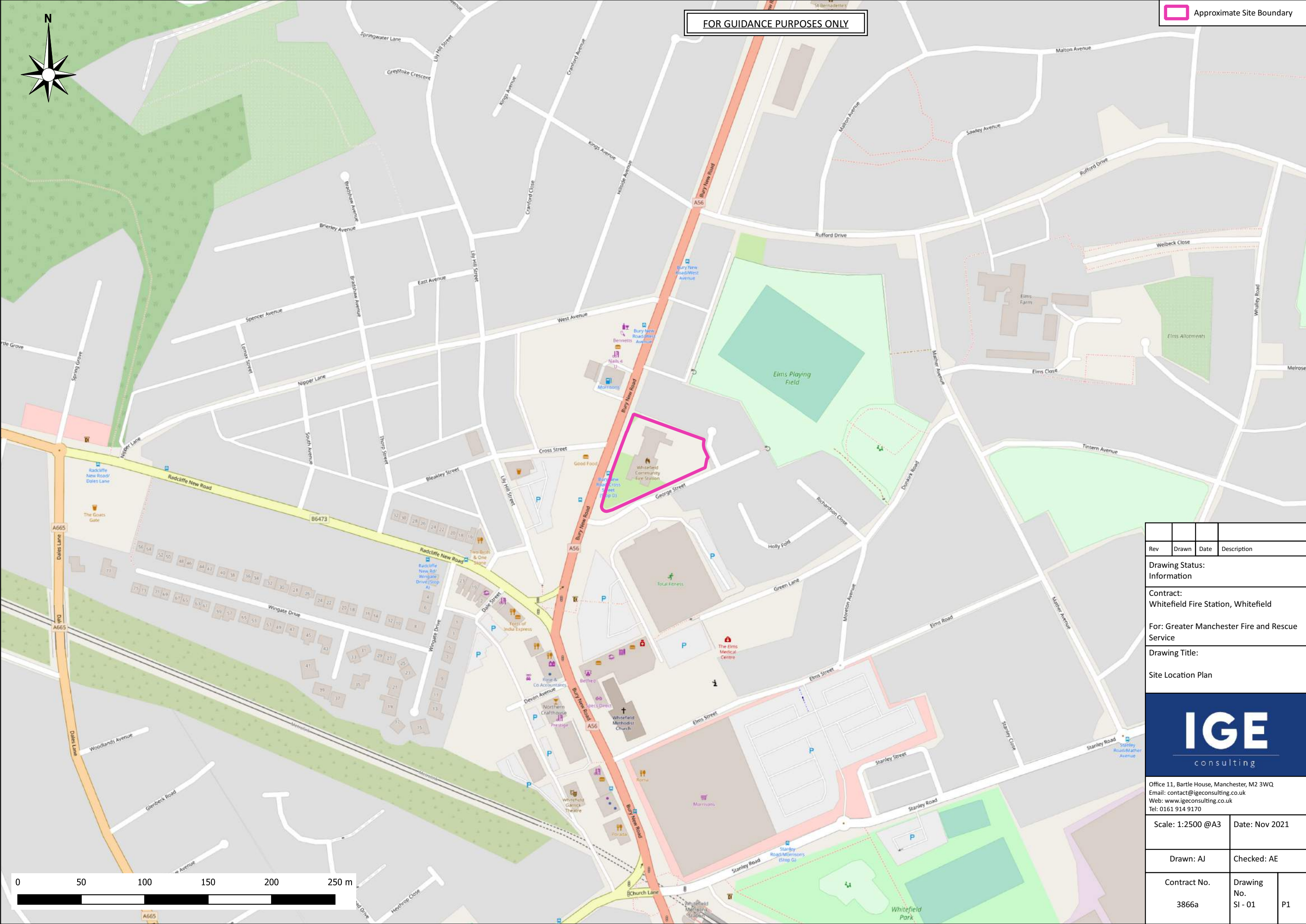
When investigating or developing potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and temporally. The absence of certain ground, ground gas, contamination or groundwater conditions at the positions tested is not a guarantee that such conditions 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

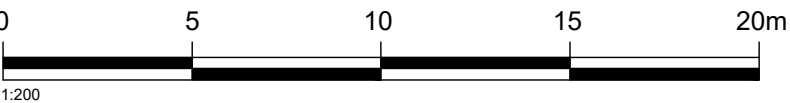
FIGURES AND DRAWINGS



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



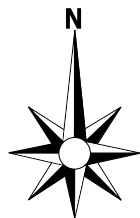
B G
& H

Architects
Consulting Engineers
Quantity Surveyors

21 Silverwell Street
Bolton
BL1 1PR
t: 01204 525321
email@bghbolton.co.uk
www.bghbolton.co.uk

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
		A1
dwg no		rev
1978.35.4203		P3



FOR GUIDANCE PURPOSES ONLY

- Approximate Site Boundary
- Proposed
- Cable Percussive Boreholes
- DCPs
- Dynamic Sample Boreholes
- Hand Dug pit



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			
IGEconsulting 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: Feb 2023	
Drawn: JH		Checked: AE	
Contract No. 3866a	Drawing No. SI-05	P1	

APPENDIX 3

CABLE PERCUSSION BOREHOLE LOGS



ver. 0.5

Sheet 1 of 1

Checked By: LM

Borehole terminated at 9.90m

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

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					

SPT Energy Ratio:

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 1 of 2

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380499E - 406486N

Level (mAOD):102.81

Dates:30/01/2023 - 31/01/2023

Weather:Overcast

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	102.76		ASPHALT. MADE GROUND	
					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	
		2.00 - 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	
		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)					
		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	
		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	

Remarks:
Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth.

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	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:

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 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		Borehole terminated at 19.95m.	19
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:									

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.
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		
				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			
SPT Energy Ratio:									

APPENDIX 4

DYNAMIC SAMPLE BOREHOLE LOGS

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. DS01 Sheet 1 of 1			
Project Name: Whitefield Fire Station				Co-ords: 380490E - 406496N		Project No. 3866a				
Location: Whitefield, Greater Manchester				Level (m AOD): 102.95		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						
					0.04	102.91		ASPHALT MADE GROUND		
					0.34	102.61		CONCRETE MADE GROUND		
								Light greyish brown clayey sandy angular to subangular fine to coarse GRAVEL of limestone and concrete. MADE GROUND		
		0.80	ES							
		0.80	PID	0.00ppm						
		1.00	SPT(C)	N=2 (2,0/1,0,0,1)						
					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	ES							
		1.50	PID	0.00ppm						
		2.00	D							
		2.00	SPT(C)	N=5 (4,2/1,1,1,2)						
		2.50	ES							
2.50	PID	0.00ppm								
			2.80	100.15		Very soft dark brown pseudofibrous PEAT GLACIOFLUVIAL SHEET DEPOSITS				
3.00	D									
3.00	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	D									
4.00	SPT(C)	N=6 (1,1/1,1,2,2)								
			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	D									
5.00	SPT(C)	N=11 (3,3/2,3,3,3)								
			5.45	97.50		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)	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%

IGEconsulting 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				
Weather:		Freezing							
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.05	102.62		ASPHALT MADE GROUND CONCRETE MADE GROUND	
		0.50 0.50	ES PID	0.00ppm	0.35	102.32		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 1.00 1.00	D ES SPT(C)	N=2 (1,0/1,0,1,0) 0.00ppm	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	PID		1.35	101.32		Very soft dark brown pseudofibrous PEAT. GLACIOFLUVIAL SHEET DEPOSITS	
		2.00 2.00	D SPT(C)	N=0 (1,0/0,0,0,0)	1.90	100.77		Soft locally very soft light grey mottled dark grey silty organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS	
					2.70	99.97		Very soft dark brown pseudofibrous clayey PEAT GLACIOFLUVIAL SHEET DEPOSITS	
		3.00 3.00	D SPT(C)	N=0 (1,0/0,0,0,0)	2.90	99.77		Very loose light grey mottled dark brown very silty fine to coarse SAND. GLACIOFLUVIAL SHEET DEPOSITS	
		4.00 4.00	D SPT(C)	N=9 (2,2/2,2,2,3)	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	
					4.40	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 5.00	D SPT(C)	N=29 (6,7/7,7,7,8)					
			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)	Diameter (mm)	
		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%	

IGEconsulting 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. DS03 Sheet 1 of 1						
Project Name: Whitefield Fire Station			Co-ords: 380521E - 406483N		Project No. 3866a					
Location: Whitefield, Greater Manchester			Level (m AOD): 102.62		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	102.57		ASPHALT MADE GROUND	1	
										CONCRETE MADE GROUND
						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	
		0.70	ES							
		0.70	PID	0.00ppm						
		1.00	SPT(C)	N=5 (1,1/1,1,2,1)		0.90	101.72		Soft locally very soft sandy organic CLAY. MADE GROUND	
		1.20	ES							
		1.20	PID	0.00ppm						
		1.60								
		2.00	D							
2.00	ES									
2.00	SPT(C)	N=5 (2,1/2,2,1,0)								
2.00	PID	0.00ppm								
2.50										
3.00	D									
3.00	SPT(C)	N=11 (2,2/3,2,3,3)								
3.70										
3.70										
4.00	SPT(C)	N=50 (2,3/4,8,18,20)								
4.38										
Dynamic Sample terminated at 4.38m.										
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%				

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. DS04			
Project Name: Whitefield Fire Station				Co-ords: 380456E - 406447N		Project No. 3866a				
Location: Whitefield, Greater Manchester				Level (m AOD): 103.45		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						
		0.15	ES		0.15	103.30	Soft dark brown sandy CLAY with roots and rootlets. TOPSOIL			
		0.50	PID	0.00ppm	0.50		Soft dark brown sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of brick fragments, clinker, concrete, ceramic and mudstone. MADE GROUND			
		0.75			0.75	102.70	Soft locally very soft dark brown organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS			
		1.00	D		1.00					
		1.00	SPT(C)	N=0 (1,0/0,0,0,0)	1.40	102.05	Very soft locally soft light grey mottled dark brownish grey silty sandy CLAY. GLACIOFLUVIAL SHEET DEPOSITS			
		1.50	ES		1.50					
		1.50	PID	0.00ppm	2.00					
		2.00	D		2.00					
		2.00	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			
		3.00	D		3.00					
3.00	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)	5.00			Light greyish brown sandy slightly clayey subangular to well rounded fine to coarse GRAVEL of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS				
5.00	SPT(C)	N=29 (5,5/7,8,7,7)	5.50	97.95						
6.00			6.00	97.45						
Dynamic Sample terminated at 6.00m.										
Remarks:				Water Strike		Casing Details		Sample Sleeve Runs		
				Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)
Dynamic sample progressed to target depth at 5.45m bgl.				1.40		3.00	115	0.00	1.00	87mm 90%
								1.00	2.00	87mm 100%
								2.00	3.00	77mm 85%
								3.00	4.00	77mm 90%
								4.00	5.00	67mm 85%
								5.00	6.00	67mm 80%

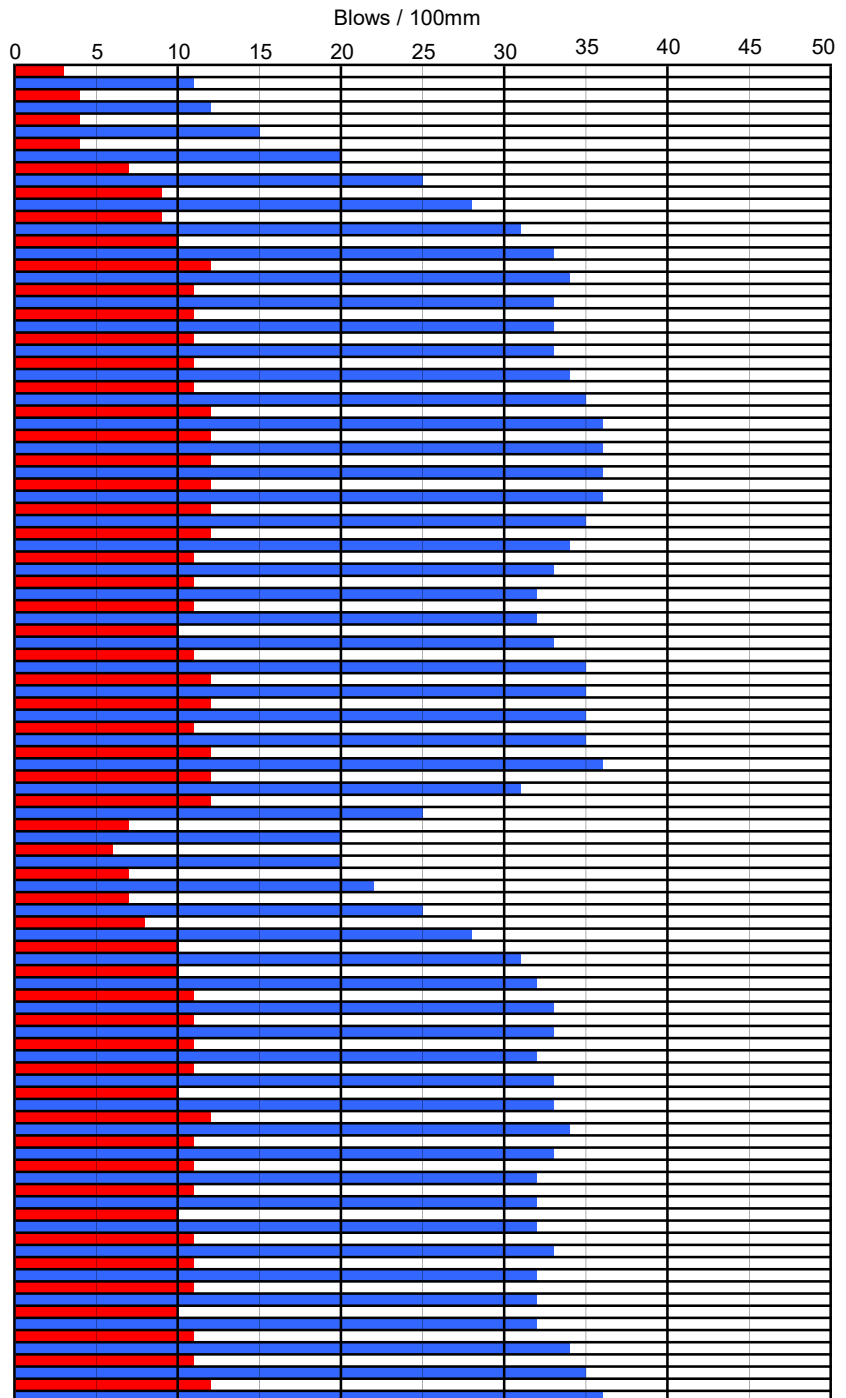


DYNAMIC PROBE TEST RESULTS SHEET

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

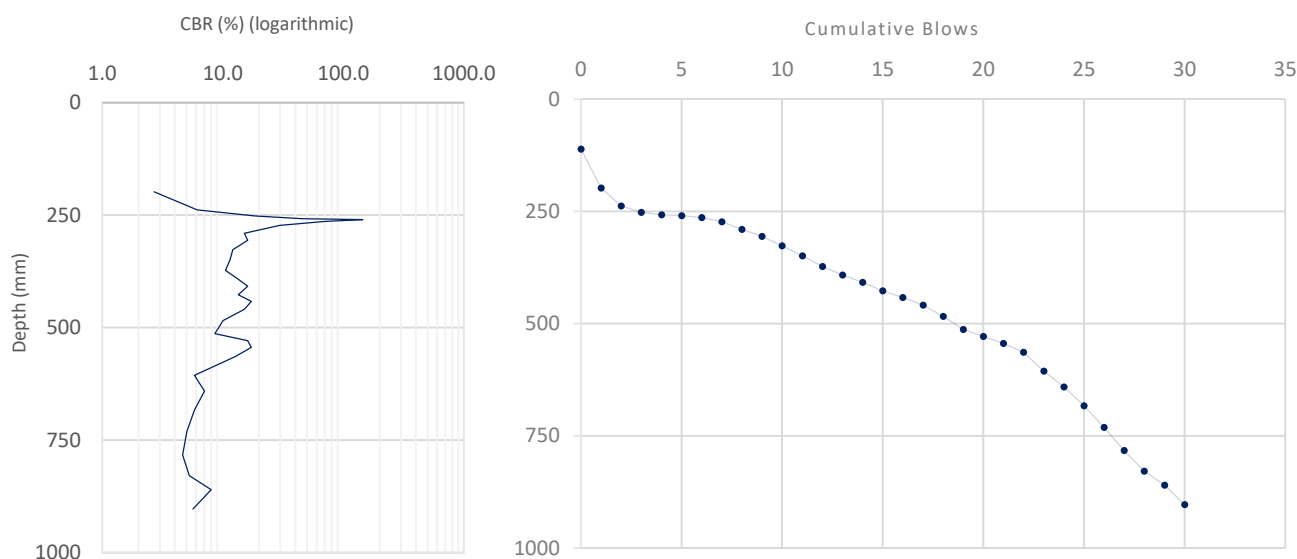
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

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)

DYNAMIC CONE PENETROMETER TEST RESULTS

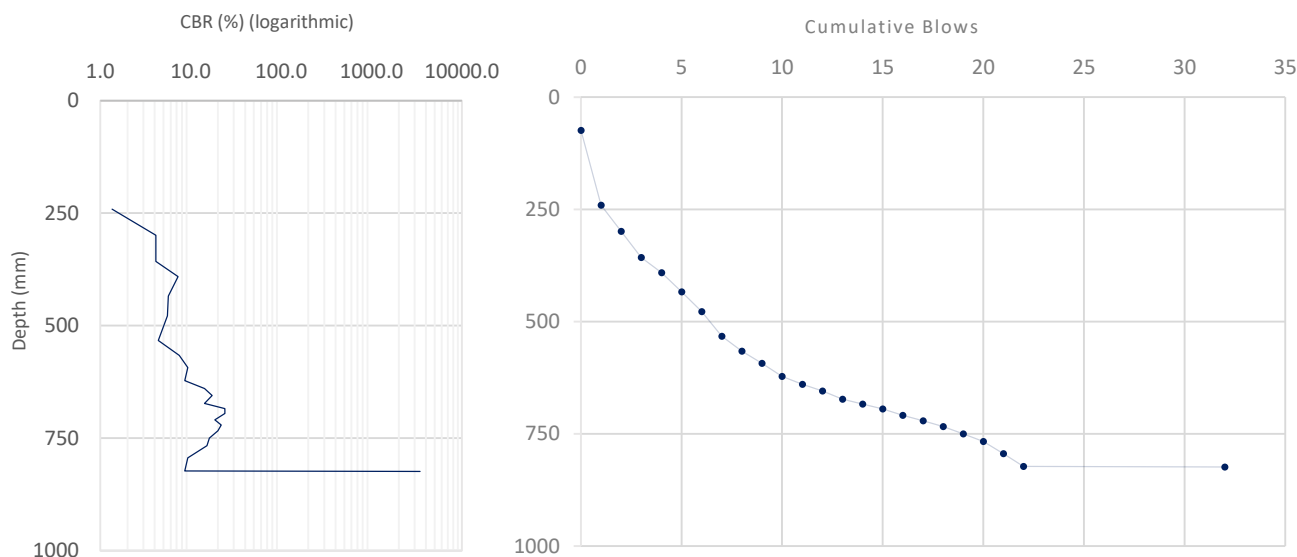
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

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: $\log_{10}(\text{CBR}) = 2.480 - 1.057 \times \log_{10}(\text{mm/blow})$
Termination Reason:	Target Depth
Notes	None

Layer	Cumulative Blows	Total Depth (mm)	Layer Thickness * (mm)	CBR Value (%)
1	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

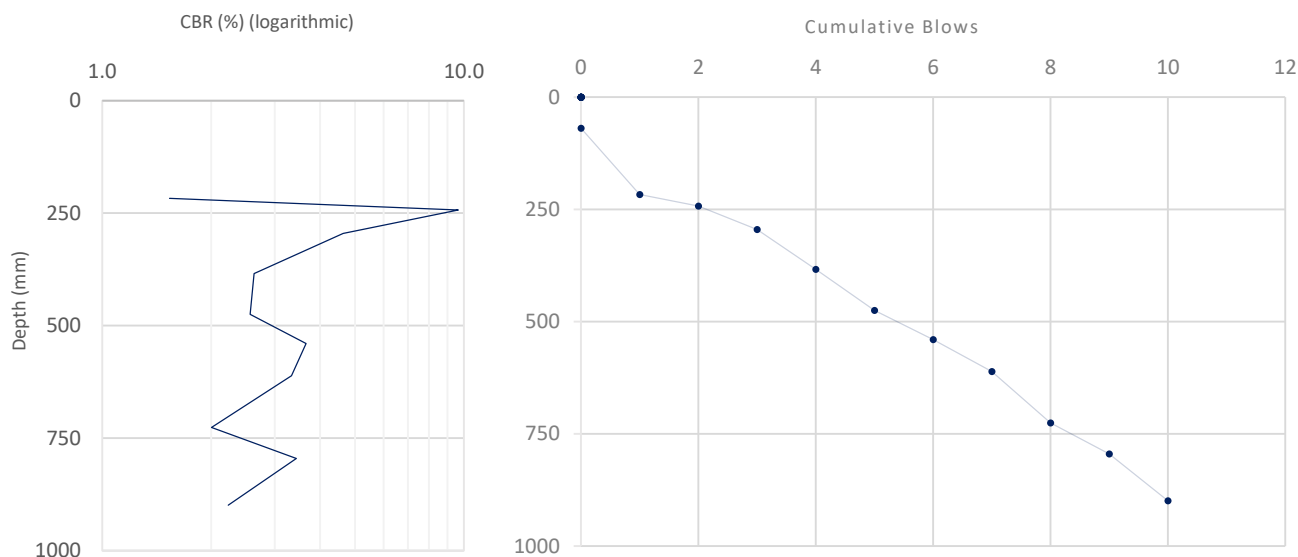
Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

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.		

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

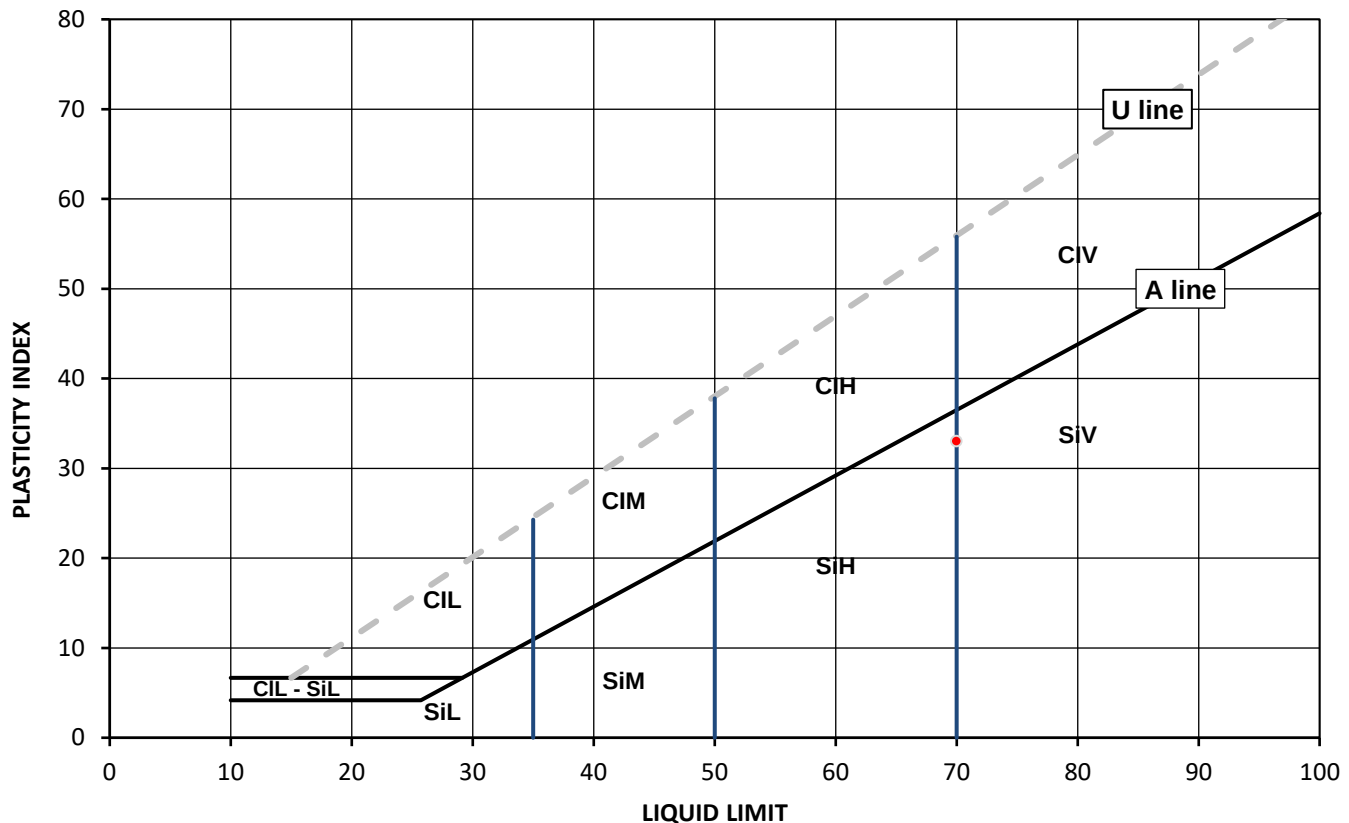
Test Results:

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	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:

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

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

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

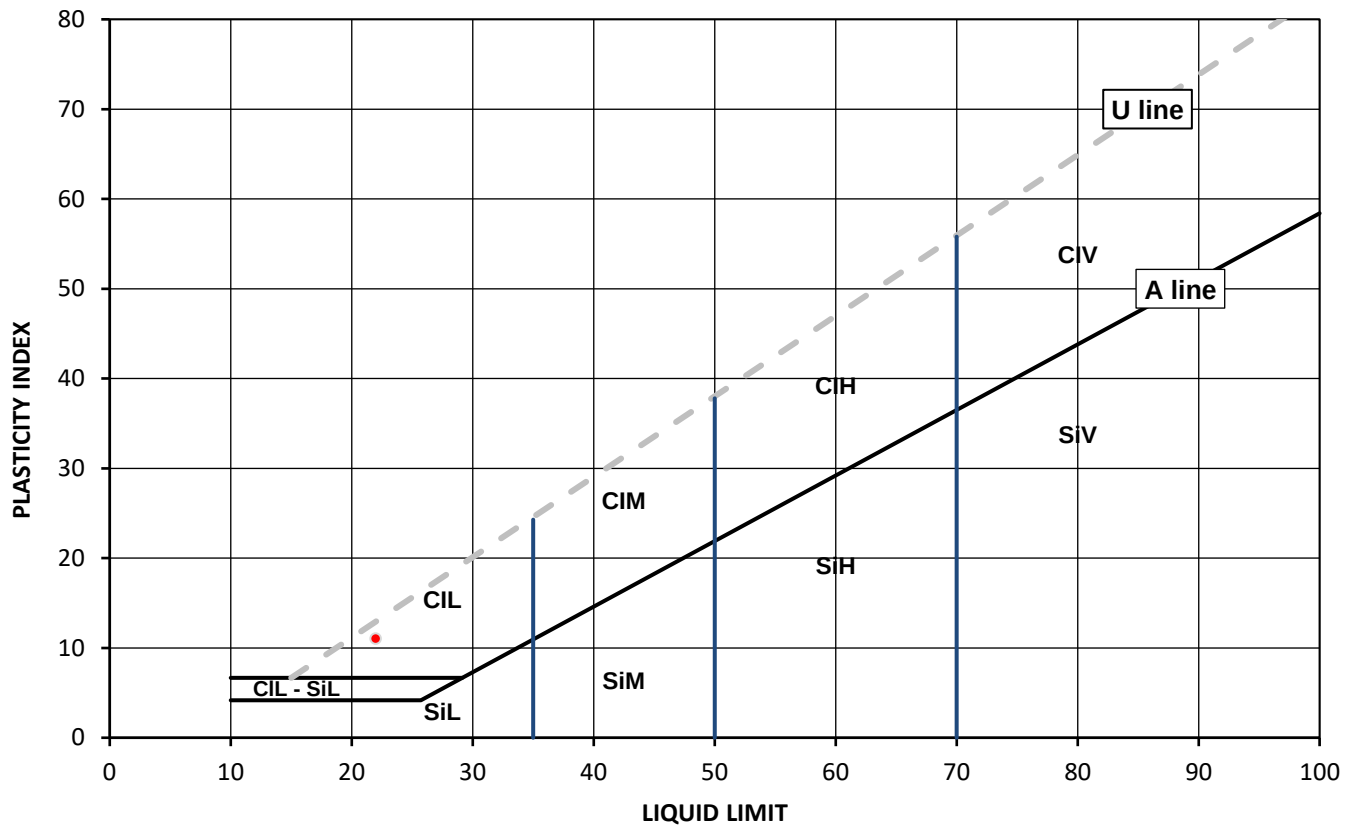
Test Results:

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

Cl	Clay	Plasticity	L	Low	Liquid Limit	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

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

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

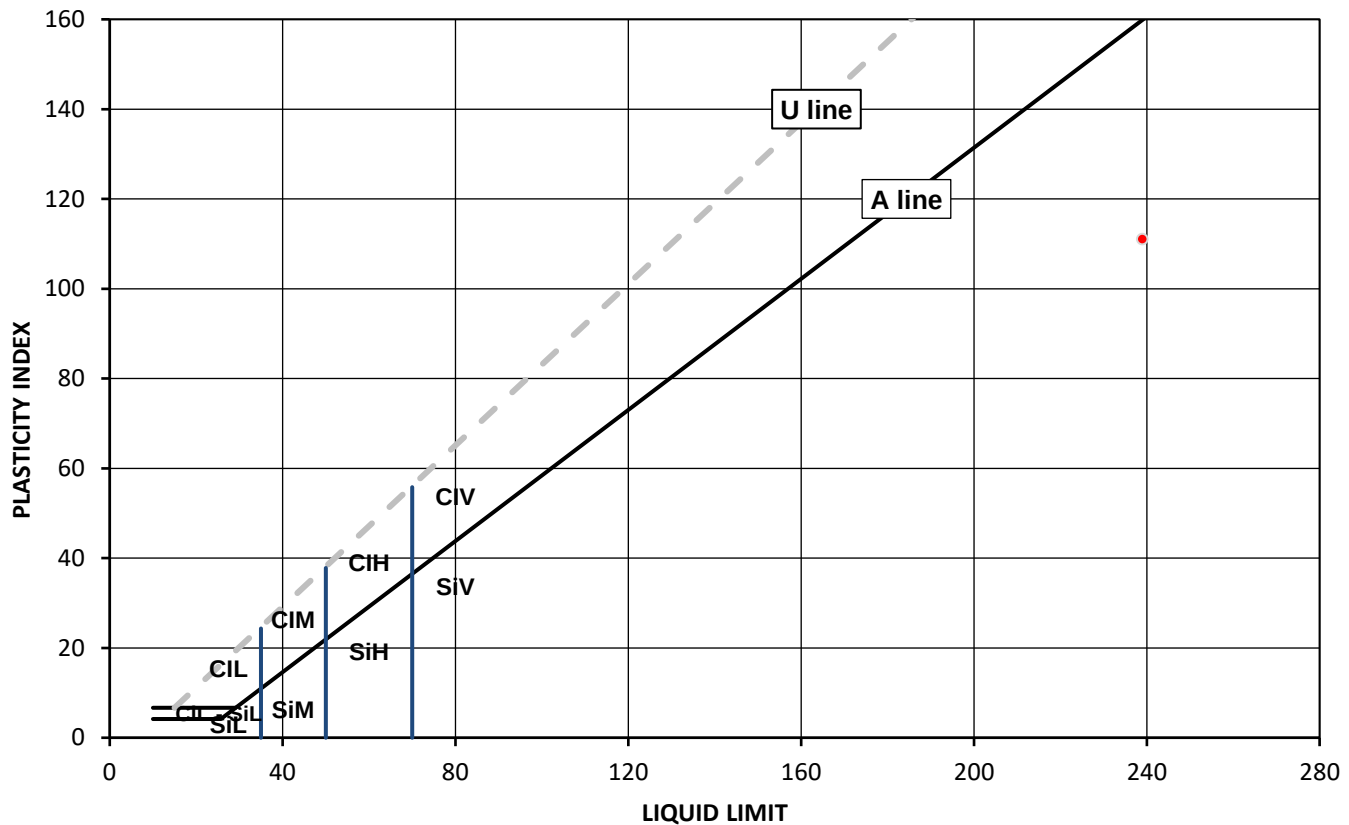
Test Results:

Laboratory Reference: 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

	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:

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

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

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

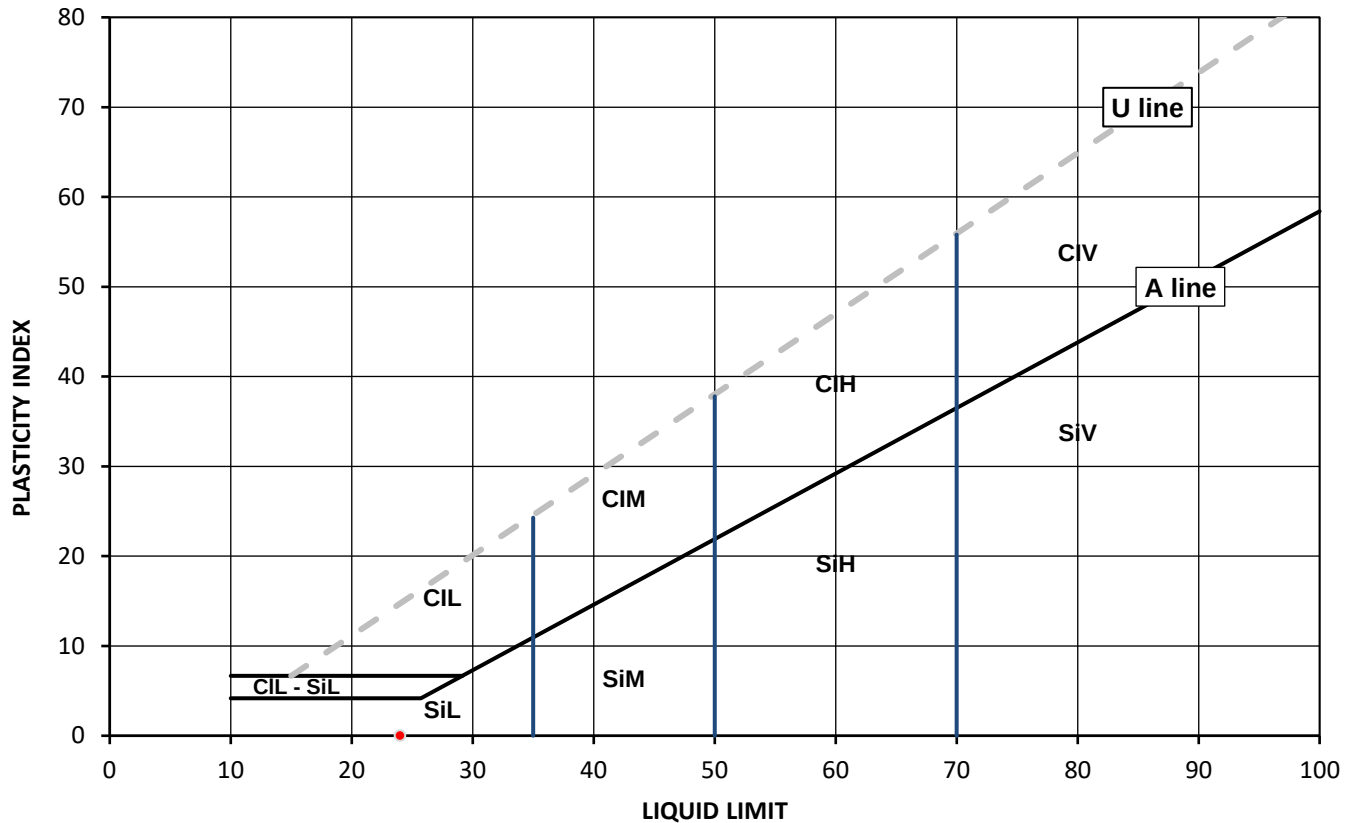
Test Results:

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

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

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

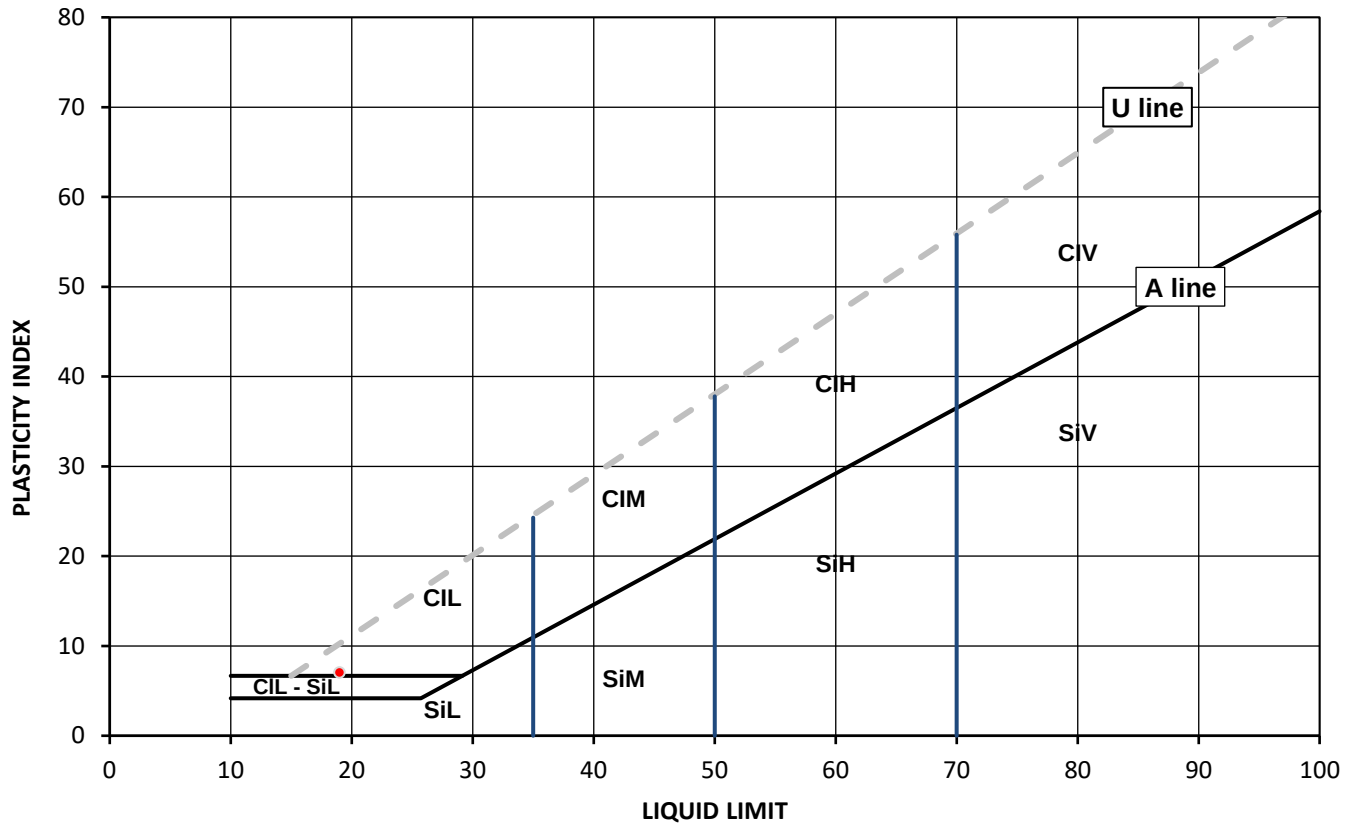
Test Results:

Laboratory Reference: 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
		50 to 70
		exceeding 70
		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

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



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

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



4041

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

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

Signed:

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

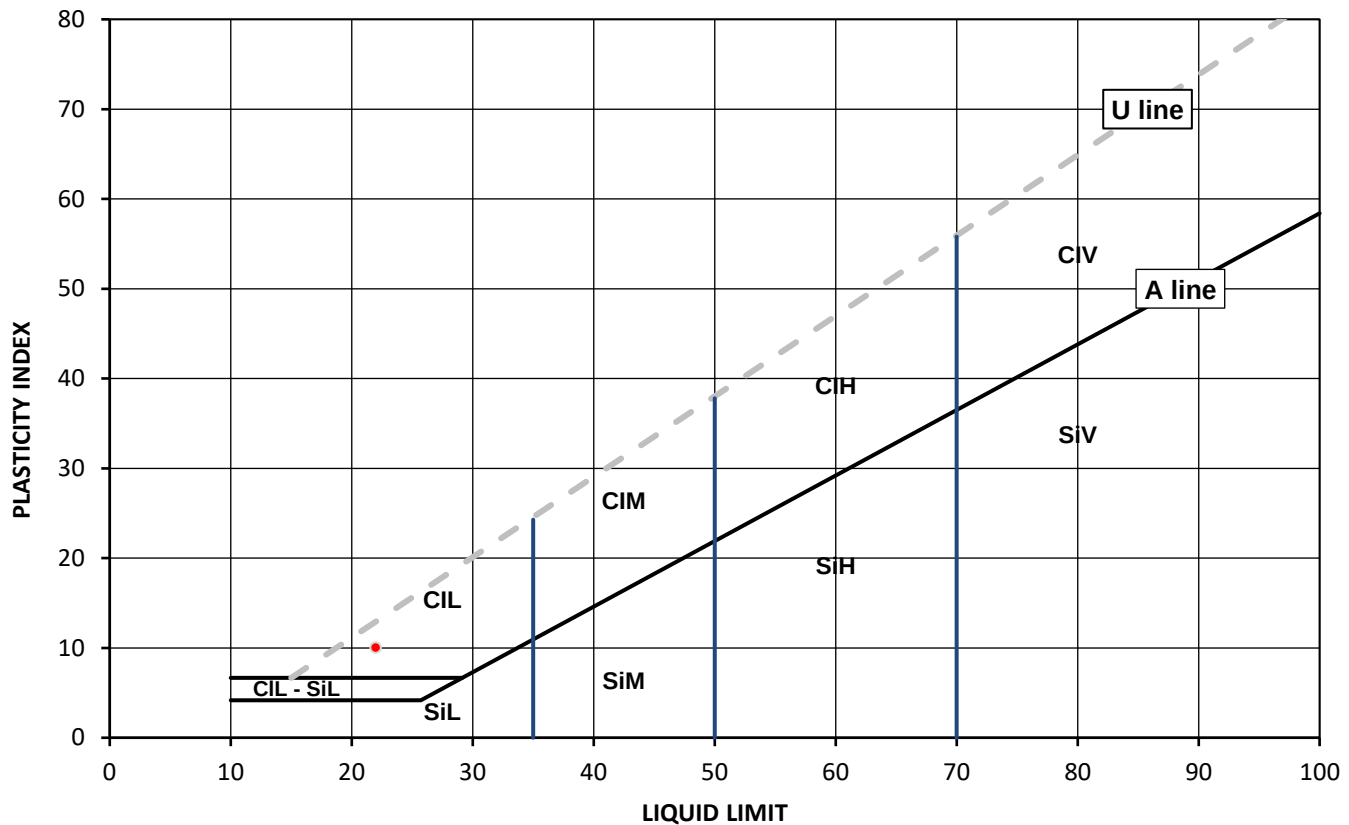
Test Results:

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	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:

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

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

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

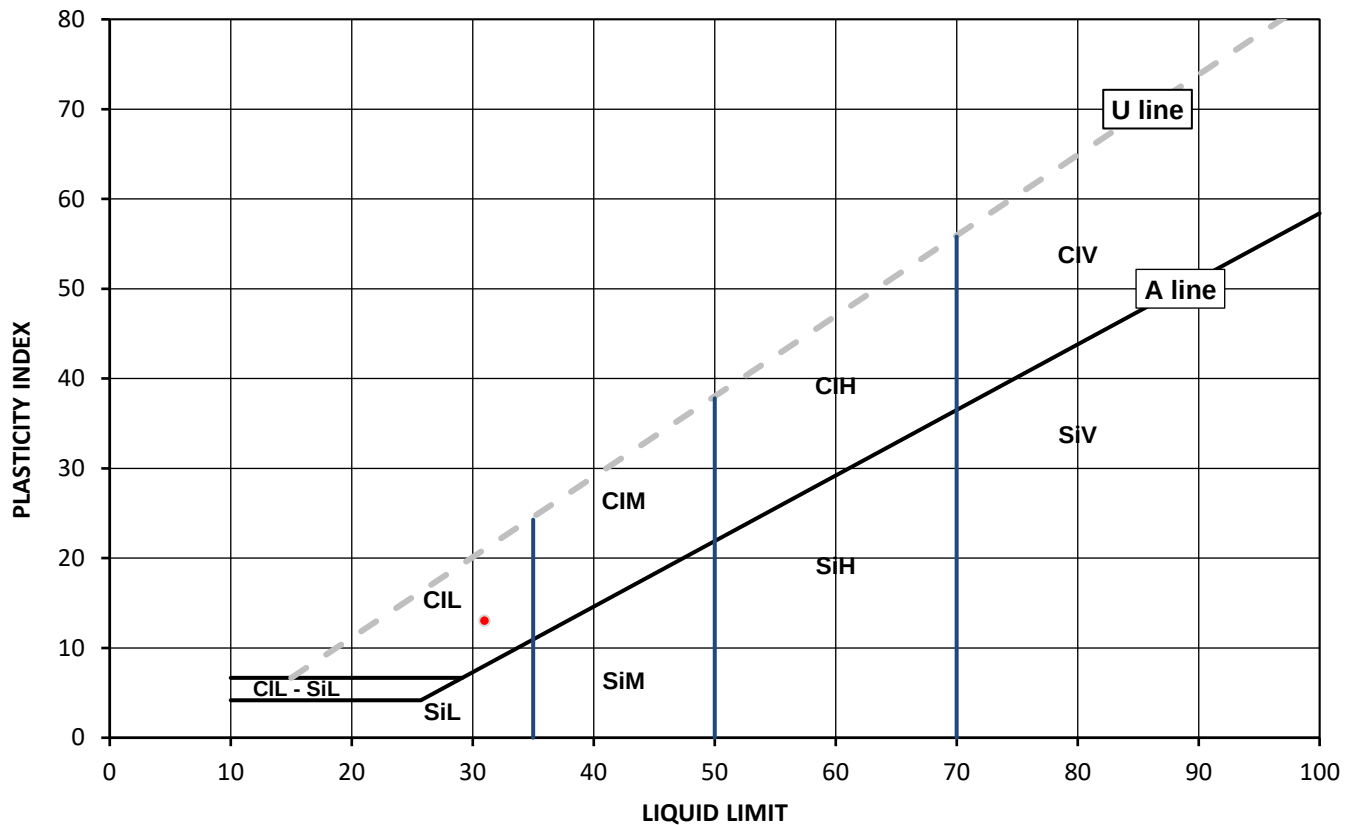
Test Results:

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:

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

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

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

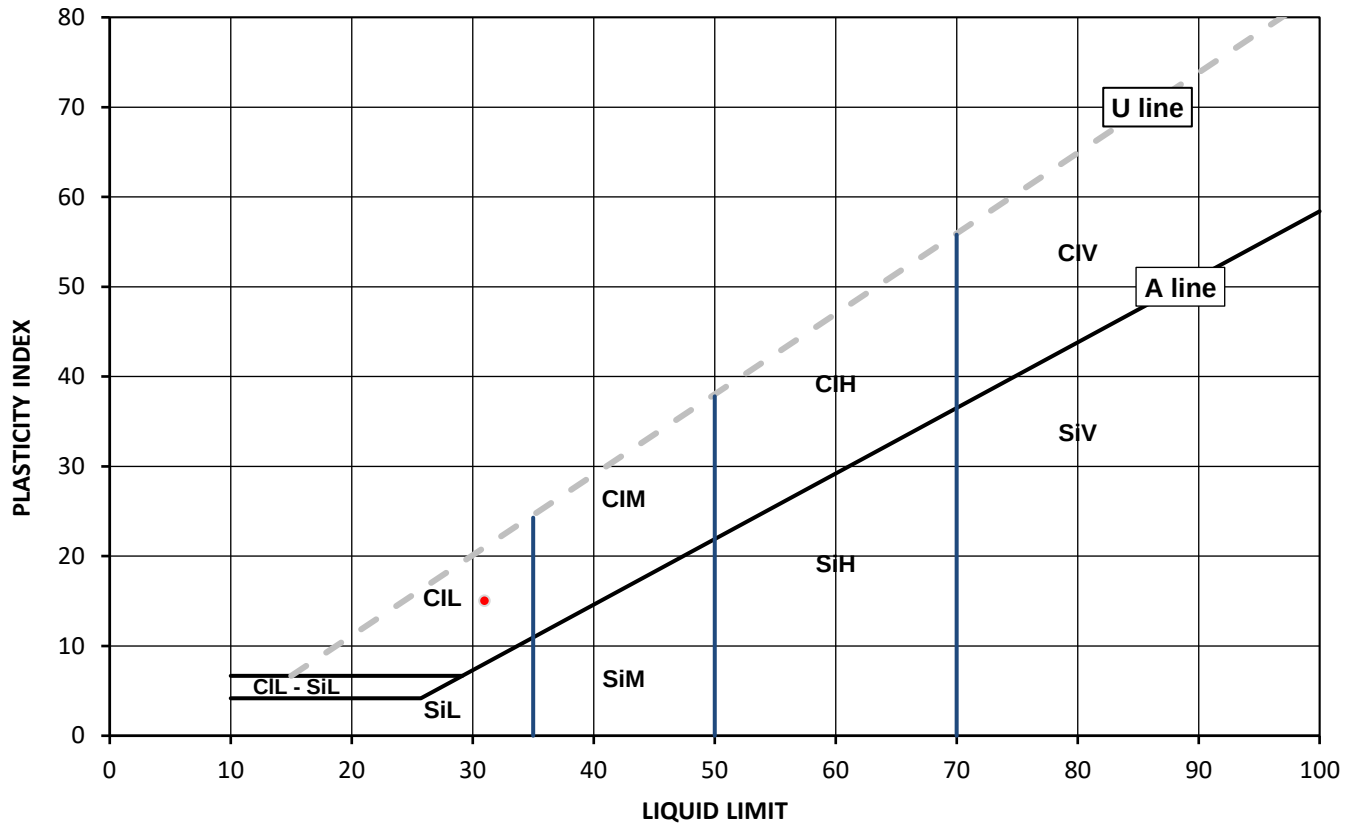
Test Results:

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:

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

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

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

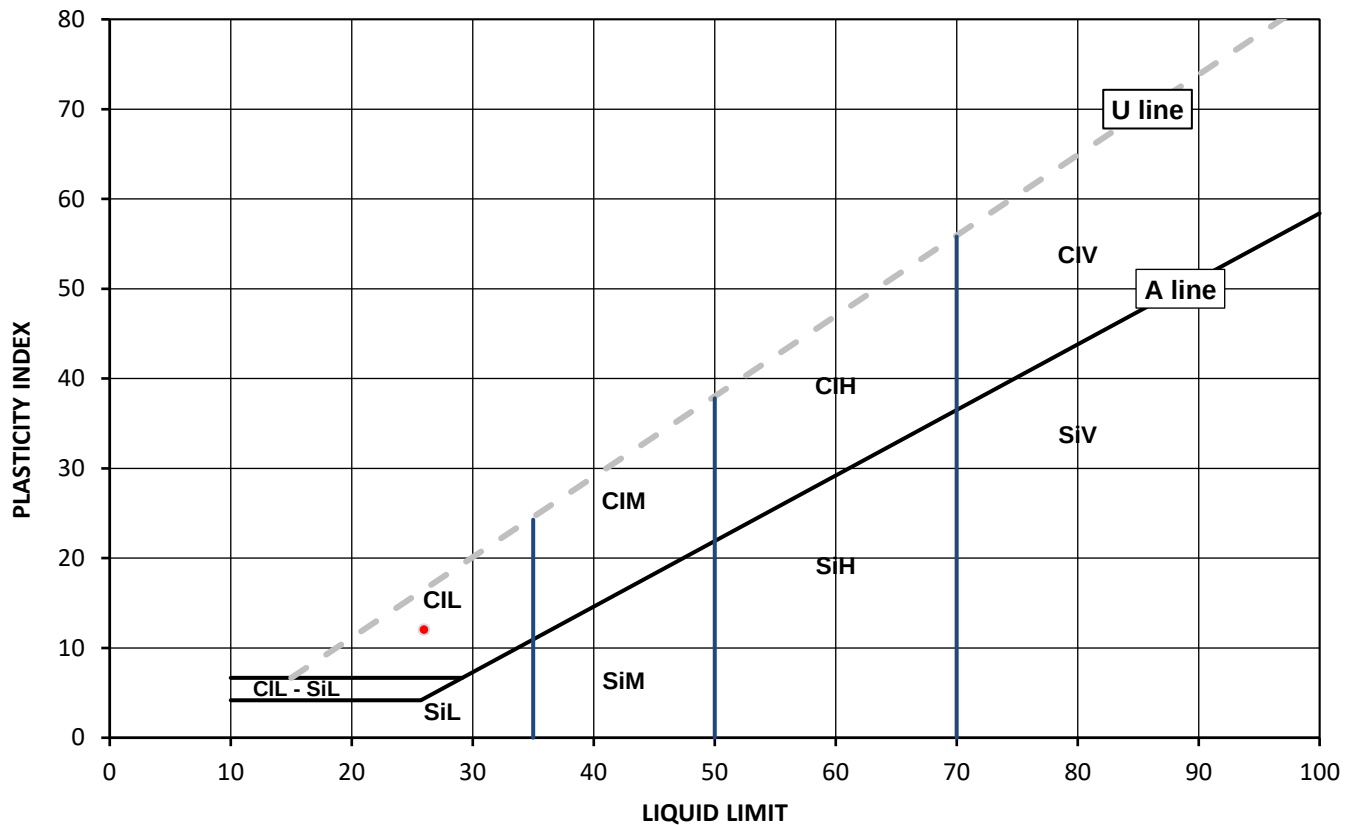
Test Results:

Laboratory Reference: 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:

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

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

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

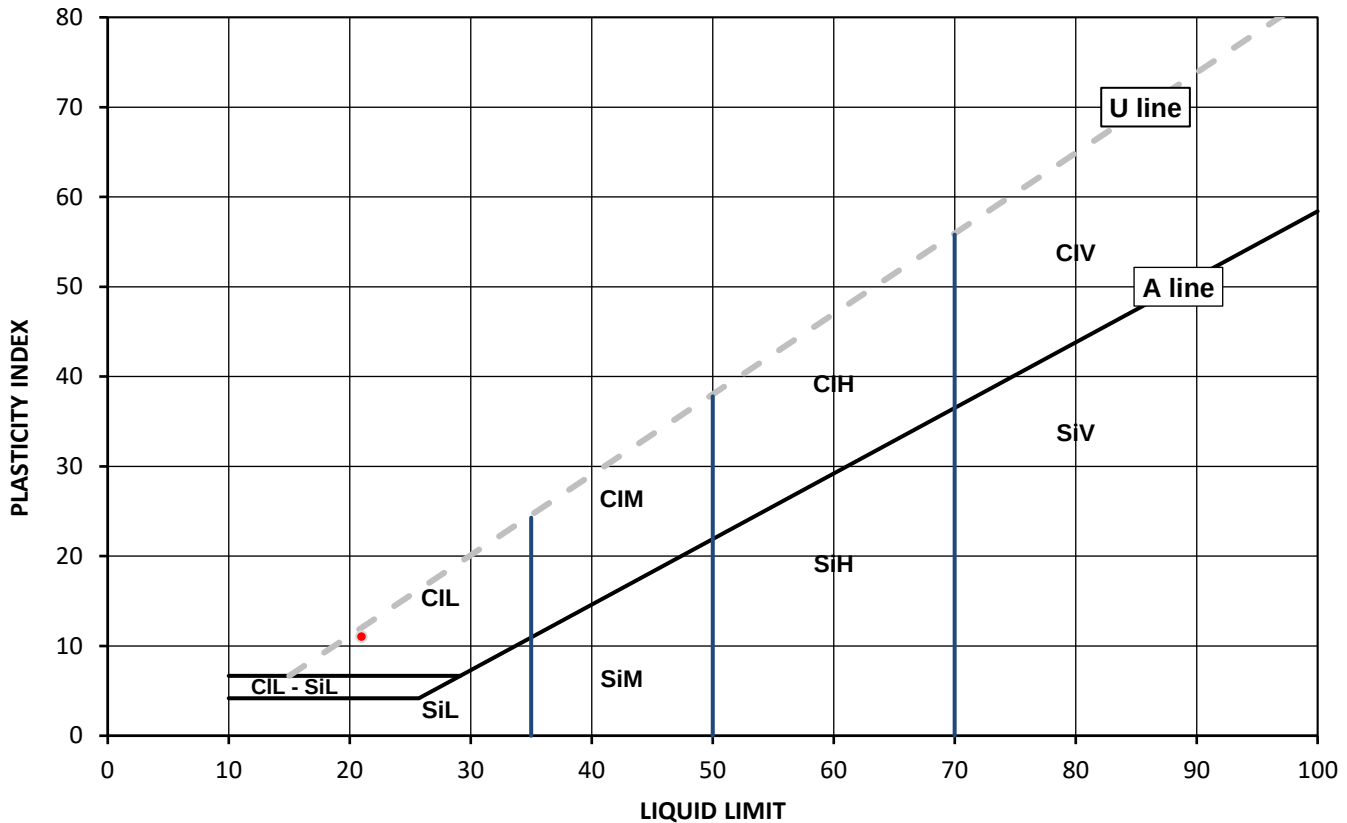
Test Results:

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

Cl	Clay	Plasticity	Liquid Limit
Si	Silt	L Low	below 35
		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

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



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	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m						%	%	%	%	Mg/m3	Mg/m3	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

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

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



4041

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

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

Signed:

Katarzyna Koziel

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

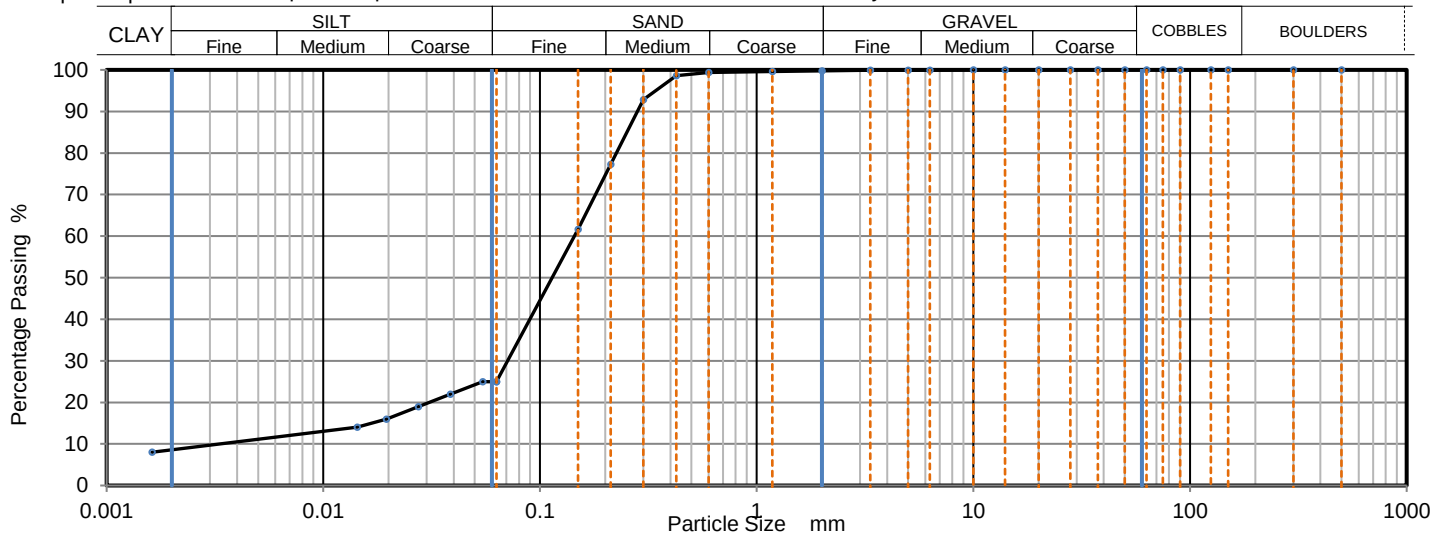
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

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

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

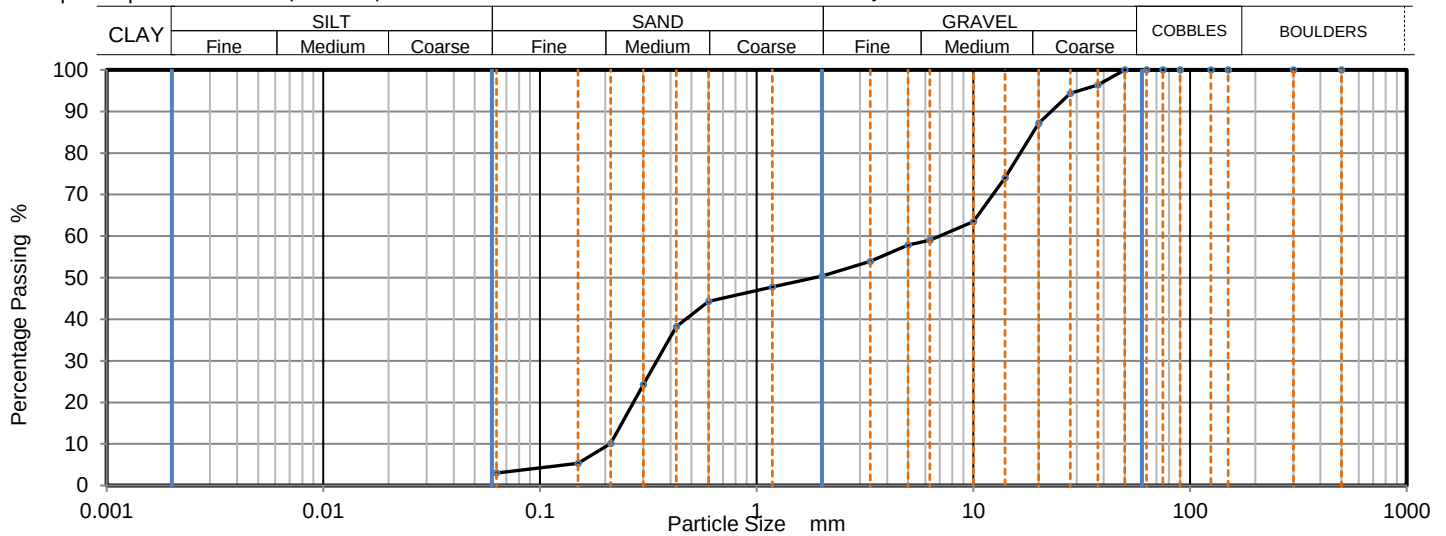
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 15/02/2023
Sampled By: Client - LM

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	33
Curvature Coefficient	0.081

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

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

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

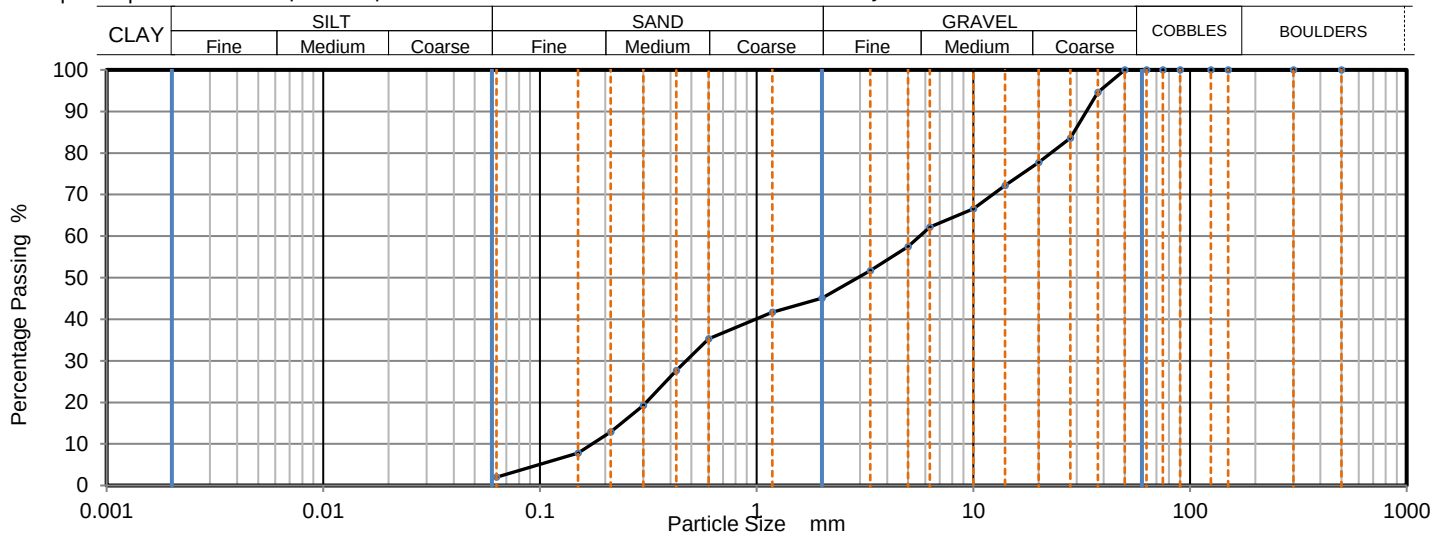
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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

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

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

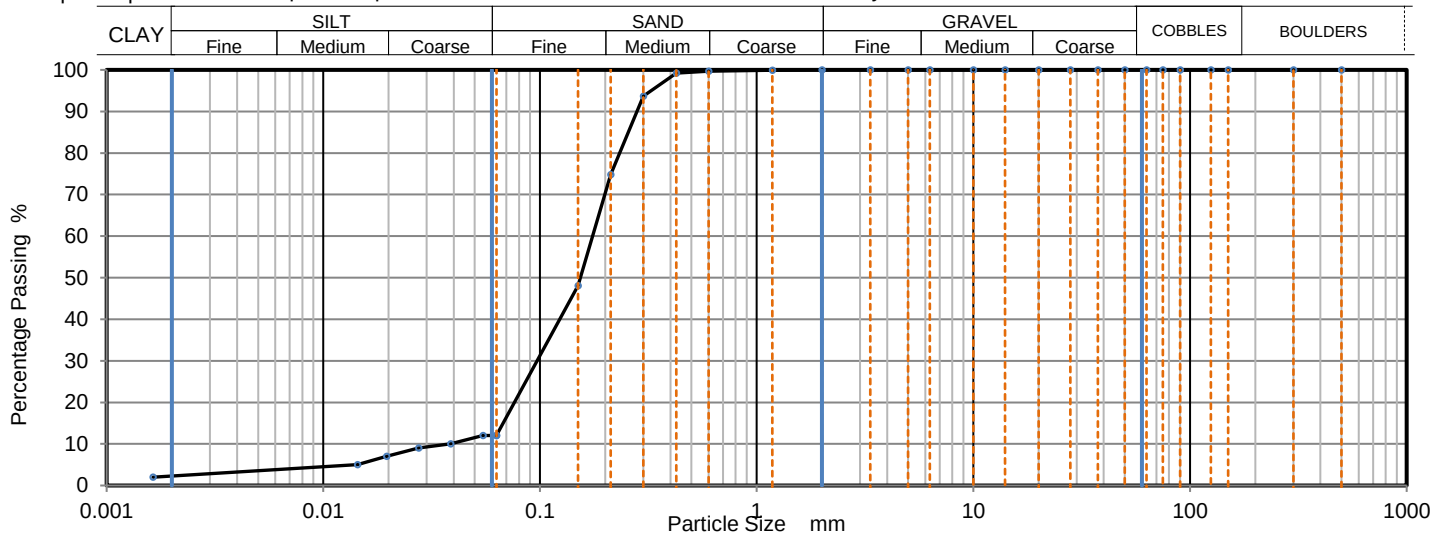
Client Reference: 3866A
Job Number: 23-16643-1
Date Sampled: Not Given
Date Received: 09/02/2023
Date Tested: 17/02/2023
Sampled By: Client - LM

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	4.8
Curvature Coefficient	1.5

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

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

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:

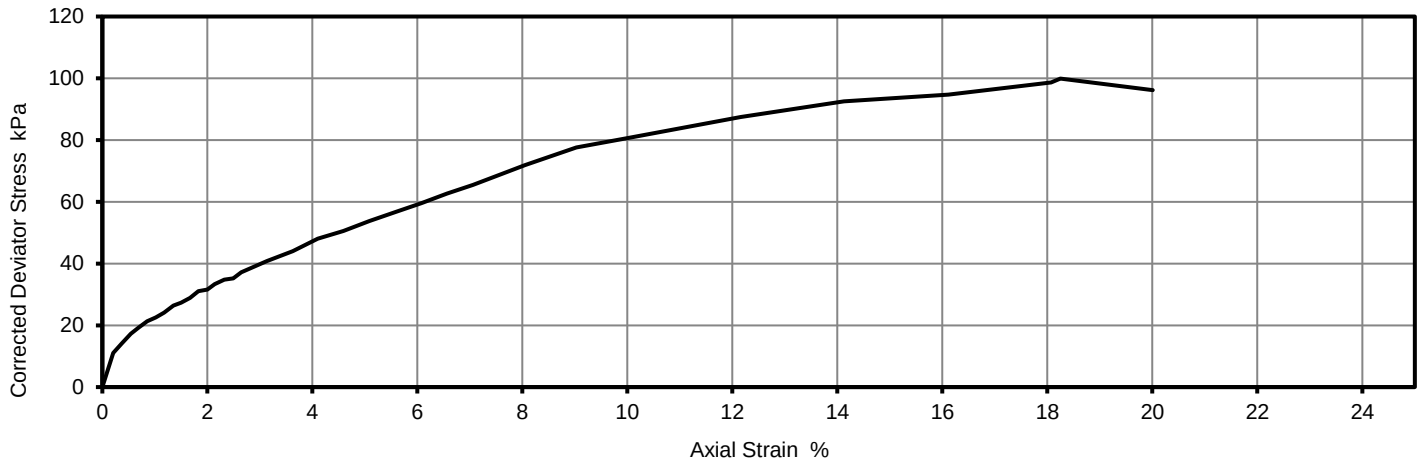
Laboratory Reference: 2579356
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

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

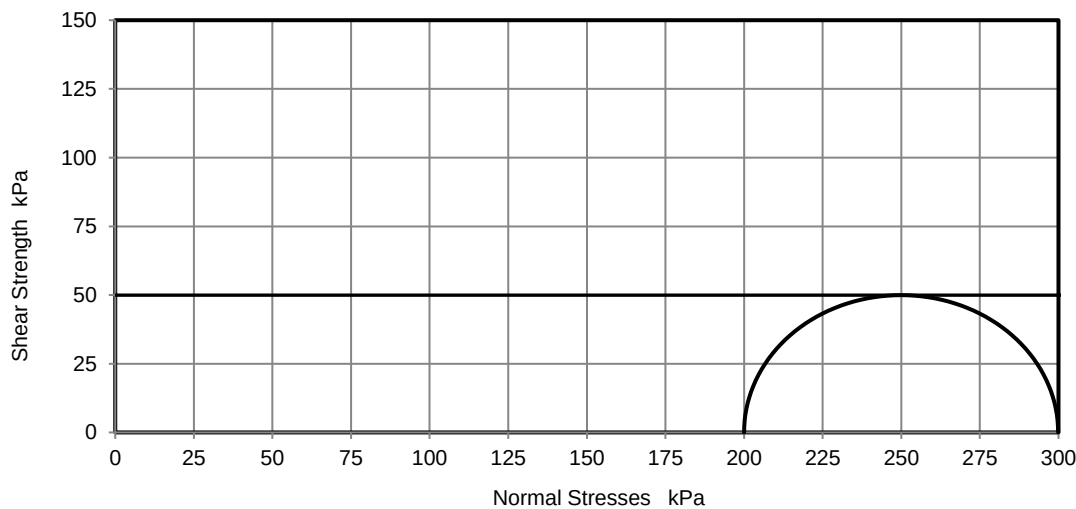
Test Number	1
Length	140.85 mm
Diameter	69.54 mm
Bulk Density	2.00 Mg/m ³
Moisture Content	25 %
Dry Density	1.59 Mg/m ³
Membrane Correction	1.28 kPa

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

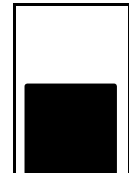
Deviator Stress v Axial Strain



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:

Katarzyna Koziel

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

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

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

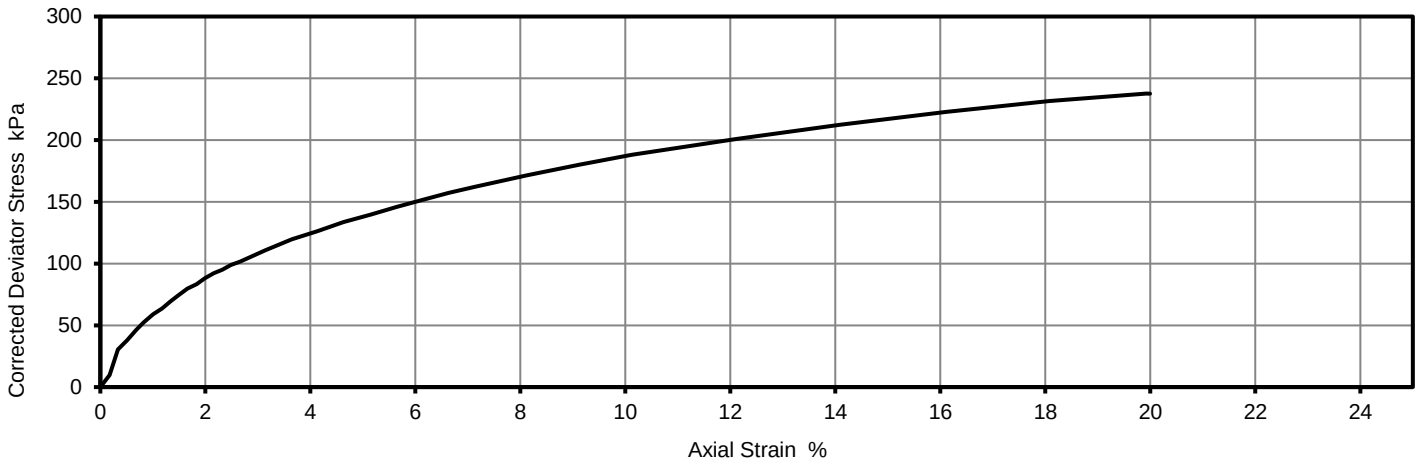
Test Results:

Laboratory Reference: 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.

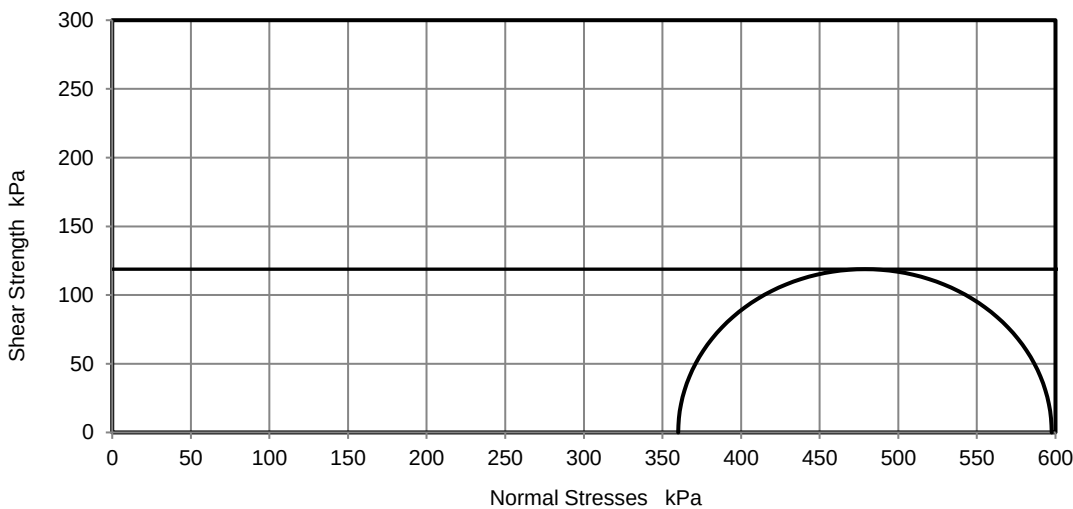
Depth Top [m]: 18.00
Depth Base [m]: Not Given
Sample Type: U

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

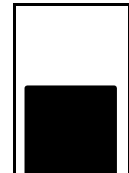
Deviator Stress v Axial Strain



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

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

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

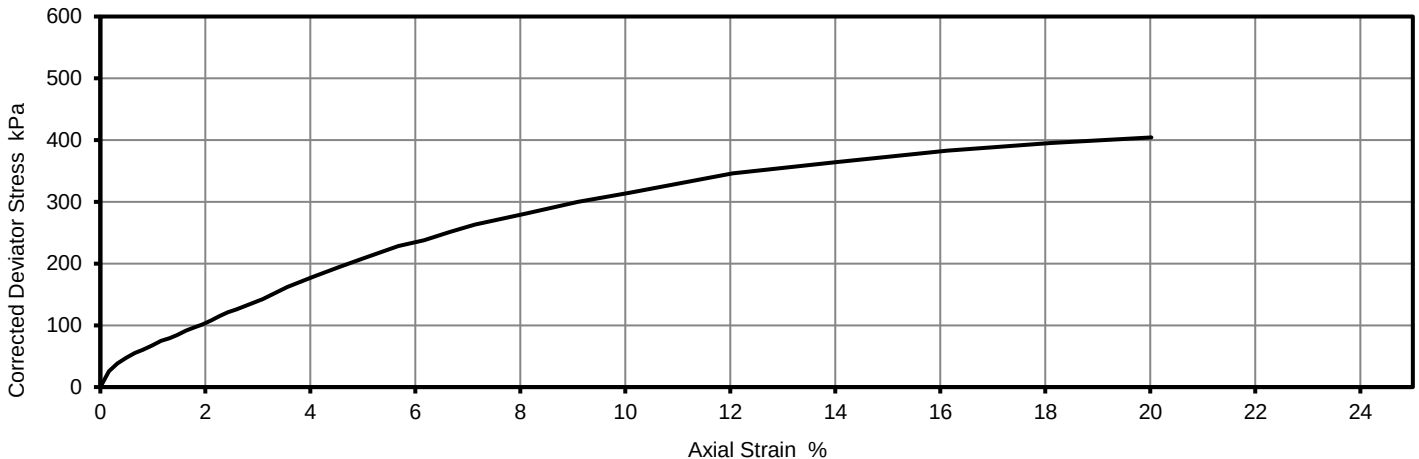
Test Results:

Laboratory Reference: 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.

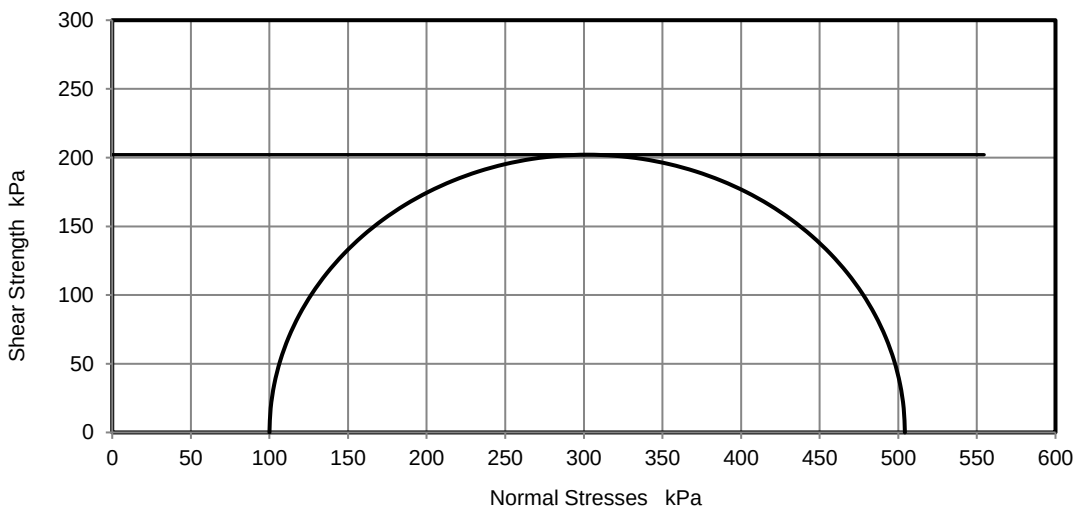
Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1	Rate of Strain	2.00	%/min
Length	141.51	Cell Pressure	100	kPa
Diameter	68.84	Axial Strain at failure	20.0	%
Bulk Density	2.29	Deviator Stress, ($\sigma_1 - \sigma_3$) _f	404	kPa
Moisture Content	12	Undrained Shear Strength, c_u	202	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Dry Density	2.04	Mode of Failure	Compound	
Membrane Correction	1.34	Latex membrane thickness	0.24	mm

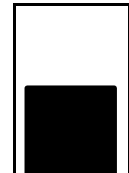
Deviator Stress v Axial Strain



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

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

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

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

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

Analytical Report Number: 22-14159
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
-----------------------------	-------	-----	-----------	--------	--------	------	-----	------

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	-	-
-----------------------------	-------	-----	-----------	---	------	--------	---	---

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

*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				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	-
-----------------------------	-------	-----	-----------	---

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

*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

* 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				

APPENDIX 8

CHEMICAL LABORATORY SCREENING TABLES



Project: Whitefield Fire Station

Job No: 3866a

Lab Sample Number			2539266	2539267	2539268	2539269	2539270	2539271	2539272	2539273	GAC - S4UL unless stated											
Sample Reference			DS01	DS01	DS02	DS02	DS03	DS03	DS04	DS04	Statistical Analysis					Statistical Results						
Sample Number			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												
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												
Analytical Parameter (Soil Analysis)		Units	LoD																			
Stone Content		%	0.1	77	0.1	0.1	0.1	0.1	0.1	0.1	8	27.19	0.1	77.0	9.7	77.0						
Moisture Content		%	0.01	5.5	25	10	28	27	13	17	8	8.52	5.50	28.00	18.69	28.00						
Total mass of sample received		kg	0.001	0.9	0.9	1	1	1	1	1	8	0.05	0.900	1.000	0.975	1.000						
Asbestos in Soil Screen			Type	N/A	Not-detected							8					-	-	-	-		
General Inorganics																						
pH - Automated		pH Units	N/A	8.6	6.8	10.1	7.3	7.3	7.4	7	8	1.10	6.80	10.10	7.71							
Total Cyanide		mg/kg	1	1	1	1	1	1	1	1	8	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	8	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	8	66.30	20.00	180.00	86.25							
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	8	0.03366	0.01000	0.09200	0.04363							
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	8	33.82	10.20	92.10	43.59							
Organic Matter (automated)		%	0.1	0.3	3	0.7	11	12	1.9	6.1	8	4.59	0.30	12.00	4.64							
Water Soluble Nitrate (2:1) as NO3		mg/kg	2	3	13	2	3.5	26	12	2.5	8	11.10	2.00	30.00	11.50							
Water Soluble Nitrate (2:1) as NO3 (leachate equivalent)		mg/l	5	5	6.2	5	5	13	6	5	8	4.06	5.00	15.00	7.53							
Speciated PAHs																						
Naphthalene		mg/kg	0.05	0.05	0.05	1.7	0.37	0.05	0.27	0.05	8	0.57	0.05	1.70	0.32	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	8	0.32	0.05	0.95	0.17	0.95	97000	Pass	0			
Acenaphthene		mg/kg	0.05	0.05	0.05	7.7	0.72	0.05	0.26	0.05	8	2.67	0.05	7.70	1.12	7.70	97000	Pass	0			
Fluorene		mg/kg	0.05	0.05	0.05	5.9	0.69	0.05	0.43	0.05	8	2.03	0.05	5.90	0.91	5.90	68000	Pass	0			
Phenanthrene		mg/kg	0.05	0.09	0.05	0.34	38	4.7	0.27	0.05	8	13.09	0.05	38.00	5.96	38.00	22000	Pass	0			
Anthracene		mg/kg	0.05	0.05	0.06	11	1.2	0.05	1.6	0.05	8	3.79	0.05	11.00	1.76	11.00	540000	Pass	0			
Fluoranthene		mg/kg	0.05	0.17	0.05	0.65	47	6.3	0.14	0.05	8	16.20	0.05	47.00	8.17	47.00	23000	Pass	0			
Pyrene		mg/kg	0.05	0.16	0.05	0.66	43	6.2	0.21	0.05	8	14.83	0.05	43.00	7.67	43.00	54000	Pass	0			
Benzo(a)anthracene		mg/kg	0.05	0.07	0.05	0.35	25	3.1	0.07	0.05	8	8.65	0.05	25.00	4.45	25.00	170.00	Pass	0			
Chrysene		mg/kg	0.05	0.07	0.05	0.31	22	2.7	0.11	0.05	8	7.58	0.05	22.00	3.79	22.00	350	Pass	0			
Benzo(b)fluoranthene		mg/kg	0.05	0.07	0.05	0.51	27	3.5	0.09	0.05	8	9.34	0.05	27.00	4.87	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	0.05	8	3.29	0.05	9.50	1.73	9.50	1200	Pass	0			
Benzo(a)pyrene		mg/kg	0.05	0.06	0.05	0.35	21	2.6	0.06	0.05	8	7.26	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	0.05	8	3.24	0.05	9.40	1.73	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	8	1.02	0.05	3.00	0.54	3.00	3.60	Pass	0			
Benzo(ghi)perylene		mg/kg	0.05	0.05	0.05	0.21	11	1.6	0.05	0.05	8	3.79	0.05	11.00	2.00	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	8	97.10	0.80	282.00	48.75							
Heavy Metals / Metalloids																						
Arsenic (aqua regia extractable)		mg/kg	1	1.9	3	2.6	34	14	5.3	32	8	13.72	1.30	34.00	11.76	34.00	640	Pass	0			
Barium (aqua regia extractable)		mg/kg	1	73	50	63	180	110	59	180	8	59.99	19.00	180.00	91.75	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	8	0.20	0.20	0.70	0.40	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	8	0.04	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	8	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	8	6.95	6.80	25.00	12.68	25.00	8600	Pass	0			
Copper (aqua regia extractable)		mg/kg	1	8.2	11	11	88	40	19	140	8	48.50	7.90	140.00	40.64	140.00	68000	Pass	0			
Lead (aqua regia extractable)		mg/kg	1	7.7	6.3	15	210	78	11	310	8	116.54	5.00	310.00	80.38	310.00	2330	Pass	0			
Mercury (aqua regia extractable)		mg/kg	0.3	0.3	0.3	0.3	1.2	0.5	0.3	0.7	8	0.02	0.30	1.20	0.49	1.20	1100	Pass	0			
Nickel (aqua regia extractable)		mg/kg	1	7	9.2	7.9	27	16	21	31	8	9.76	5.80	31.00	15.61	31.00	980	Pass	0			
Selenium (aqua regia extractable)		mg/kg	1	1	1	1	1	1	1	1	8	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	8	15.26	7.90	46.00	20.44	46.00	9000	Pass	0			
Zinc (aqua regia extractable)		mg/kg	1	36	21	36	180	83	45	210	8	75.06	17.00	210.00	78.50	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	8	0.00	0.10	0.10	0.10							
TPH C10 - C40		mg/kg	10	10	12	210	120	10	84	10	8	74.60	10.00	210.00	58.25							
TPH2 (C6 - C10)		mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	8	0.00	0.10	0.10	0.10							
TPH C6 - C40		mg/kg	10	10	12	210	120	10	84	10	8	74.60	10.00	210.00	58.25							
TPH (C10 - C25)		mg/kg	10	10	10	120	63	10	38	10	8	39.88	10.00	120.00	33.88							
TPH (C25 - C40)		mg/kg	10	10	10	96	61	10	45	10	8	32.79	10.00	96.00	31.50							

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
 Job No.: 3866a Date: 04.01.2023
 Engineer: AS Start time: 13:30
 Visit No.: 1 End time: 14:37

Recent weather: Overcast
 Air temperature: 11°C
 Cloud cover: 60%
 Wind 11.3 km/h SE

Precipitation: Light rain
 Ground condition: Damp
 Pressure trend: Rising
 On-site activities (e.g.construction): Fire station

2hr pre-visit pressure: 1009
 2hr post-visit pressure: 1011



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
 Job No.: 3866a Date: 16.01.2023
 Engineer: AS Start time: 09:18
 Visit No.: 2 End time: 10:20

Recent weather: Rain
 Air temperature: 2°C
 Cloud cover: 70%
 Wind 1.6 km/h SE

Precipitation: None
 Ground condition: Damp
 Pressure trend: Rising
 On-site activities (e.g.construction): Fire station

2hr pre-visit pressure: 988
 2hr post-visit pressure: 990



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
 Job No.: 3866a Date: 21.02.2023
 Engineer: AS Start time: 08:00
 Visit No.: 4 End time: 09:10

Recent weather: Rain
 Air temperature: 7°C
 Cloud cover: 80%
 Wind 3.15 km/h NW

Precipitation: None
 Ground condition: Damp
 Pressure trend: Falling
 On-site activities (e.g.construction): Fire station

2hr pre-visit pressure: 1018
 2hr post-visit pressure: 1016



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	0.0	0.0	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.