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## Whitefield Fire Station, Whitefield

### Hydrogeological Risk Assessment

For: Greater Manchester Combined Authority (GMCA)

**GMCA** GREATER  
MANCHESTER  
COMBINED  
AUTHORITY

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## 1.0 INTRODUCTION

IGE Consulting Ltd have been instructed by Greater Manchester Combined Authority (GMCA) to undertake a *Hydrogeological Risk Assessment* for the development at Whitefield Fire Station.

### 1.1 Brief

IGE Consulting Ltd (IGE) have previously completed Phase 1 and Phase 2 ground investigation works at the subject site. These report references are detailed below:

- **IGE Consulting Phase 1 Geo-Environmental Investigation** (Ref: 3866a-01, Rev A, dated February 2023)
- **IGE Consulting Phase 2 Geo-Environmental Investigation** (Ref: 3866a-02, Rev B, dated October 2023)

These reports were completed in support of a planning application to Bury Metropolitan Council Planning Authority (Ref: 69940). Following receipt of the Phase 1 report, the Environment Agency responded in October 2023 with two relevant draft conditions requiring attention (Ref: SO/2023/123503/01-L01).

**Draft Condition 6** - *A scheme for managing any borehole installed for the investigation of soils, groundwater or geotechnical purposes shall be submitted to and approved in writing by the local planning authority. The scheme shall provide details of how redundant boreholes are to be decommissioned and how any boreholes that need to be retained, post-development, for monitoring purposes will be secured, protected, and inspected. The scheme as approved shall be implemented prior to the occupation of any part of the permitted development.*

**Reason** - *To ensure that redundant boreholes are safe and secure, and do not cause groundwater pollution or loss of water supplies in line with paragraph 174 of the National Planning Policy Framework and Position Statement J of 'The Environment Agency's approach to groundwater protection'.*

**Draft Condition 7** - *Piling or any other foundation designs using penetrative methods shall not be permitted other than with the express written consent of the local planning authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to groundwater. The development shall be carried out in accordance with the approved details.*

**Reason** - *To ensure that the proposed piling, does not harm groundwater resources in line with paragraph 174 of the National Planning Policy Framework and Position Statement J of the 'The Environment Agency's approach to groundwater protection'.*

This report has been prepared to address the conditions detailed above. The report will include:

- Background on the site setting and any contamination;
- A summary of the Conceptual Site Model;
- Details of the proposed development and the selected foundation methodology;
- A Piling Risk Assessment in accordance with Environment Agency guidance on piling and pollution prevention ref. NC/99/73;
- Borehole decommissioning methodology; and
- Justification of foundations methodology selection and measures required to mitigate and associated risks.

## 1.2 Proposed Development

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 is contained in Appendix 2 and an extract is included below:

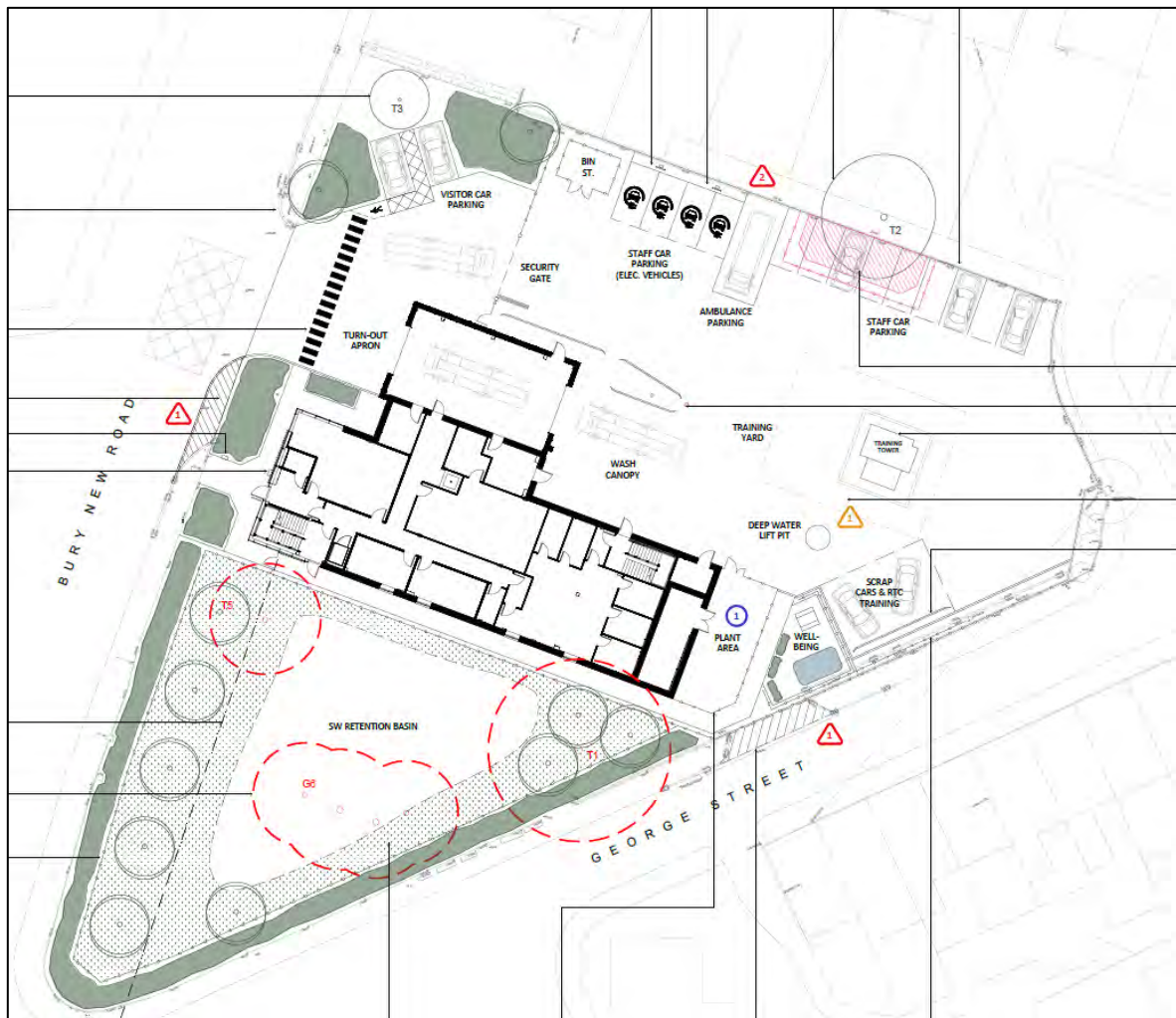


Figure 1: Extract of the Proposed Development Plan

## 1.3 Proposed Piling Methodology

This hydrogeological risk assessment has been prepared to demonstrate that the proposed piling methods are appropriate for the proposed development and do not create preferential pathways and thus to enable the discharge of the relevant above-

listed draft conditions. This report provides the context and framework for piling on land affected by contamination and provides justification for the choice of piling methodology for the proposed development and any mitigation measures that may be required.

The foundation solution will comprise bottom-driven steel tubular piles bearing onto the underlying stiff cohesive (clay) soils or medium dense becoming dense coarse (sand and gravel) soils encountered below 5.00m bgl. Though the final depth is unknown, it is anticipated that these piles will terminate at depths between 10.00 and 15.00m bgl – to be confirmed during piling works. The data sheet, containing key data including installation methods, for the above mentioned pile type is presented in Appendix 3.

The pile type should be confirmed by a specialist piling contractor and sufficient anchorage depth should be confirmed. The use of a raft foundation solution or ground improvement via vibratory stone columns is not recommended due to the presence of adjacent residential properties to the north and east and the potential impact to existing services on the site.

Established trees are present along the boundaries of the site and in the south western site section. The majority of the Made Ground was noted to be cohesive as well as the underlying superficial deposits. Due to the presence of this cohesive material, heave precaution should be considered, however, this should be confirmed by specialist piling contractors.

## 2.0 SITE SUMMARY

### 2.1 Site Location

The site is a c. 0.35 Ha area located at Whitefield Fire Station, 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.

### 2.2 Site Description

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.

### 2.3 Site History

Residential dwellings and allotment gardens were present on site from the earliest mapping records, until the existing fire station was constructed in the 1960s. The site has remained relatively unchanged since. No surface water features are present within 500m of the site.

### 2.4 Ground Conditions – Desk Study

#### 2.4.1 Superficial Geology and Hydrogeology

The BGS 1:50,000 Solid and Drift Geological Maps of the area (Sheet No: 85, Dated: 2010 and 2011 respectively) indicate that the majority of the site is underlain by superficial deposits comprising **Glacial Till** which typically comprises a heterogenous mixture of clays, sands and gravels and is classified as a Secondary (undifferentiated) Aquifer. The eastern site section is underlain by superficial deposits comprising **Glaciofluvial Deposits** which typically comprise sand and gravels and is classified as a Secondary (A) Aquifer.

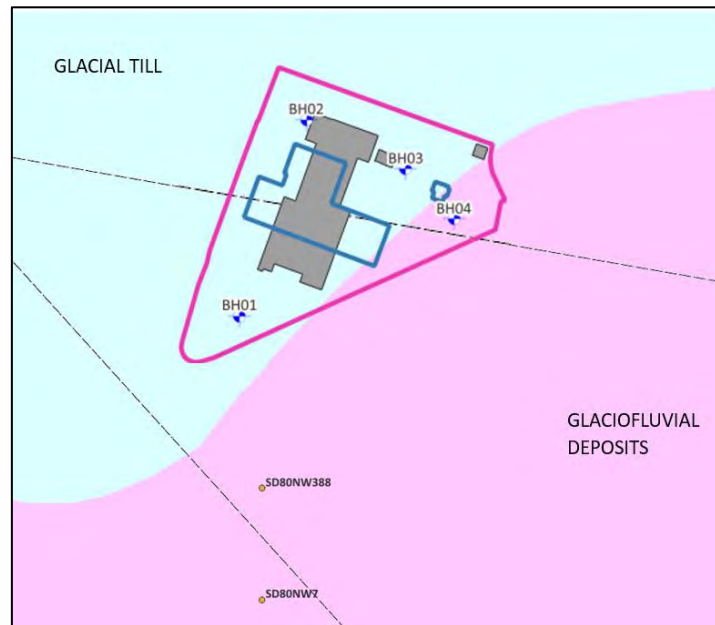


Figure 2: Superficial Geology

#### 2.4.2 Bedrock Geology and Hydrogeology

Two bedrock formations are shown beneath the site. The northern site section is underlain by the **Collyhurst Sandstone Formation** comprising sandstone and classified as a Principal Aquifer. The southern site section is underlain by **Manchester Marls Formation** comprising mudstone and classified as a Secondary (B) Aquifer. A fault is recorded to cross the site, downthrowing to the south.

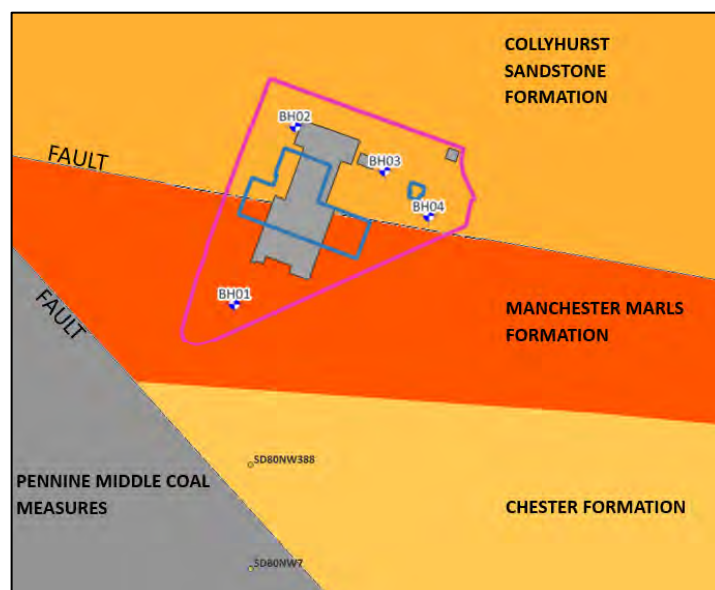


Figure 3: Bedrock Geology

Though not shown to be present beneath the site, the Chester Formation is classified as a Principal Aquifer. A fault (unconformity) is present to the south west of the site, accounting for the presence of the Pennine Middle Coal Measures, classified as a Secondary (A) Aquifer.

#### 2.4.3 BGS Borehole Logs

There are 2 No. BGS boreholes available in close proximity to the site within a comparable geological setting. These boreholes are shown on Figures 2 and 3 above, and the pertinent information from the borehole logs is outlined below:

##### BGS Borehole Reference: SDNW388

This borehole is located approximately c. 40m south east of the site and was progressed to a depth of 182m bgl in 2002. The log recorded the following pertinent information:

- Made Ground to 2.70m;
- Sands and Clays to 57.00m – inferred to be Glaciofluvial Deposits;
- Marls to 163m – inferred to be Manchester Marls and Chester Formation;  
and
- Sandstone to 182m – inferred to be Chester Formation.

Groundwater was encountered at c. 42m bgl.

##### BGS Borehole Reference: SD71NE7

This borehole is located approximately c. 70m south east of the site and was drilled to a depth of 152.70m bgl in 1933. The log recorded the following pertinent information:

- Sands and Clays to 57.91m – inferred to be Glaciofluvial Deposits;
- Marls to 122.22m – inferred to be Manchester Marls Formation; and
- Sandstones, Marls and Rock to 152.70m – inferred to be Chester Formation.

## 2.5 Ground Conditions – Intrusive Investigation

IGE completed 4 No. dynamic sampling boreholes, 3 No. cable percussion boreholes and 3 No. shallow concrete cores across the site. Foundation inspection pits and CBR determinations were also completed across the site, though are not relevant to this assessment. The exploratory hole logs are contained in Appendix 4 of this report. The investigation locations are shown on Figure 4, below.

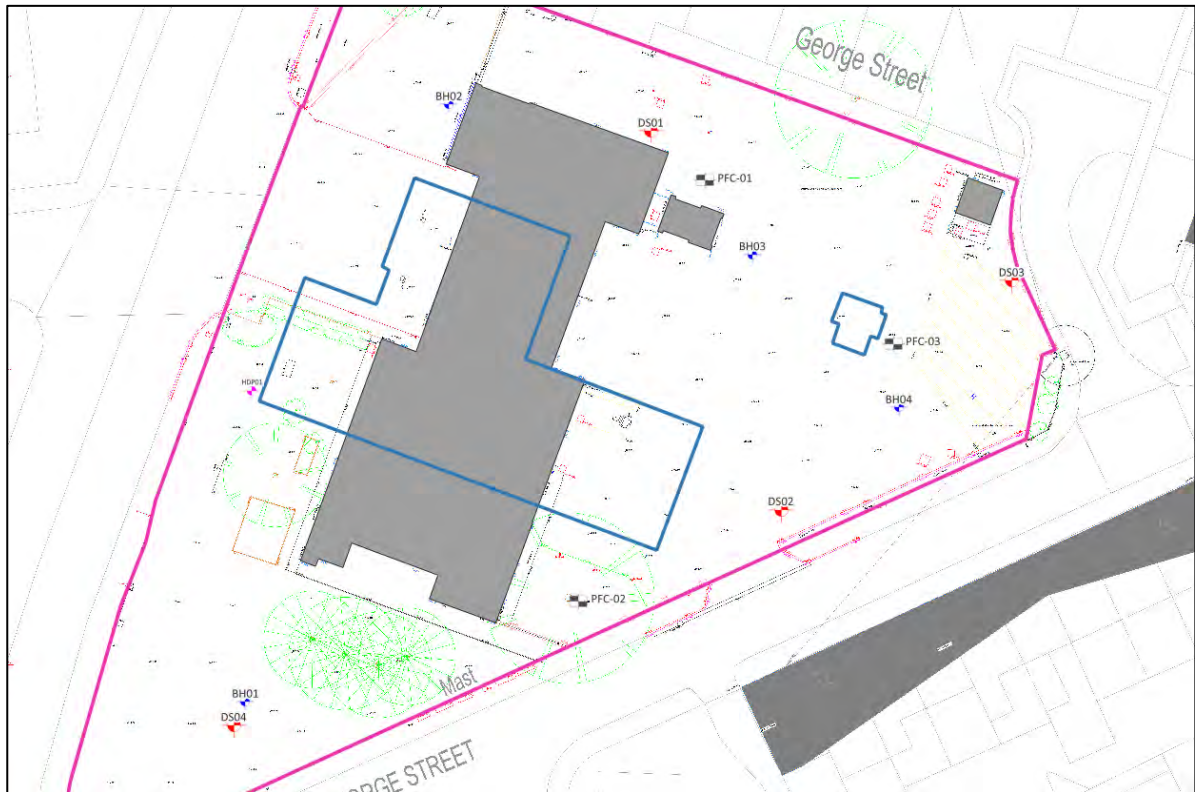


Figure 4: Exploratory Hole Location Plan extract.

The cable percussion and dynamic sample boreholes were undertaken in order 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 and to allow for the installation of ground gas and groundwater monitoring wells.

The exploratory holes revealed a general succession of Made Ground overlying Glaciofluvial Deposits which were in turn underlain by Glacial Till in localised areas.

### 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 Deposits

Natural strata representative of Glaciofluvial 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 only. 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.

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

| Location | Groundwater strike depth -<br>m bgl (m AOD) | Groundwater depth after 20<br>minutes –<br>m bgl (m AOD) | Groundwater depth during<br>monitoring –<br>m bgl (mAOD) |
|----------|---------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| DS01     | 3.25<br>(99.70)                             | 3.25<br>(99.70)                                          | 1.64 – 1.69<br>(101.31 – 101.26)                         |
| DS02     | 2.90<br>(99.77)                             | 2.90<br>(99.77)                                          | 0.83 – 1.12<br>(101.84 – 101.55)                         |
| DS03     | 2.20<br>(100.42)                            | 2.20<br>(100.42)                                         | 1.82 – 2.42<br>(98.22 – 98.00)                           |
| DS04     | 1.40<br>(102.25)                            | 1.40<br>(102.25)                                         | 0.87 – 1.70<br>(102.78 – 101.95)                         |
| BH02     | 3.80<br>(99.13)                             | 3.80<br>(99.13)                                          | Not installed                                            |
|          | 7.90                                        | 6.00                                                     |                                                          |

|      |                 |                  |                                 |
|------|-----------------|------------------|---------------------------------|
|      | (95.03)         | (96.93)          |                                 |
| BH03 | 3.00<br>(99.81) | 2.70<br>(100.11) | Not installed                   |
| BH04 | 6.00<br>(96.65) | 3.70<br>(98.95)  | 1.64 – 2.69<br>(101.01 – 99.96) |

## 2.6 Contamination Assessment

During the intrusive ground investigation works, no visual or olfactory evidence of contamination was observed. Chemical laboratory testing of site soils (Made Ground and Glacifluvial Deposits) recorded no exceedances of any human health general assessment criteria (GAC) for a commercial end use for metals, total petroleum hydrocarbons (TPH) or Polycyclic Aromatic Hydrocarbons (PAH). A single sample (of nine analysed) returned a positive identification for asbestos. Quantification by weight showed the total asbestos to be present at only 'trace' levels.

Anecdotal evidence at the site suggested that aqueous film forming foam (AFFF) **had not been used** at the site for training purposes. The risk of PFAS compounds being present in the ground and able to reach the sensitive receptors identified (Principal Aquifer within bedrock) was assessed in the Phase 1 report to be low. In order to confirm the assessment of the Phase 1 report that the site is at a low risk from PFAS compounds, a supplementary phase of investigation was completed to determine the concentrations of PFAS within the site soils. Full details of the supplementary phase of investigation are included within the Phase 2 report and are summarised below.

3 No. concrete cores (PFC-01, PFC-02 and PFC-03, inclusive) were undertaken in the eastern site section to allow for the collection of shallow site soils for PFAS analysis. The concrete core barrel equipment and the shovels used for sampling were rinsed with PFAS-free de-ionised water before sampling. A rinsate sample from the concrete core and shovel was collected and submitted for PFAS in water analysis. A sample of the on-site water supply was also collected and submitted for PFAS in water analysis. A concrete swab was performed on an approximate 100mm x 100mm area adjacent a site drain and submitted for laboratory analysis.

No exceedances of laboratory detection limits were recorded on the soil samples or the concrete swab. However, an exceedance of the laboratory detection limit for PFOA (335-67-1) was recorded in the water sample taken from the on-site water supply, taken for quality assurance purposes. A concentration of 1.03 ng/l was recorded, compared to a laboratory detection limit of 0.65 ng/l.

## 2.7 Ground Gas Risk Assessment

Following a ground gas monitoring period of 6 No. visits over 12 No. weeks, the site was designated as Characteristic Situation (CS) 1. The full ground gas risk assessment is included within the Phase 2 report and has been summarised below.

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. It should be noted that BH03 was only monitored three times given its installation as part of a later stage of investigation.

Subsequently, the following observations were made:

- Steady oxygen concentrations ranged between 10.3% v/v and 20.8% v/v;
- Peak carbon dioxide concentrations ranged between <0.1% v/v and 4.5% v/v;
- Peak methane concentrations ranged between <0.1% v/v and 4.3% v/v;
- No steady methane concentrations were recorded above detection limits (<0.1% v/v);
- No peak or steady hydrogen sulphide concentrations were recorded above detection limits (<1ppm); and
- No steady flow rates were recorded above detection limits (0.1l/hr).

## 2.8 Summary of Conceptual Site Model

The ground investigation has revealed that the site is underlain by strata representative of Glaciofluvial Deposits, with strata representative of Glacial Till encountered beneath c. 94.00m AOD in BH02 and BH03.

Glacial Till was not encountered at BH04 at 16.45m bgl (86.20m AOD). This area of the site is shown to be underlain by Glaciofluvial Deposits; however, it is likely that Glacial Till is present between this and the underlying bedrock.

No material representative of bedrock was encountered during the ground investigation; historical borehole records indicate that bedrock is at least 50m below ground level (c. 45m AOD).

The Glaciofluvial Deposits were recorded to be saturated, with groundwater strikes recorded in this formation in all exploratory holes. Groundwater levels were recorded to generally rest above 3.00m bgl across the site.

The Phase 2 report demonstrated that the site is considered to pose a **very low risk** to human health receptors at the site. The ground gas risk on-site is deemed to be **very low** as the site has been classified as a Characteristic Situation (CS) 1. The risk to controlled waters was also deemed **very low** as no contaminative linkages have been identified.

The Phase 1 and Phase 2 reports contain a Preliminary Conceptual Site Model and a refined Conceptual Site Model, respectively. The feasible pollutant linkages with relation to piling works included in the Conceptual Site Model are contained in the hydrogeological CSM extract below and included in Appendix 2.

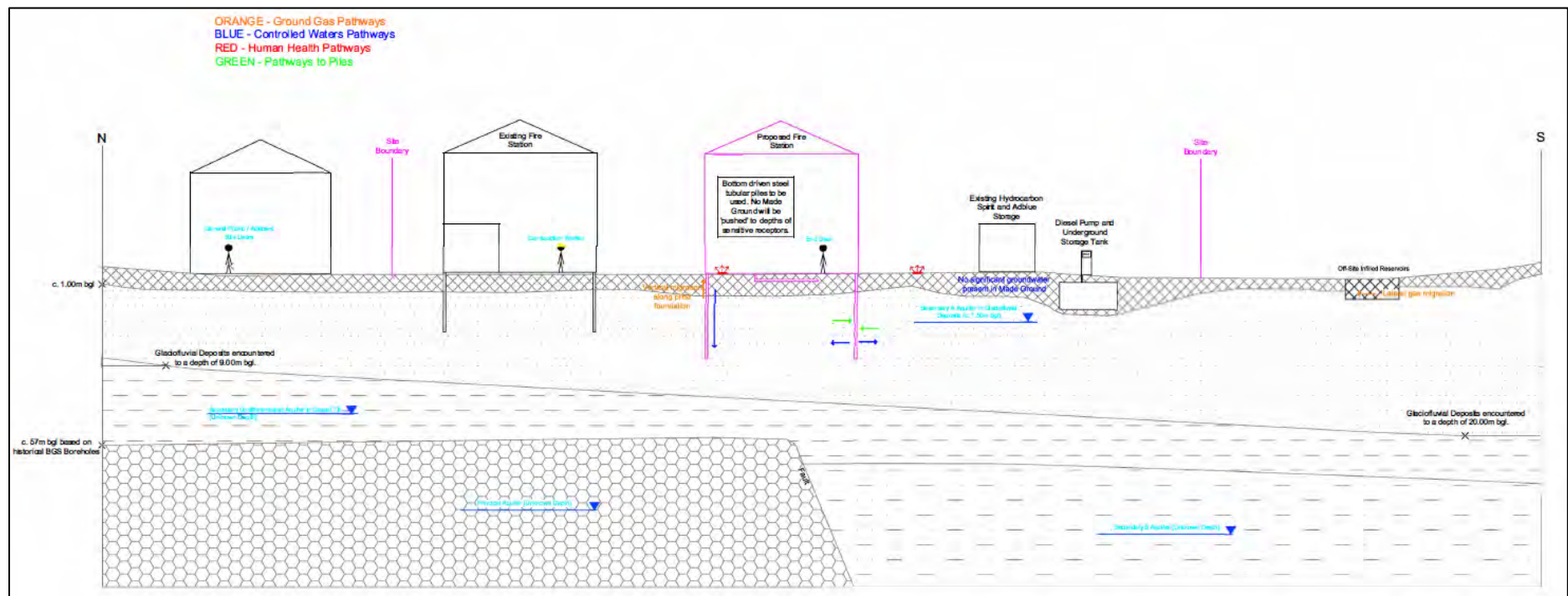


Figure 5: Conceptual Site Model extract.

## 3.0 PILING RISK ASSESSMENT

### 3.1 General

The Hydrogeological Risk Assessment has been undertaken in accordance with guidance by the Environment Agency, in particular, *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention* NC/99/73 (EA, 2001). The risk assessment refers to the six pollution scenarios detailed within NC/99/73 which are included in Table 1 below:

Table 1: Pollution Scenarios

| Scenario | Details                                                                                                                                                                                                             |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer                                                                        |
| 2        | Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface                                              |
| 3        | Direct contact of site workers and others with contaminated soil arisings which have been brought to the surface                                                                                                    |
| 4        | Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration) |
| 5        | The driving of solid contaminants down into an aquifer during pile driving                                                                                                                                          |
| 6        | Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout                                                                                                                   |

### 3.2 Risk Assessment

The Piling Risk Assessment contained within Table 2 below has been undertaken in line with guidance provided by the NHBC and Environment Agency (NHBC/EA 2008).

**Table 2: Piling Risk Assessment**

| Scenario * | Source                               | Pathway                                          | Receptor                                  | Risk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------|--------------------------------------|--------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | Made Ground                          | Pile / Soil interface                            | Secondary (A) Aquifer / Principal Aquifer | <b>Low Risk:</b> The proposed bottom driven steel tubular piling method will have high friction between the pile surface and the surrounding deposits (including the cohesive Made Ground), effectively sealing the pile in intimate contact with the surrounding deposits, precluding any preferential pathways along the side of the piles to depth.                                                                                                                                                                                                                   |
| 2          | Ground Gas / Soil Vapour             | Pile / Soil interface                            | Buildings and construction workers        | <b>Low Risk:</b> The steel tubular pile will have high friction between its surface and any present cohesive Made Ground, precluding any preferential pathways along the sides of the pile.<br><br>Based on the measured ground gas concentrations on site and the conceptual site model, the site has been classified as a Characteristic Situation 1, with a very low risk to end users.<br><br>Subsequently the overall design mitigates the risk to low.                                                                                                             |
| 3          | Contaminated Made Ground             | Direct contact, inhalation and ingestion of dust | Construction workers                      | <b>Low Risk:</b> The proposed piling methods will not produce arisings.<br><br>Following site investigation, contaminants were recorded across the site, and therefore could pose a risk to the construction workers during piling works. PPE is recommended to be worn to mitigate the effects of the close contact with the contaminated soils.<br><br>Subsequently the overall design mitigates the risk to low.                                                                                                                                                      |
| 4          | Contaminants in soil and groundwater | Direct contact and aggressive attack             | Piles and other below ground structures   | <b>Low Risk:</b> The concrete pile will not be exposed the soils as it is contained and protected by the steel outer casing.<br><br>Following the intrusive site investigation, soluble sulfate concentrations were recorded within Design Sulfate level DS-2. It should be ensured that the pile type selected is resistant to this classification.<br><br>Subsequently the overall design mitigates the risk to low.                                                                                                                                                   |
| 5          | Contaminated Made Ground             | Pile / Soil interface                            | Secondary A Aquifer / Principal Aquifer   | <b>Low Risk:</b> The proposed piling solution will be driven. However, the first length of steel (known as the starter casing) has a crimped (closed) end, therefore any soil will be displaced to the side to the length, not driven downwards into the superficial deposits. Therefore, the potential of the Made Ground to reach depths beneath the pile is low. Additionally, although the piles will penetrate through the cohesive deposits, the skin friction is regarded to negate considerable migration to soils underlying the base of the foundation.        |
| 6          | Construction Materials               | Migration through permeable strata               | Groundwater                               | <b>Low Risk:</b> Utilising the proposed piling solutions will not result in the construction materials (e.g. concrete) entering groundwater through permeable strata due to the presence of the steel outer casing. The groundwater table depth within the superficial and bedrock aquifers are unknown, anticipated to occur at 19.95+ m bgl. Perched water is present across the site; however, the continuity of the water table is not confirmed.<br><br>Due to the low likelihood of the occurrence of water within the permeable deposits, the risk is deemed low. |

\*Scenarios 1-6 refer to the scenarios specified in Table 1: Pollution Scenarios

## 4.0 EXISTING BOREHOLES

There are currently 5 No. monitoring wells installed at the site, at DS01, DS02, DS03, DS04 and BH03.

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.

The response zones for all wells (with the exception of DS01) are located solely within strata representative of Glaciofluvial Deposits. The response zone of DS01 is located within Made Ground.

| Exploratory Hole | Response Zone Stratum                                                                                                      | Response Zone Depth m bgl (m AOD) |                       |
|------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------|
|                  |                                                                                                                            | Top of Response Zone              | Base of Response Zone |
| DS01             | <b>Made Ground</b> comprising CLAY and GRAVEL of concrete, brick fragments, limestone, mudstone and sandstone              | 1.00<br>(101.95)                  | 2.00<br>(100.95)      |
| DS02             | <b>Glaciofluvial Sheet Deposits</b> comprising organic CLAY, pseudofibrous PEAT and sandy gravelly CLAY.                   | 2.00<br>(100.67)                  | 4.00<br>(98.67)       |
| DS03             | <b>Glaciofluvial Sheet Deposits</b> comprising silty organic CLAY, sandy gravelly CLAY and silty SAND.                     | 2.00<br>(100.62)                  | 4.00<br>(98.62)       |
| DS04             | <b>Glaciofluvial Sheet Deposits</b> comprising organic CLAY and sandy CLAY.                                                | 1.00<br>(102.45)                  | 2.00<br>(101.45)      |
| BH03             | <b>Glaciofluvial Sheet Deposits</b> comprising gravelly silty SAND and <b>Glacial Till</b> comprising sandy gravelly CLAY. | 6.00<br>(96.81)                   | 10.00<br>(92.81)      |

It is not considered that the existing monitoring wells pose a risk of polluting the underlying aquifers nor causing the loss of water supplies. However, as part of the construction process, these monitoring wells should be decommissioned in accordance with Environment Agency guidelines. The decommissioning programme should include:

- Removal of the flush concrete headworks;
- Backfilling of the monitoring wells.
  - o Whilst it would normally be a requirement to return the ground

conditions as closely as possible to their pre-drilled conditions (i.e. coarse strata should be backfilled with coarse material, fine strata should be backfilled with fine material), given the relatively shallow nature of the monitoring wells, this is not deemed to be necessary. Furthermore, the presence of Made Ground (though not assessed to pose a significant contaminative risk) may preclude this. It is therefore recommended that the monitoring wells are backfilled with a low permeability material that will prevent significant vertical or horizontal movement of groundwater, such as bentonite cement grout. **The backfill materials must be clean, inert and non-polluting.**

- Sealing of the monitoring well surface; and
- Recording of the decommissioning.

## 5.0 CONCLUSIONS & RECOMMENDATIONS

The foundation solution for the site at Whitefield Fire Station is proposed to comprise bottom driven tubular steel foundations bearing into the underlying stiff cohesive (clay) soils or medium dense becoming dense coarse (sand and gravel) soils encountered below 5.00m bgl.

Whilst the final depth of the piles is unknown, the piles will terminate in strata representative of either Glacial Till or Glaciofluvial Deposits. No piles will reach the underlying bedrock of either the Collyhurst Sandstone Formation (Principal Aquifer) or the Manchester Marls Formation (Secondary (B) Aquifer).

The formation of bottom driven tubular steel foundations is such that any potential contamination present at shallow depths will not be 'dragged' down vertically during construction.

Chemical laboratory analysis has shown that there are no elevated levels of contamination within the site soils, including for PFAS compounds within shallow soils.

As part of this assessment a number of potential adverse environmental impacts have been considered and assessed on a qualitative basis. The overall risk associated with the proposed foundation works are considered to be **low**, thus the use of bottom driven tubular steel piles are considered appropriate for the ground conditions at the site.

Any alterations to the proposed piling methodology or further information should instigate the reappraisal of the conclusions of this report.

## **APPENDIX 1**

### **LIMITATIONS OF INVESTIGATION WORK AND REPORT AND CONTAMINATED LAND LEGISLATIVE FRAMEWORK**

## **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 suspected presence asbestos or asbestos-containing materials this is for indicative purposes only and does not constitute or replace full and proper surveys.

Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements) and the term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation and these two main aspects are inter-related. The geo-environmental sections are written in broad agreement with BS 10175:2011+A2 2017.

## **LIMITATIONS OF INVESTIGATION WORK**

### **Desk Study References**

This report is based upon IGE's observations of existing physical conditions at the site gained from a walkover survey of the site together with IGE's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. Reliance has been placed on this publicly available data obtained from the sources identified in the main report. When using the information, it has been assumed that it is correct. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst IGE have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified. No responsibility can be accepted for errors within third party items presented in this report. IGE did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services. IGE is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to IGE and including the doing of any independent investigation of the information provided to IGE except when otherwise provided in the terms of the contract between the client and IGE.

### **Historical Mapping**

Historical Ordnance Survey maps do not provide a comprehensive description of a site history. They provide details of the site from a date prior to the publication of the map (i.e. a snapshot in time). The period between map editions can be substantial (i.e. several decades). Not all map series are available for every date range in many areas of the UK and therefore there will be gaps in this mapped record for some sites. Potentially contaminative land uses could have been present and removed during such periods and may therefore not form a part of this particular record. In addition, there will be potentially contaminative land uses which are not identified on the map records such as small scale storage / use of hazardous materials, illegal / unlicensed waste disposal activities etc. Different map series identify different features utilising different symbols which can result in features that remain on-site being removed from maps. Some features are also not mapped for security reasons (e.g. airfields and other military installations). These areas are mostly shown as blank areas on historical maps.

### **Site Walkover**

During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

### **Flooding**

Flooding in this report is defined as flooding caused by the sea, ditches, rivers, streams, ponds, lakes, reservoirs and the like. It does not extend to flooding caused by surcharged piped drainage systems and investigations into flooding of this nature are excluded from this report.

### **Extent of Contamination Studies**

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 and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the reporting in full. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

### **Intrusive Investigation**

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.

## PLANNING CONTEXT

The National Planning Policy Framework (NPPF, 2023) states that the purpose of the planning system is to contribute to the achievement of sustainable development. In order to do this the planning system has three overarching objectives, one of which directly relates to the potential for pollution and contaminated land:

- *'environmental objective - to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy'.*

In accordance with this environmental objective, Paragraph 124 clarifies that 'making effective use of land' includes to:

- *'give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land'.*

In accordance with this environmental objective, Paragraph 180 clarifies that 'conserving and enhancing the natural environment includes:

- *'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability'; and*
- *'remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate'.*

Paragraph 189 of the NPPF states that planning policies and decisions for developments should also ensure that:

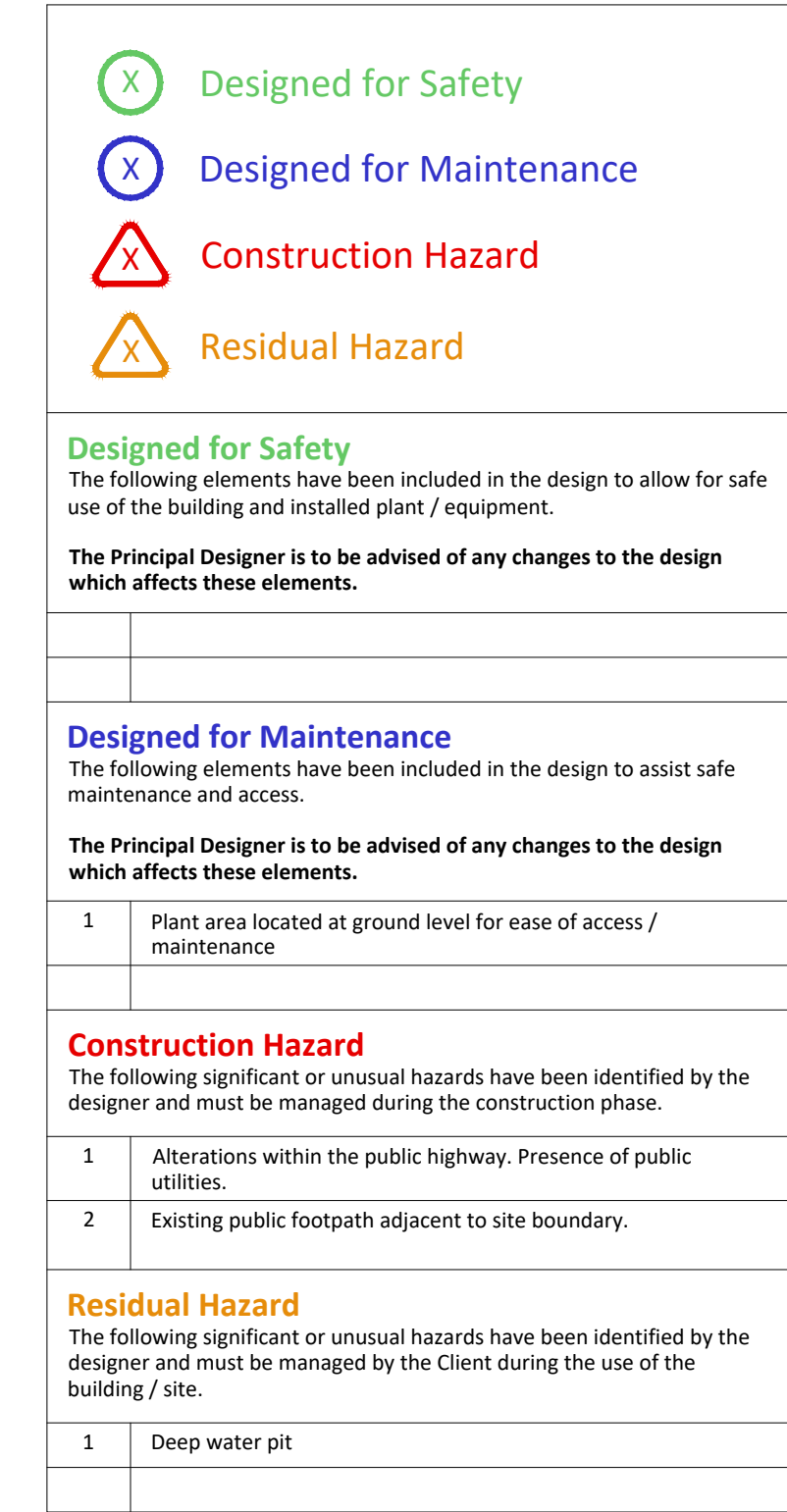
- *'a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation)'; and,*
- *'after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990'; and*
- *'adequate site investigation information, prepared by a competent person, is available to inform these assessments'.*

This report has been prepared and authorised by staff that are competent as defined in the NPPF.

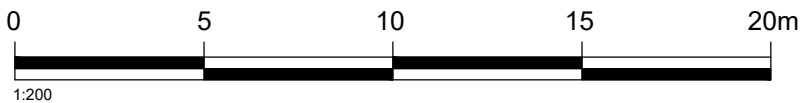


## **APPENDIX 2**

### FIGURES AND DRAWINGS

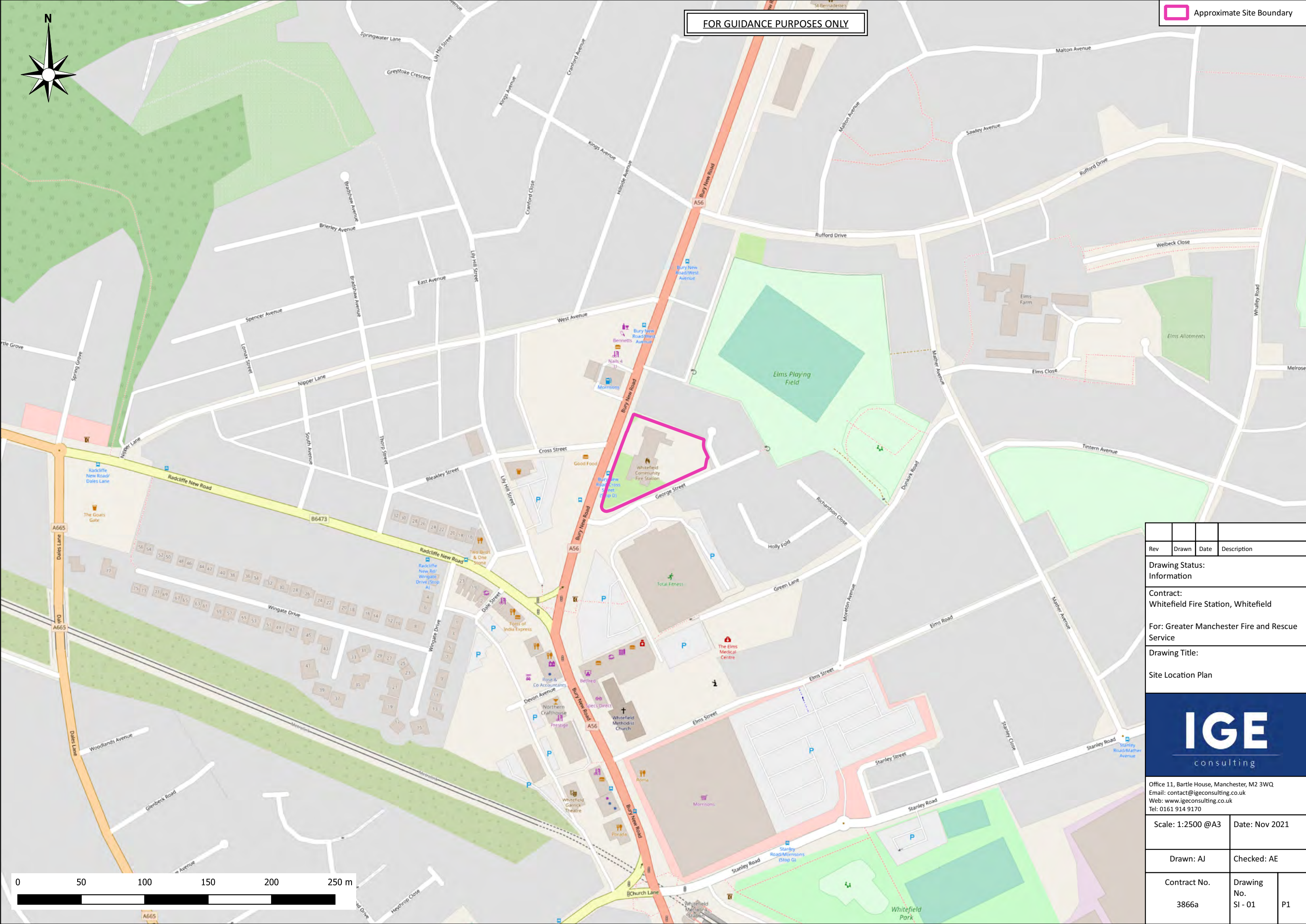


ARMCO TYPE BARRIER  
(FOR RTC TRAINING)



| <b>PRELIMINARY</b>                                                                                                                                                                                                                |                                                                                                          |                                 |                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------|
| This drawing is copyright Bradshaw Gass & Hope LLP and is not to be copied, reproduced or re-distributed either in whole or in part without the prior written permission of the originator.                                       |                                                                                                          |                                 |                                                                                      |
| The originator shall have no responsibility for any liability, loss, cost, damage or expense arising from or resulting to any use of this document other than for its intended purpose on this project.                           |                                                                                                          |                                 |                                                                                      |
| This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work. |                                                                                                          |                                 |                                                                                      |
| All dimensions are to be checked on site by the contractor prior to proceeding with any work.                                                                                                                                     |                                                                                                          |                                 |                                                                                      |
| <b>Hazard Identification</b>                                                                                                                                                                                                      |                                                                                                          |                                 |  |
| ref                                                                                                                                                                                                                               | hazard                                                                                                   |                                 | date                                                                                 |
|                                                                                                                                                                                                                                   |                                                                                                          |                                 |                                                                                      |
| <br>N                                                                                                                                          |                                                                                                          |                                 |                                                                                      |
|                                                                                                                                                                                                                                   |                       | TREE TO BE RETAINED             |                                                                                      |
|                                                                                                                                                                                                                                   |                       | TREE TO BE REMOVED              |                                                                                      |
|                                                                                                                                                                                                                                   |                       | NEW TREE                        |                                                                                      |
|                                                                                                                                                                                                                                   |                       | NEW SOFT LANDSCAPING            |                                                                                      |
|                                                                                                                                                                                                                                   |                      | WORKS WITHIN THE PUBLIC HIGHWAY |                                                                                      |
|                                                                                                                                                                                                                                   |                     | AREA OF GROUND TO BE HAND DUG   |                                                                                      |
|                                                                                                                                                                                                                                   |                     | TEMPORARY TREE PROTECTION       |                                                                                      |
| P6                                                                                                                                                                                                                                | TRAINING TOWER REVERTED BACK TO ITS ORIGINAL PROPOSED POSITION                                           | LC                              | 12.01.24                                                                             |
| P5                                                                                                                                                                                                                                | RETENTION BASIN REPOSITIONED TO AVOID UNDERGROUND CABLE ROUTE. PROPOSED TRAINING TOWER POSITION CHANGED. | LC                              | 02.01.24                                                                             |
| P4                                                                                                                                                                                                                                | REVISED TO INCORPORATE VARIOUS DESIGN CHANGES FROM ISG / BGH DESIGN REVIEW                               | ST                              | 30.11.23                                                                             |
| P3                                                                                                                                                                                                                                | TRAINING FIRE HYDRANT & EXCLUSION ZONE FOR TRAINING TOWER ADDED                                          | LC                              | 28.11.23                                                                             |
| P2                                                                                                                                                                                                                                | WORKS TO TREE T2 ADDED TO DRAWING                                                                        | LC                              | 06.11.23                                                                             |
| P1                                                                                                                                                                                                                                | FIRST ISSUE                                                                                              | ST                              | 30.08.23                                                                             |
| ref                                                                                                                                                                                                                               | revision                                                                                                 | by                              | date                                                                                 |

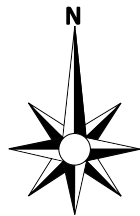
|                                                                                       |                                                          |       |                                                                                                             |    |
|---------------------------------------------------------------------------------------|----------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------|----|
|  | Architects<br>Consulting Engineers<br>Quantity Surveyors |       | 21 Silverwell Street<br>Bolton<br>BL1 1PR<br>t 01204 525321<br>email@bghbolton.co.uk<br>www.bghbolton.co.uk |    |
|                                                                                       | <h1>Bradshaw Gass &amp; Hope LLP</h1>                    |       |                                                                                                             |    |
| client                                                                                |                                                          |       |                                                                                                             |    |
| <h2>ISG CONSTRUCTION LTD</h2>                                                         |                                                          |       |                                                                                                             |    |
| project                                                                               |                                                          |       |                                                                                                             |    |
| <h3>WHITEFIELD FIRE STATION</h3>                                                      |                                                          |       |                                                                                                             |    |
| drawing                                                                               |                                                          |       |                                                                                                             |    |
| <h4>PROPOSED SITE PLAN</h4>                                                           |                                                          |       |                                                                                                             |    |
| drawn by                                                                              |                                                          | ST    | date                                                                                                        |    |
| checked by                                                                            |                                                          |       | date                                                                                                        |    |
| scale                                                                                 |                                                          | 1:200 |                                                                                                             | A1 |
| dwg no                                                                                |                                                          |       | rev                                                                                                         |    |
| WFS-BGH-XX-XX-DR-A-0203                                                               |                                                          |       | P6                                                                                                          |    |



FOR GUIDANCE PURPOSES ONLY

Approximate Site Boundary

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



FOR GUIDANCE PURPOSES ONLY

- Approximate Site Boundary
- Proposed
- Proposed FSX Holes



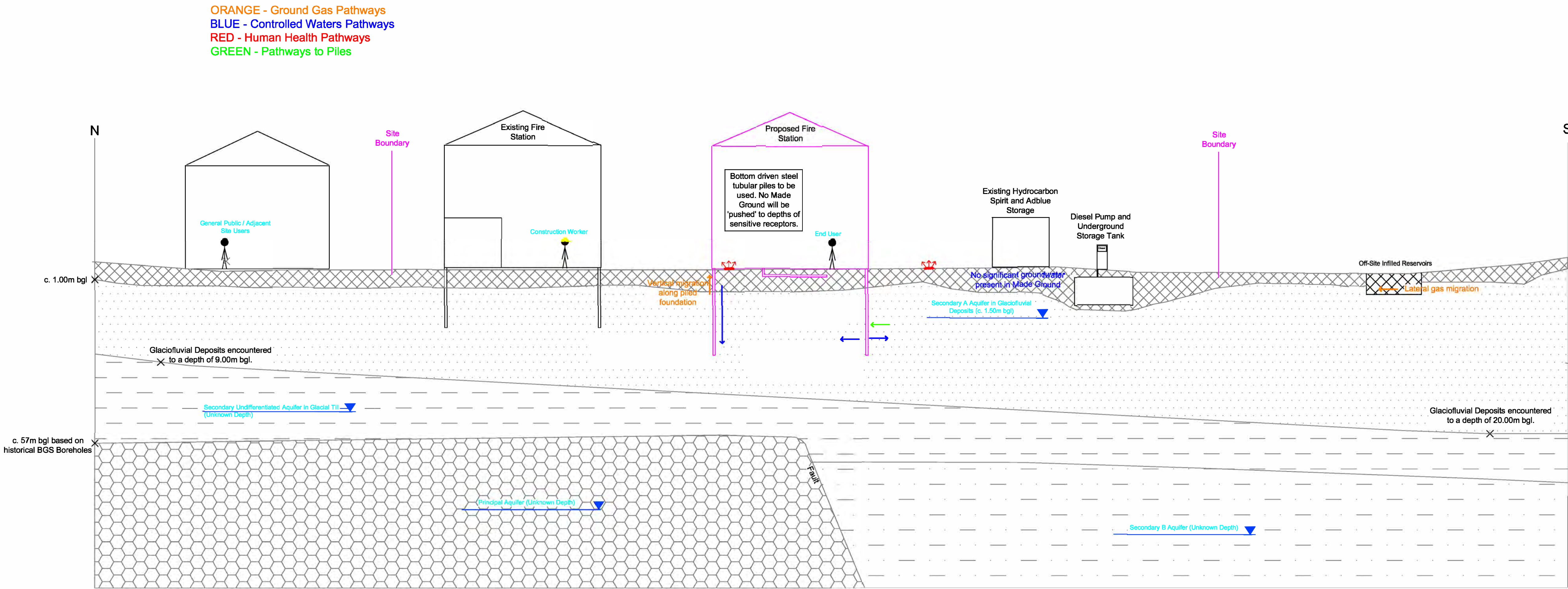
|                                                                                                                                                                                                                                                                               |      |                |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|-------------|
| Rev                                                                                                                                                                                                                                                                           | Draw | Date           | Description |
| Drawing Status: Information                                                                                                                                                                                                                                                   |      |                |             |
| Contract: Whitefield Fire Station                                                                                                                                                                                                                                             |      |                |             |
| For: Greater Manchester Combined Authority                                                                                                                                                                                                                                    |      |                |             |
| Drawing Title: Exploratory Hole Location Plan                                                                                                                                                                                                                                 |      |                |             |
| <div>IGE consulting</div> <div>Office 16, Bartle House, Manchester, M2 3WQ<br/>Email: <a href="mailto:contact@igeconsulting.co.uk">contact@igeconsulting.co.uk</a><br/>Web: <a href="http://www.igeconsulting.co.uk">www.igeconsulting.co.uk</a><br/>Tel: 0161 914 9170</div> |      |                |             |
| Scale: 1:300 @A3                                                                                                                                                                                                                                                              |      | Date: Jan 2024 |             |
| Drawn: LM                                                                                                                                                                                                                                                                     |      | Checked: AE    |             |
| Contract No. 3866a                                                                                                                                                                                                                                                            |      | Drawing No. SI | P3          |

Notes

- 1 This drawings is abstract and not to scale.
- 2 This drawing is to be read in conjunction with all relevant Architects and Service Engineers drawings.

Key

- Proposed Development
- Made Ground
- Glaciofluvial Deposits
- Glacial Till
- Collyhurst Sandstone
- Manchester Marls



|                                                                                                                                                                                                                                               |       |             |             |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|-------------|----|
|                                                                                                                                                                                                                                               |       |             |             |    |
| Rev                                                                                                                                                                                                                                           | Drawn | Date        | Description |    |
| Drawing Status                                                                                                                                                                                                                                |       |             |             |    |
| INFORMATION                                                                                                                                                                                                                                   |       |             |             |    |
| Contract                                                                                                                                                                                                                                      |       |             |             |    |
| WHITEFIELD FIRE STATION, WHITEFIELD                                                                                                                                                                                                           |       |             |             |    |
| FOR: GREATER MANCHESTER COMBINED AUTHORITY (GMCA)                                                                                                                                                                                             |       |             |             |    |
| Drawing Title                                                                                                                                                                                                                                 |       |             |             |    |
| CONCEPTUAL SITE MODEL DIAGRAM (PILING RISK ASSESSMENT)                                                                                                                                                                                        |       |             |             |    |
| <div><div></div><div>© Drawing created by Drawing Design TECHNICAL SERVICES using REVIT 2014</div></div>                                                                                                                                      |       |             |             |    |
| Office 11, Bartle House, Manchester, M2 3WQ<br>email: <a href="mailto:contact@igecoconsulting.co.uk">contact@igecoconsulting.co.uk</a><br>web: <a href="http://www.igecoconsulting.co.uk">www.igecoconsulting.co.uk</a><br>tel: 0161 914 9170 |       |             |             |    |
| Scale                                                                                                                                                                                                                                         |       | Date        |             |    |
| NTS                                                                                                                                                                                                                                           |       | JAN 2024    |             |    |
| Drawn                                                                                                                                                                                                                                         |       | Checked     |             |    |
| ARE                                                                                                                                                                                                                                           |       | AE          |             |    |
| Contract No.                                                                                                                                                                                                                                  |       | Drawing No. |             |    |
| 3866a                                                                                                                                                                                                                                         |       | SI-06       |             | P1 |

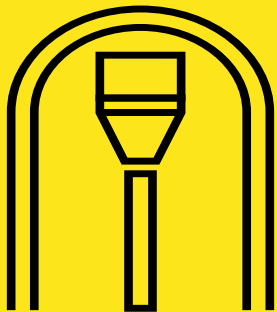
## **APPENDIX 3**

### **BOTTOM DRIVEN MINI PILING DATA SHEET**

[www.roger-bullivant.co.uk](http://www.roger-bullivant.co.uk)

# BOTTOM DRIVEN MINI PILING

Bottom Driven Mini Piles are quick, cost-effective, low-energy driven displacement piles. Suitable for most ground conditions and ideal for poor ground conditions and contaminated soils. This method is one of the most environmentally friendly piling systems as it requires much less concrete than other solutions and does not produce any spoil.





## DESCRIPTION

Bottom-driven mini piles are quick and efficient. Piles are formed by driving a crimped closed-end, thin-wall casing into the ground in lengths of 1m to 4m using an internal drop hammer onto a dry concrete plug. A wide range of pile diameters can be achieved from 105mm to 323mm, with load-bearing capacities from 50kN to 600kN.

This method is low noise, low vibration in comparison to more conventional driven precast or steel tube techniques and can be used in sensitive environments where the use of driven techniques is generally not permitted.

Bottom-driven mini piles are suitable for a wide range of sectors such as industrial, infrastructure, railway, residential and commercial projects.

At Roger Bullivant, we have a range of different rigs which enhances our ability to accommodate a variety of restricted access requirements.



## APPLICATIONS



Rail



Commercial



Suitable for most ground conditions



Residential

## ADVANTAGES



Minimal site preparation



Quiet installation



Minimum vibration



Cost effective



Limited headroom & restricted access



Electric piling rigs



Small lightweight equipment



Zero spoil

## INSTALLATION

Bottom-driven piles are installed using a thin wall prefabricated tube typically supplied in lengths ranging between 1.0m – 4.0m

The pile is formed by first driving a closed ended starter casing into the ground using an internal drop hammer weight, driving onto a dry concrete plug. The drop hammer weight is lifted and dropped repetitively which drives onto the plug allowing the

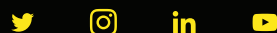
casing to be driven into the ground. Subsequent casing sections are added as the pile is driven to depth. Casings are joined by a full but non-structural fillet weld as the installation proceeds. The pile is driven to a predetermined set or design depth. Once the required depth is reached the casing is then filled with concrete or grout with pile reinforcement introduced to complete pile formation.

## TECHNIQUE CAPABILITIES

| SPECIFICATION          | FROM      | TO        |
|------------------------|-----------|-----------|
| Standard pile size     | 105mm dia | 323mm dia |
| Range of load capacity | 50kN      | 600kN     |
| Range of pile depth    | 3.0m      | 25.0m     |

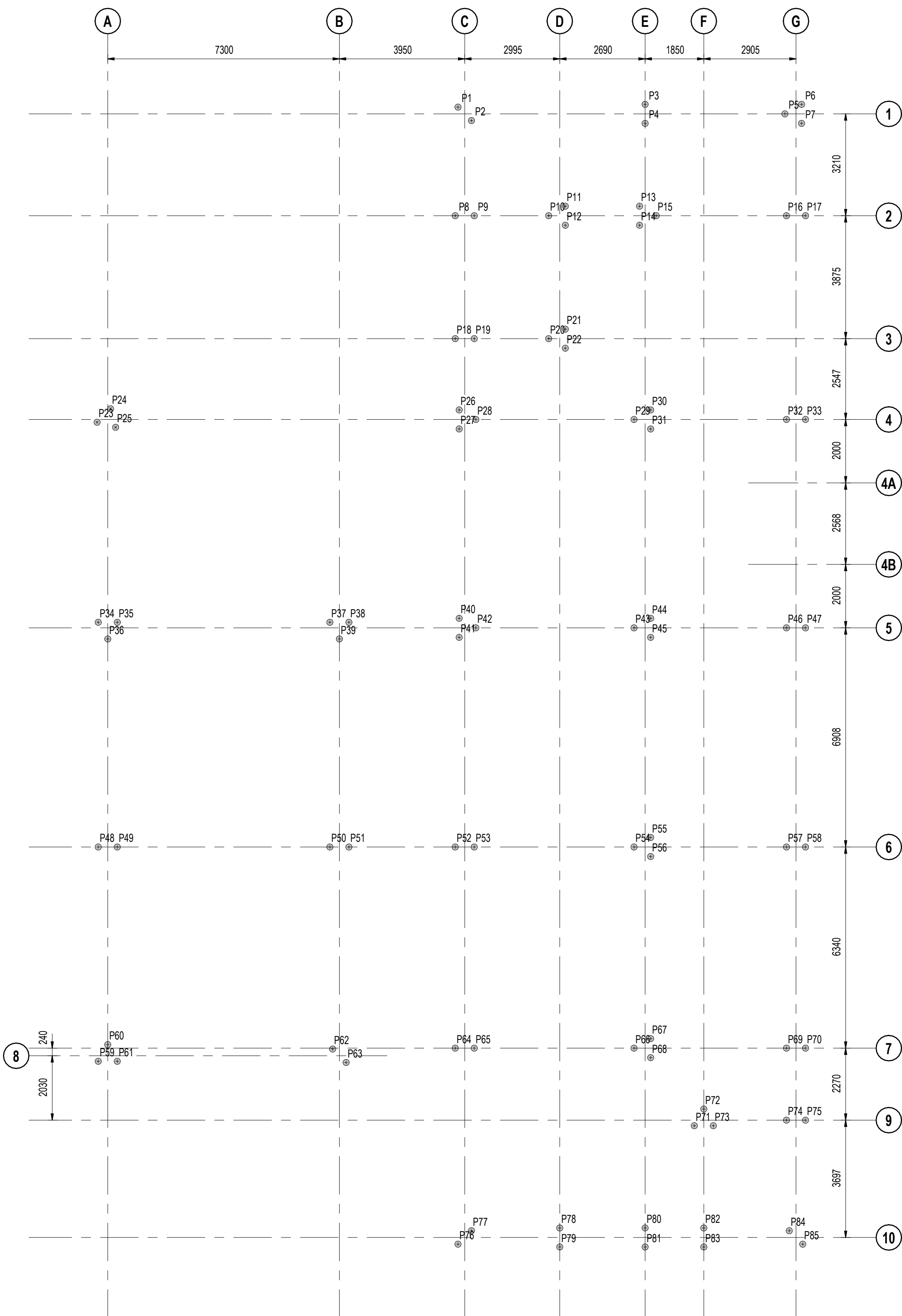
\*pile depth subject to ground conditions

[www.roger-bullivant.co.uk](http://www.roger-bullivant.co.uk)



Call Nationwide on 0845 8381801

Email [info@roger-bullivant.co.uk](mailto:info@roger-bullivant.co.uk)



PLAN ON PILING LAYOUT - ALL PILES TO BE CONTRACTOR DESIGNED

1 : 100

NOTE : DESIGN IS BASED ON THE USE OF 200mm DIAMETER STEEL MINI PILES

NOTE : PILE CUT OFF LEVELS ARE BASED UPON A FFL OF 103.100m OSGB



| PILE SCHEDULE |               |           |           |                         |                                 |
|---------------|---------------|-----------|-----------|-------------------------|---------------------------------|
| PILE REF      | CUT OFF LEVEL | EASTING   | NORTHING  | UNFACTORED DEAD LOAD kN | UNFACTORED WIND LOAD kN (SHEAR) |
| P1            | 102.125m      | 380494452 | 406470220 | 200 kN                  | 10 kN                           |
| P2            | 102.125m      | 380493906 | 406469971 | 200 kN                  | 10 kN                           |
| P3            | 102.125m      | 380492472 | 406464665 | 200 kN                  | 50 kN                           |
| P4            | 102.125m      | 380491910 | 406464875 | 200 kN                  | 50 kN                           |
| P5            | 102.125m      | 380490650 | 406460643 | 200 kN                  | 50 kN                           |
| P6            | 102.125m      | 380490747 | 406460046 | 200 kN                  | 50 kN                           |
| P7            | 102.125m      | 380490185 | 406460256 | 200 kN                  | 50 kN                           |
| P8            | 102.125m      | 380491277 | 406471500 | 200 kN                  | 50 kN                           |
| P9            | 102.125m      | 380491067 | 406470937 | 200 kN                  | 50 kN                           |
| P10           | 102.125m      | 380490247 | 406468741 | 200 kN                  | 10 kN                           |
| P11           | 102.125m      | 380490344 | 406468144 | 200 kN                  | 10 kN                           |
| P12           | 102.125m      | 380489782 | 406468354 | 200 kN                  | 10 kN                           |
| P13           | 102.125m      | 380489526 | 406465952 | 200 kN                  | 10 kN                           |
| P14           | 102.125m      | 380488964 | 406466162 | 200 kN                  | 10 kN                           |
| P15           | 102.125m      | 380489061 | 406465565 | 200 kN                  | 10 kN                           |
| P16           | 102.125m      | 380487625 | 406461719 | 200 kN                  | 10 kN                           |
| P17           | 102.125m      | 380487415 | 406461157 | 200 kN                  | 10 kN                           |
| P18           | 102.125m      | 380487647 | 406472855 | 200 kN                  | 50 kN                           |
| P19           | 102.125m      | 380487437 | 406472283 | 200 kN                  | 50 kN                           |
| P20           | 102.125m      | 380486617 | 406470096 | 200 kN                  | 10 kN                           |
| P21           | 102.125m      | 380486714 | 406469499 | 200 kN                  | 10 kN                           |
| P22           | 102.125m      | 380486152 | 406469709 | 200 kN                  | 10 kN                           |
| P23           | 102.125m      | 380489125 | 406484350 | 200 kN                  | 10 kN                           |
| P24           | 102.125m      | 380489374 | 406483804 | 200 kN                  | 10 kN                           |
| P25           | 102.125m      | 380488772 | 406483859 | 200 kN                  | 10 kN                           |
| P26           | 102.125m      | 380485498 | 406473524 | 200 kN                  | 10 kN                           |
| P27           | 102.125m      | 380484936 | 406473734 | 200 kN                  | 10 kN                           |
| P28           | 102.125m      | 380485033 | 406473137 | 200 kN                  | 10 kN                           |
| P29           | 102.125m      | 380483290 | 406468467 | 200 kN                  | 10 kN                           |
| P30           | 102.125m      | 380483387 | 406467870 | 200 kN                  | 10 kN                           |
| P31           | 102.125m      | 380482825 | 406468080 | 200 kN                  | 10 kN                           |
| P32           | 102.125m      | 380481609 | 406463965 | 200 kN                  | 50 kN                           |
| P33           | 102.125m      | 380481399 | 406463403 | 200 kN                  | 50 kN                           |
| P34           | 102.125m      | 380483206 | 406486521 | 200 kN                  | 10 kN                           |
| P35           | 102.125m      | 380482996 | 406485959 | 200 kN                  | 10 kN                           |
| P36           | 102.125m      | 380482610 | 406486424 | 200 kN                  | 10 kN                           |
| P37           | 102.125m      | 380480653 | 406479682 | 200 kN                  | 10 kN                           |
| P38           | 102.125m      | 380480443 | 406479120 | 200 kN                  | 10 kN                           |
| P39           | 102.125m      | 380480056 | 406479585 | 200 kN                  | 10 kN                           |
| P40           | 102.125m      | 380479345 | 406475821 | 200 kN                  | 10 kN                           |
| P41           | 102.125m      | 380478783 | 406476031 | 200 kN                  | 10 kN                           |
| P42           | 102.125m      | 380478880 | 406475434 | 200 kN                  | 10 kN                           |
| P43           | 102.125m      | 380477136 | 406470764 | 200 kN                  | 10 kN                           |
| P44           | 102.125m      | 380477234 | 406470167 | 200 kN                  | 10 kN                           |
| P45           | 102.125m      | 380476672 | 406470377 | 200 kN                  | 10 kN                           |
| P46           | 102.125m      | 380475456 | 406466263 | 200 kN                  | 50 kN                           |
| P47           | 102.125m      | 380475246 | 406465701 | 200 kN                  | 50 kN                           |
| P48           | 102.125m      | 380476571 | 406488999 | 200 kN                  | 50 kN                           |
| P49           | 102.125m      | 380476361 | 406488437 | 200 kN                  | 50 kN                           |
| P50           | 102.125m      | 380474018 | 406482160 | 200 kN                  | 10 kN                           |
| P51           | 102.125m      | 380473808 | 406481598 | 200 kN                  | 10 kN                           |
| P52           | 102.125m      | 380472636 | 406478459 | 200 kN                  | 10 kN                           |
| P53           | 102.125m      | 380472426 | 406477897 | 200 kN                  | 10 kN                           |
| P54           | 102.125m      | 380470665 | 406473180 | 200 kN                  | 10 kN                           |
| P55           | 102.125m      | 380470763 | 406472583 | 200 kN                  | 10 kN                           |
| P56           | 102.125m      | 380470201 | 406472793 | 200 kN                  | 10 kN                           |
| P57           | 102.125m      | 380468985 | 406468679 | 200 kN                  | 10 kN                           |
| P58           | 102.125m      | 380468775 | 406468117 | 200 kN                  | 10 kN                           |
| P59           | 102.125m      | 380470243 | 406491361 | 200 kN                  | 50 kN                           |
| P60           | 102.125m      | 380470630 | 406490897 | 200 kN                  | 50 kN                           |
| P61           | 102.125m      | 380470033 | 406490799 | 200 kN                  | 50 kN                           |
| P62           | 102.125m      | 380468021 | 406484305 | 200 kN                  | 10 kN                           |
| P63           | 102.125m      | 380467476 | 406484056 | 200 kN                  | 10 kN                           |
| P64           | 102.125m      | 380466697 | 406480677 | 200 kN                  | 10 kN                           |
| P65           | 102.125m      | 380466487 | 406480115 | 200 kN                  | 10 kN                           |
| P66           | 102.125m      | 380464726 | 406475398 | 200 kN                  | 10 kN                           |
| P67           | 102.125m      | 380464823 | 406474801 | 200 kN                  | 10 kN                           |
| P68           | 102.125m      | 380464261 | 406475011 | 200 kN                  | 10 kN                           |
| P69           | 102.125m      | 380463045 | 406470896 | 200 kN                  | 10 kN                           |
| P70           | 102.125m      | 380462835 | 406470334 | 200 kN                  | 10 kN                           |
| P71           | 102.125m      | 380461771 | 406474473 | 200 kN                  | 10 kN                           |
| P72           | 102.125m      | 380462157 | 406474008 | 200 kN                  | 10 kN                           |
| P73           | 102.125m      | 380461561 | 406473911 | 200 kN                  | 10 kN                           |
| P74           | 102.125m      | 380460918 | 406471690 | 200 kN                  | 10 kN                           |
| P75           | 102.125m      | 380460709 | 406471128 | 200 kN                  | 10 kN                           |
| P76           | 102.125m      | 380460877 | 406482756 | 200 kN                  | 10 kN                           |
| P77           | 102.125m      | 380461126 | 406482210 | 200 kN                  | 10 kN                           |
| P78           | 102.125m      | 380460235 | 406479572 | 200 kN                  | 50 kN                           |
| P79           | 102.125m      | 380459673 | 406479782 | 200 kN                  | 50 kN                           |
| P80           | 102.125m      | 380459294 | 406477052 | 200 kN                  | 50 kN                           |
| P81           | 102.125m      | 380458732 | 406477262 | 200 kN                  | 50 kN                           |
| P82           | 102.125m      | 380458647 | 406475319 | 200 kN                  | 10 kN                           |
| P83           | 102.125m      | 380458085 | 406475529 | 200 kN                  | 10 kN                           |
| P84           | 102.125m      | 380457623 | 406472827 | 200 kN                  | 10 kN                           |
| P85           | 102.125m      | 380457077 | 406472578 | 200 kN                  | 10 kN                           |

status PRELIMINARY

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

| Hazard Identification |        |      |  |
|-----------------------|--------|------|--|
| ref                   | hazard | date |  |
|                       |        |      |  |

NOTES - PILES

DO NOT SCALE FROM THIS DRAWING. ANY DIMENSIONAL DISCREPANCIES TO BE REPORTED TO THE ENGINEERS

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS

ALL EXCAVATION WORK TO BE CARRIED OUT IN ACCORDANCE WITH BS8000:1:1989 CODE OF PRACTICE FOR EXCAVATION AND FILLING.

PILE LOADS SHOWN ARE IMPOSED FROM THE STRUCTURE AND GROUND BEAMS AND DO NOT INCLUDE FOR ANY LOADS IMPOSED BY THE OVERBURDEN FRICTION ON THE PILES

PILE DESIGN, INSTALLATION AND TESTING IS TO COMPLY WITH THE CURRENT EDITION OF THE SPECIFICATION FOR PILING AND EMBEDDED RETAINING WALLS

PILE DESIGN IS BY THE PILING CONTRACTOR TO THE LOADS SHOWN. PILE INTEGRITY AND DYNAMIC TESTING IS AS LAID OUT IN THE SPECIFICATION

TOPS OF ALL GROUND BEAMS TO BE LEVEL UNLESS NOTED OTHERWISE

CONTRACTOR TO ALLOW FOR PROVIDING CRUSHER RUN PILING MAT ON A GEOMEMBRANE

PILES TO BE GRUBBED DOWN USING SPECIALIST EQUIPMENT. METHOD TO BE REVIEWED BY THE ENGINEERS PRIOR TO COMMENCEMENT

THE CONTRACTOR SHALL ENSURE THE STABILITY OF THE STRUCTURE & ANY ADJOINING STRUCTURES IS MAINTAINED AT ALL STAGES DURING CONSTRUCTION. THE CONTRACTOR SHALL DESIGN, INSTALL & MAINTAIN ANY NECESSARY TEMPORARY WORKS. THE PILING METHOD SHOULD TAKE DUE CONSIDERATION OF THE STABILITY AND OCCUPATION OF ADJOINING STRUCTURES.

FOR GROUND INVESTIGATION REFER TO REPORT

|     |                       |     |          |
|-----|-----------------------|-----|----------|
| P1  | STAGE 4 DRAWING ISSUE | DMC | 25.09.23 |
| ref | revision              | by  | date     |

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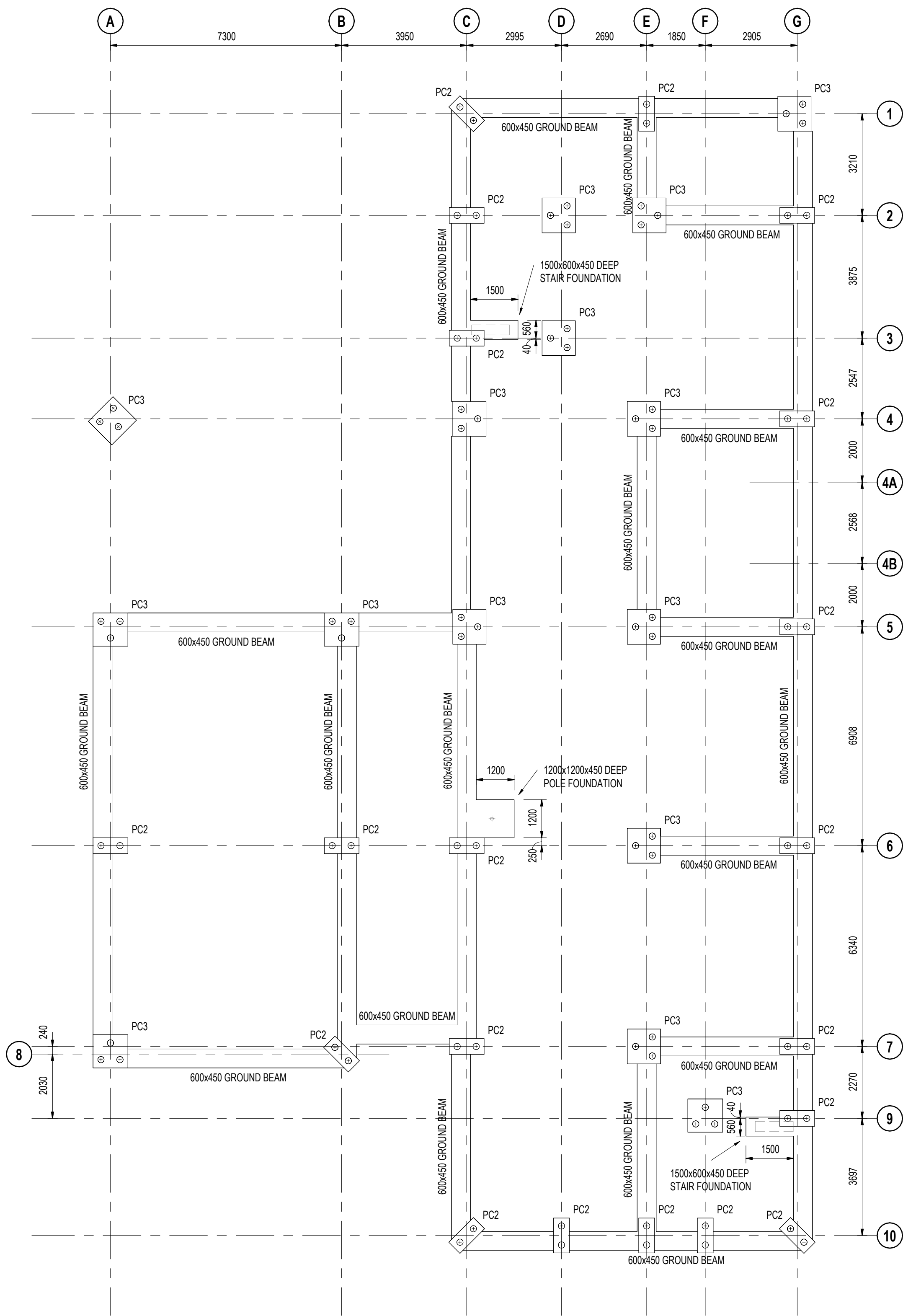
H

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www.bghbolton.co.uk

Bradshaw Gass & Hope LLP

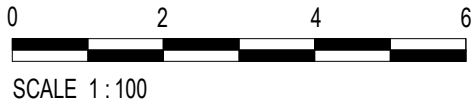
|                                    |                               |
|------------------------------------|-------------------------------|
| client<br>ISG CONSTRUCTION         |                               |
| project<br>WHITEFIELD FIRE STATION |                               |
| drawing<br>PLAN ON PILING LAYOUT   |                               |
| drawn by<br>checked by<br>scale    | DMC<br>date<br>As indicated @ |
| date<br>SEPT 2023                  | rev<br>A1                     |
| dwg no<br>WFSBGH-01-GF-DR-S-0101   | rev<br>P1                     |



PLAN ON PILECAPS AND GROUND BEAMS - TOC = 102.650m  
1 : 100

PC2 1100x500x600 DEEP PILECAP  
PC3 1100x1050x600 DEEP PILECAP

ALL GROUND BEAMS TO BE 600 WIDE x 450 DEEP



status

PRELIMINARY

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

Hazard Identification

ref

hazard

date

|  |  |  |
|--|--|--|
|  |  |  |
|  |  |  |

NOTES - REINFORCED FOUNDATIONS

DO NOT SCALE FROM THIS DRAWING. ANY DIMENSIONAL DISCREPANCIES TO BE REPORTED TO THE ENGINEERS

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS DRAWINGS AND SPECIFICATIONS

ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT SPECIFICATIONS AND BRITISH STANDARDS

THE CONTRACTOR SHALL ENSURE THE STABILITY OF THE BUILDING AND ANY ADJOINING STRUCTURES IS MAINTAINED AT ALL STAGES OF CONSTRUCTION. THE CONTRACTOR SHALL DESIGN, INSTALL AND MAINTAIN ANY NECESSARY TEMPORARY WORKS.

CONTRACTOR TO PROVIDE METHOD STATEMENTS AND RISK ASSESSMENTS TO THE ENGINEER AND PLANNING SUPERVISOR A MINIMUM OF 14 DAYS BEFORE THE WORKS COMMENCE

ALL STRUCTURAL CONCRETE TO BE DESIGN-MIXED FOR GRADE C28/35, WITH MINIMUM CEMENT CONTENT OF 330kg/m³. MAXIMUM FREE WATER/CEMENT RATIO OF 0.65

MAXIMUM AGGREGATE SIZE TO BE 20mm

COVER TO FABRIC REINFORCEMENT:  
40mm TOP  
40mm BTM  
40mm SIDES

LAPS TO FABRIC REINFORCEMENT TO BE 400mm

CONCRETE TO BE PROPERLY VIBRATED ONCE PLACED

HOLDING DOWN BOLTS ARE TO BE CAST INSITU AND SET OUT AS SHOWN ON THE STEEL FABRICATORS GENERAL ARRANGEMENT. BOLTS ARE TO BE LOOSENED BEFORE THE CONCRETE HAS SET

REFER TO ARCHITECTS DRAWINGS FOR FULL DPC & DPM SPECIFICATIONS

|     |                       |     |          |
|-----|-----------------------|-----|----------|
|     |                       |     |          |
|     |                       |     |          |
|     |                       |     |          |
| P1  | STAGE 4 DRAWING ISSUE | DMC | 25.09.23 |
| ref | revision              | by  | date     |

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&  
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client

ISG CONSTRUCTION

project

WHITEFIELD FIRE STATION

drawing

PLAN ON PILECAPS AND GROUND BEAMS

drawn by

DMC

date

SEPT 2023

checked by

date

scale

As indicated @

A1

dwg no

WFSBGH-01-GF-DR-S-0102

rev

P1

## **APPENDIX 4**

### **EXPLORATORY HOLE LOGS**

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.

BH02

Sheet 1 of 1

Project Name:

Whitefield Fire Station

Co-ords:

380473E - 406498N

Project No.:

3866a

Location:

Whitefield, Greater Manchester

Level (mAOD):

102.93

Rev.:

1.0

Client:

Greater Manchester Combined Authority

Dates:

25/02/2023

Logged By:

JH

Weather:

Showers

Checked By:

LM

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

Remarks:

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

SPT Energy Ratio:

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



## ver. 0.5

Sheet 1 of 2

Project No.: 3866a

**Rev.:** 1.0

**Checked By:**

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:**

|                                                                                                     |               |                                                                                                                                                        |               |                                             |                    |                    |                                 |                                                                                                                                                                |                |
|-----------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------|--------------------|--------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <div><div>IGE</div><div>consulting</div></div>                                                      |               | Office 11, Bartle House, Oxford Court<br>Manchester M2 3WQ<br>email: contact@igeconsulting.co.uk<br>web: www.igeconsulting.co.uk<br>tel: 0161 914 9170 |               | <div>Borehole Log</div> <div>ver. 0.5</div> |                    |                    |                                 | <div>Borehole No.</div> <div>BH03</div> <div>Sheet 2 of 2</div>                                                                                                |                |
| 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.<br>GLACIAL TILL | 11             |
|                                                                                                     |               | 12.00 - 12.45<br>12.00 - 12.50<br>12.00                                                                                                                | D<br>B<br>SPT | N=40<br>(5,7/8,10,10,12)                    | 12.00              | 90.81              |                                 | Firm, brown, laminated, sandy, silty CLAY.<br>GLACIAL TILL                                                                                                     | 12             |
|                                                                                                     |               | 12.00 - 12.45<br>12.00 - 12.50<br>12.00                                                                                                                | D<br>B<br>SPT | N=40<br>(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.<br>GLACIAL TILL          | 13             |
|                                                                                                     |               | 13.50 - 13.95<br>13.50 - 14.00<br>13.50                                                                                                                | D<br>B<br>SPT | N=31<br>(4,5/7,7,8,9)                       |                    |                    |                                 |                                                                                                                                                                | 14             |
|                                                                                                     |               | 15.00 - 15.45<br>15.00 - 15.50<br>15.00                                                                                                                | D<br>B<br>SPT | N=27<br>(3,4/6,6,7,8)                       |                    |                    | Becoming stiff from 15.00m bgl. |                                                                                                                                                                | 15             |
|                                                                                                     |               | 16.50 - 16.95<br>16.50 - 17.00<br>16.50                                                                                                                | D<br>B<br>SPT | N=29<br>(3,4/5,7,8,9)                       |                    |                    |                                 |                                                                                                                                                                | 16             |
|                                                                                                     |               | 18.00 - 18.45                                                                                                                                          | U             |                                             |                    |                    |                                 |                                                                                                                                                                | 17             |
|                                                                                                     |               | 19.50 - 19.95<br>19.50                                                                                                                                 | D<br>SPT      | N=35<br>(3,5/7,8,9,11)                      |                    |                    |                                 | 18                                                                                                                                                             |                |
|                                                                                                     |               |                                                                                                                                                        |               |                                             | 19.95              | 82.86              |                                 | Borehole terminated at 19.95m.                                                                                                                                 | 19             |
| Remarks:<br>Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth. |               |                                                                                                                                                        |               | Casing Details                              |                    | Chiselling Details |                                 |                                                                                                                                                                |                |
|                                                                                                     |               |                                                                                                                                                        |               | Depth Top (m)                               | Depth Base (m)     | Diameter (mm)      | Depth Top (m)                   | Depth Base (m)                                                                                                                                                 | Duration (hrs) |
|                                                                                                     |               |                                                                                                                                                        |               | 0.00                                        | 6.00               | 200                |                                 |                                                                                                                                                                |                |
|                                                                                                     |               |                                                                                                                                                        |               | 0.00                                        | 15.00              | 150                |                                 |                                                                                                                                                                |                |
|                                                                                                     |               |                                                                                                                                                        |               | Water Strike                                |                    |                    |                                 |                                                                                                                                                                |                |
|                                                                                                     |               |                                                                                                                                                        |               | Depth Strike (m)                            | Time Elapsed (min) | Water Level (m)    |                                 |                                                                                                                                                                |                |
|                                                                                                     |               |                                                                                                                                                        |               | 3.00                                        | 20                 | 2.70               |                                 |                                                                                                                                                                |                |
| SPT Energy Ratio:                                                                                   |               |                                                                                                                                                        |               |                                             |                    |                    |                                 |                                                                                                                                                                |                |

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Borehole Log

ver. 0.5

Borehole No.  
BH04

Sheet 1 of 2

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380511E - 406469N

Level (mAOD):102.65

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

Weather:Rain

Project No.:3866a

Rev.:1.0

Logged By:AS

Checked By:

| Well / Backfill | Water Strikes | Sample and In Situ Testing         |               |                       | Depth (mbgl) | Level (mAOD) |   | Stratum Description                                                                                                                                                                                |   |
|-----------------|---------------|------------------------------------|---------------|-----------------------|--------------|--------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                 |               | Depth (m)                          | Type          | Results               |              |              |   |                                                                                                                                                                                                    |   |
| <div></div>     | <div></div>   |                                    |               |                       | 0.05         | 102.60       |   | ASPHALT.<br>MADE GROUND                                                                                                                                                                            |   |
|                 |               |                                    |               |                       | 0.40         | 102.25       |   | CONCRETE.<br>MADE GROUND                                                                                                                                                                           |   |
|                 |               |                                    |               |                       |              |              |   | Light brown, slightly sandy, subangular to subrounded, fine to coarse GRAVEL of concrete (70%) and limestone (30%).<br>MADE GROUND                                                                 | 1 |
|                 |               | 1.20 - 1.65<br>1.20 - 1.65<br>1.20 | B<br>D<br>SPT | N=5<br>(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%).<br>MADE GROUND |   |
|                 |               | 2.00 - 2.45<br>2.00 - 2.50<br>2.00 | D<br>B<br>SPT | N=3<br>(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.<br>GLACIOFLUVIAL SHEET DEPOSITS                | 2 |
|                 |               | 3.00 - 3.45<br>3.00 - 3.50<br>3.00 | D<br>B<br>SPT | N=11<br>(3,2/1,3,3,4) |              |              |   | Becoming firm from 3.00m bgl.                                                                                                                                                                      | 3 |
|                 |               | 4.00 - 4.45<br>4.00 - 4.50<br>4.00 | D<br>B<br>SPT | N=12<br>(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.<br>GLACIOFLUVIAL SHEET DEPOSITS                              | 4 |
|                 |               | 5.00 - 5.45                        | U             |                       |              |              |   |                                                                                                                                                                                                    | 5 |
|                 |               | 6.00 - 6.45<br>6.00 - 6.50<br>6.00 | D<br>B<br>SPT | N=19<br>(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.<br>GLACIOFLUVIAL SHEET DEPOSITS               | 6 |
|                 |               | 7.50 - 7.95<br>7.50 - 8.00<br>7.50 | D<br>B<br>SPT | N=8<br>(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.<br>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            |                    |                |                |

|                                                                                                    |               |                                                                                                                                                        |               |                                             |                    |                    |                                                                 |                                                                                                                                                                               |                |
|----------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------|--------------------|--------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <div><div>IGE</div><div>consulting</div></div>                                                     |               | Office 11, Bartle House, Oxford Court<br>Manchester M2 3WQ<br>email: contact@igeconsulting.co.uk<br>web: www.igeconsulting.co.uk<br>tel: 0161 914 9170 |               | <div>Borehole Log</div> <div>ver. 0.5</div> |                    |                    | <div>Borehole No.</div> <div>BH04</div> <div>Sheet 2 of 2</div> |                                                                                                                                                                               |                |
| 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                                     |                    |                    |                                                                 |                                                                                                                                                                               |                |
| <div></div>                                                                                        | <div></div>   | 10.50                                                                                                                                                  | SPT           | N=27<br>(3,4/6,6,7,8)                       |                    | 87.65              | <div></div>                                                     | Medium dense, brown, silty, fine to coarse SAND and subangular to well rounded, fine to coarse GRAVEL of mixed natural lithologies.<br>GLACIOFLUVIAL SHEET DEPOSITS           | <div></div>    |
|                                                                                                    |               | 12.00 - 12.45<br>12.00 - 12.50<br>12.00                                                                                                                | D<br>B<br>SPT | N=30<br>(3,5/7,7,8,8)                       |                    |                    |                                                                 |                                                                                                                                                                               |                |
|                                                                                                    |               | 13.50 - 13.95<br>13.50 - 14.00<br>13.50                                                                                                                | D<br>B<br>SPT | N=40<br>(4,6/9,9,10,12)                     |                    |                    |                                                                 |                                                                                                                                                                               |                |
|                                                                                                    |               | 15.00 - 15.45<br>15.00 - 15.50<br>15.00                                                                                                                | D<br>B<br>SPT | N=50 (6,8/50 for 295mm)                     |                    |                    |                                                                 |                                                                                                                                                                               |                |
|                                                                                                    |               | 16.00 - 16.45<br>16.00                                                                                                                                 | D<br>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.<br>GLACIOFLUVIAL SHEET DEPOSITS |                |
|                                                                                                    |               |                                                                                                                                                        |               |                                             |                    |                    |                                                                 | Borehole terminated at 16.45m.                                                                                                                                                |                |
| Remarks:<br>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:                                                                                  |               |                                                                                                                                                        |               |                                             |                    |                    |                                                                 |                                                                                                                                                                               |                |



|                                                                                                                           |                                                                                                                           |                                                                                                                                                        |        |                                                            |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><div>IGE</div><div>consulting</div></div>                                                                            |                                                                                                                           | Office 16, Bartle House, Oxford Court<br>Manchester M2 3WQ<br>email: contact@igeconsulting.co.uk<br>web: www.igeconsulting.co.uk<br>tel: 0161 914 9170 |        | <div>Dynamic Sample Borehole Log</div> <div>ver. 1.5</div> |           |                                                                                                                                                                  | Dynamic Sample No.<br><div>DS02</div>                                                                                     |        |                                                                                                                                                                     |
| Project Name: Whitefield Fire Station                                                                                     |                                                                                                                           |                                                                                                                                                        |        | Co-ords: 380501E - 406463N                                 |           | Project No.<br>3866a                                                                                                                                             |                                                                                                                           |        |                                                                                                                                                                     |
| Location: Whitefield, Greater Manchester                                                                                  |                                                                                                                           |                                                                                                                                                        |        | Level (m AOD): 102.67                                      |           | Logged By<br>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                                                    |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
| <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> | <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> | 0.05                                                                                                                                                   |        |                                                            | 102.62    | ASPHALT<br>MADE GROUND<br>CONCRETE<br>MADE GROUND                                                                                                                | <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 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.<br>MADE GROUND |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 0.50                                                                                                                                                   | ES     |                                                            |           | 0.85                                                                                                                                                             |                                                                                                                           | 101.82 | Soft dark grey slightly sandy slightly gravelly organic CLAY. Gravel is subangular fine of mudstone and timber fragments.<br>MADE GROUND                            |
|                                                                                                                           |                                                                                                                           | 0.50                                                                                                                                                   | PID    | 0.00ppm                                                    |           | 1.00                                                                                                                                                             |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 1.00                                                                                                                                                   | D      |                                                            |           | 1.35                                                                                                                                                             |                                                                                                                           | 101.32 | Very soft dark brown pseudofibrous PEAT.<br>GLACIOFLUVIAL SHEET DEPOSITS                                                                                            |
|                                                                                                                           |                                                                                                                           | 1.00                                                                                                                                                   | ES     |                                                            |           | 1.90                                                                                                                                                             |                                                                                                                           | 100.77 | Soft locally very soft light grey mottled dark grey silty organic CLAY.<br>GLACIOFLUVIAL SHEET DEPOSITS                                                             |
|                                                                                                                           |                                                                                                                           | 1.00                                                                                                                                                   | SPT(C) | N=2<br>(1,0/1,0,1,0)                                       |           | 2.70                                                                                                                                                             |                                                                                                                           | 99.97  | Very soft dark brown pseudofibrous clayey PEAT<br>GLACIOFLUVIAL SHEET DEPOSITS                                                                                      |
|                                                                                                                           |                                                                                                                           | 1.00                                                                                                                                                   | PID    | 0.00ppm                                                    |           | 2.90                                                                                                                                                             |                                                                                                                           | 99.77  | Very loose light grey mottled dark brown very silty fine to coarse SAND.<br>GLACIOFLUVIAL SHEET DEPOSITS                                                            |
|                                                                                                                           |                                                                                                                           | 2.00                                                                                                                                                   | D      |                                                            |           | 3.40                                                                                                                                                             |                                                                                                                           | 99.27  | Soft becoming firm light grey slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of mudstone and sandstone.<br>GLACIOFLUVIAL SHEET DEPOSITS |
|                                                                                                                           |                                                                                                                           | 2.00                                                                                                                                                   | SPT(C) | N=0<br>(1,0/0,0,0,0)                                       |           | 4.40                                                                                                                                                             |                                                                                                                           | 98.27  | Medium dense dark brown very silty very gravelly fine to coarse SAND. Gravel is subrounded fine or mixed lithologies.<br>GLACIOFLUVIAL SHEET DEPOSITS               |
| 3.00                                                                                                                      | D                                                                                                                         |                                                                                                                                                        |        | 5.00                                                       |           |                                                                                                                                                                  | 5                                                                                                                         |        |                                                                                                                                                                     |
| 3.00                                                                                                                      | SPT(C)                                                                                                                    | N=0<br>(1,0/0,0,0,0)                                                                                                                                   |        | 5.45                                                       | 97.22     | Dynamic Sample terminated at 5.45m.                                                                                                                              |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 4.00                                                                                                                                                   | D      |                                                            |           |                                                                                                                                                                  | 4                                                                                                                         |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 4.00                                                                                                                                                   | SPT(C) | N=9<br>(2,2/2,2,2,3)                                       |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.00                                                                                                                                                   | D      |                                                            |           |                                                                                                                                                                  | 3                                                                                                                         |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.00                                                                                                                                                   | SPT(C) | N=29<br>(6,7/7,7,7,8)                                      |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  | 2                                                                                                                         |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  | 1                                                                                                                         |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  | 0                                                                                                                         |        |                                                                                                                                                                     |
|                                                                                                                           |                                                                                                                           | 5.45                                                                                                                                                   |        |                                                            |           |                                                                                                                                                                  |                                                                                                                           |        |                                                                                                                                                                     |

|                                                                                         |              |         |                |          |                    |                |               |
|-----------------------------------------------------------------------------------------|--------------|---------|----------------|----------|--------------------|----------------|---------------|
| Remarks:<br>Hardstanding cored. Dynamic sample progressed to target depth at 5.45m bgl. | Water Strike |         | Casing Details |          | Sample Sleeve Runs |                |               |
|                                                                                         | Depth Strike | Remarks | Depth Base     | Diameter | Depth Top (m)      | Depth Base (m) | Diameter (mm) |
|                                                                                         | 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%      |               |

|                                                                                                                                                                                                          |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------|----------------------------------------------------------------|-------------------|--------------------|----------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <div><div>IGEconsulting</div><div>Office 16, Bartle House, Oxford Court<br/>Manchester M2 3WQ<br/>email: contact@igeconsulting.co.uk<br/>web: www.igeconsulting.co.uk<br/>tel: 0161 914 9170</div></div> |                                                                                                                           | <div>Dynamic Sample Borehole Log</div> <div>ver. 1.5</div> |                            | <div>Dynamic Sample No.<br/>DS03</div> <div>Sheet 1 of 1</div> |                   |                    |                |                        |                                                                                                                                    |                         |
| 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                                                        |                   |                    |                |                        |                                                                                                                                    |                         |
| <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>                                                                                | <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> |                                                            |                            |                                                                | 0.05              | 102.57             |                | ASPHALT<br>MADE GROUND |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    | CONCRETE<br>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.<br>MADE GROUND |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 0.70                                                       | ES                         |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 0.70                                                       | PID                        | 0.00ppm                                                        |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 1.00                                                       | SPT(C)                     | N=5<br>(1,1/1,1,2,1)                                           |                   | 0.90               | 101.72         |                        | Soft locally very soft sandy organic CLAY.<br>MADE GROUND                                                                          | 1                       |
|                                                                                                                                                                                                          |                                                                                                                           | 1.20                                                       | ES                         |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 1.20                                                       | PID                        | 0.00ppm                                                        |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 1.60                                                       |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           | 2.00                                                       | D                          |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 2.00                                                                                                                                                                                                     | ES                                                                                                                        |                                                            |                            |                                                                |                   |                    |                | 2                      |                                                                                                                                    |                         |
| 2.00                                                                                                                                                                                                     | SPT(C)                                                                                                                    | N=5<br>(2,1/2,2,1,0)                                       |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 2.00                                                                                                                                                                                                     | PID                                                                                                                       | 0.00ppm                                                    |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 2.50                                                                                                                                                                                                     |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 3.00                                                                                                                                                                                                     | D                                                                                                                         |                                                            |                            |                                                                |                   |                    |                | 3                      |                                                                                                                                    |                         |
| 3.00                                                                                                                                                                                                     | SPT(C)                                                                                                                    | N=11<br>(2,2/3,2,3,3)                                      |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 3.70                                                                                                                                                                                                     |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 3.70                                                                                                                                                                                                     |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
| 4.00                                                                                                                                                                                                     | SPT(C)                                                                                                                    | N=50<br>(2,3/4,8,18,20)                                    |                            |                                                                |                   |                    |                | 4                      |                                                                                                                                    |                         |
| 4.38                                                                                                                                                                                                     |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                |                        |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                | 5                      |                                                                                                                                    |                         |
|                                                                                                                                                                                                          |                                                                                                                           |                                                            |                            |                                                                |                   |                    |                | 6                      |                                                                                                                                    |                         |
| Remarks:                                                                                                                                                                                                 |                                                                                                                           | Water Strike                                               |                            | Casing Details                                                 |                   | Sample Sleeve Runs |                |                        |                                                                                                                                    |                         |
| Hardstanding cored. Dynamic sample progressed to refusal at 4.39m bgl                                                                                                                                    |                                                                                                                           | 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%               |                                                                                                                                    |                         |

|                                                         |               |                                                                                                                                                        |                       |                                                            |           |                   |                                                                                                                                                                        |                                                                                                                                                  |                |               |
|---------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------|-----------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|
| <div><div>IGE</div><div>consulting</div></div>          |               | Office 16, Bartle House, Oxford Court<br>Manchester M2 3WQ<br>email: contact@igeconsulting.co.uk<br>web: www.igeconsulting.co.uk<br>tel: 0161 914 9170 |                       | <div>Dynamic Sample Borehole Log</div> <div>ver. 1.5</div> |           |                   | Dynamic Sample No.<br><div>DS04</div> <div>Sheet 1 of 1</div>                                                                                                          |                                                                                                                                                  |                |               |
| 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      | 103.30            | Soft dark brown sandy CLAY with roots and rootlets.<br>TOPSOIL                                                                                                         |                                                                                                                                                  |                |               |
|                                                         |               |                                                                                                                                                        |                       |                                                            |           |                   | Soft dark brown sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of brick fragments, clinker, concrete, ceramic and mudstone.<br>MADE GROUND        |                                                                                                                                                  |                |               |
|                                                         | 0.50<br>0.50  | ES<br>PID                                                                                                                                              | 0.00ppm               |                                                            | 0.75      | 102.70            | Soft locally very soft dark brown organic CLAY.<br>GLACIOFLUVIAL SHEET DEPOSITS                                                                                        | 1                                                                                                                                                |                |               |
|                                                         | 1.00<br>1.00  | D<br>SPT(C)                                                                                                                                            | N=0<br>(1,0/0,0,0,0)  |                                                            | 1.40      | 102.05            | Very soft locally soft light grey mottled dark brownish grey silty sandy CLAY.<br>GLACIOFLUVIAL SHEET DEPOSITS                                                         | 2                                                                                                                                                |                |               |
|                                                         | 1.50<br>1.50  | ES<br>PID                                                                                                                                              | 0.00ppm               |                                                            | 2.70      | 100.75            | Firm dark brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies.<br>GLACIOFLUVIAL SHEET DEPOSITS | 3                                                                                                                                                |                |               |
|                                                         | 2.00<br>2.00  | D<br>SPT(C)                                                                                                                                            | N=0<br>(1,0/0,0,0,0)  |                                                            | 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.<br>GLACIOFLUVIAL SHEET DEPOSITS       | 4                                                                                                                                                |                |               |
|                                                         |               |                                                                                                                                                        |                       |                                                            |           |                   | Becomes orangish brown                                                                                                                                                 |                                                                                                                                                  |                |               |
|                                                         | 4.00          | SPT(C)                                                                                                                                                 | N=10<br>(1,0/2,3,2,3) |                                                            |           |                   |                                                                                                                                                                        |                                                                                                                                                  |                |               |
|                                                         |               |                                                                                                                                                        |                       |                                                            |           | 5.50              | 97.95                                                                                                                                                                  | Light greyish brown sandy slightly clayey subangular to well rounded fine to coarse GRAVEL of mixed lithologies.<br>GLACIOFLUVIAL SHEET DEPOSITS | 5              |               |
|                                                         |               |                                                                                                                                                        |                       |                                                            |           | 6.00              | 97.45                                                                                                                                                                  | Dynamic Sample terminated at 6.00m.                                                                                                              | 6              |               |
| 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%      |

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