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Environment

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Stockport Interchange - Ground Investigation Report

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Introduction

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1 Introduction

1.1 Background

AECOM has been commissioned on behalf of Transport for Greater Manchester (TfGM) to prepare a Ground Investigation Report (GIR) for the development of the site known as Stockport Interchange.

The details of the proposed development and proposed planning application boundary are provided in the masterplan provided by TfGM (Appendix A). The scheme includes the building of a new interchange, realignment of the current road layout, expansion of Mersey Square and the construction of a bridge across the River Mersey.

1.2 Scope of Work

Based on the findings of the Desk Study (Ref. 01) (AECOM, 2015) the objectives of this report are to:

- determine the general ground conditions;
- provide geotechnical information to support preliminary design based on the masterplan;
- investigate the potential for soil and/or groundwater contamination;
- investigate the ground gases on-site and determine their impact on the proposed design; and
- determine the level of remediation required for the proposed end-use.

This GIR will present a description of the ground investigation undertaken, findings and assessment of the site work, conclusions and recommendations.

1.3 Sources of Information

Information was obtained from a number of sources regarding the historical and current condition of the site, these included:

- Landmark Envirocheck Report (Ref: 02);
- Environment Agency (EA) Website: www.environment-agency.gov.uk;
- British Geological Survey (BGS) Geological Map Sheet 98 Stockport (Bedrock and Superficial), 1:50,000 scale, 1971 (Ref. 03) and 1977 (Ref. 04);
- BGS Website - Historical Boreholes: www.bgs.ac.uk/geoindex; and
- Zetica Unexploded Ordnance Risk Desk Study (Ref. 05).

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1.4 Parties Involved

The parties involved are as follows:

The Client is:

Transport for Greater Manchester.

The Consulting Engineer for the preparation of this report is:

AECOM,

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1.5 Limitations

This document has been prepared by AECOM Limited (“AECOM”) for sole use of the client company detailed above (the “Company”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Company.

Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the Report. No third party may rely upon this document without the prior and express written agreement of AECOM.

The report has been prepared and appropriate recommendations made on the basis of the proposed works described in the background Information section of this report and shown on the Figures. Should the proposed end use of the study area change it will be necessary to re-interpret the results of the assessment.

The information reviewed should not be considered exhaustive and has been accepted in good faith by AECOM as providing a true description of the study area conditions. However, no liability can be accepted for the accuracy of any of the reports prepared for the client or for third parties, or for any associated errors or omissions.

Any risks identified are perceived and based on information reviewed; actual risks can only be assessed following a physical investigation on site.

The effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance is subject to change from time to time. The conclusions presented herein are based on the guidance available at the time of writing. No liability can be accepted for the retrospective effects of any changes or amendments to the legislation or guidance.

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Site Details

2 Site Details

2.1 Introduction

This section provides a summary of relevant information as detailed in the AECOM Desk Study (Ref. 01).

2.2 Site Description

The site is an irregular shape and covers approximately 6.5 hectares; the boundary is defined by the red line shown on the masterplan included in Appendix A. The site comprises Stockport bus station, Mersey Square, two surface car parks and associated infrastructure, including the Stockport Viaduct.

Current Ordnance Survey (OS) mapping indicates that the site is located in the mixed commercial, industrial and residential setting of Stockport Town Centre. The River Mersey flows east to west through the site and is culverted under the north eastern section of the site, beneath Mersey Square Road. The northern boundary of the site extends to the M60. Merseyway Shopping Centre forms the eastern site boundary, with Stockport Rail Station forming the southern and south west boundary. The western boundary is the Stockport Rail Viaduct.

Relevant features in the near vicinity of the site are summarised in Table 2.1.

Table 2.1. Features Surrounding the Site.

Direction	Summary
North	River Mersey, commercial buildings, several car parks, M60.
South	Stockport Rail Station, Station Road.
East	Merseyway Shopping Centre, commercial buildings.
West	Stockport Rail Viaduct.

2.3 Site History

The historical Ordnance Survey (OS) maps obtained with the Landmark Envirocheck Report (Ref. 02) date between 1848 and 2015. Development that may have occurred between map editions is recorded as occurring on the latter published map, hence there are some limitations to the accuracy to the date of development unless supplementary evidence is available.

The historical maps show that the site included residential properties with some industrial buildings on the first OS edition in 1848. The historical maps show the site and surrounding area to have become more industrialised over time. The current Stockport bus station was built during the late 1970's.

A summary of the historical land uses is presented in Table 2.2.

Table 2.2. Historical Land Uses.

Year [scale]	Features on-site	Features off site
1848 (1;10,560)	There is general development recorded across the site, including terraced housing and various commercial and industrial developments. The principal features are as follows: - Wellington Road South runs through the site approximately north to south. - There is a mill in the north eastern part of the site. - A viaduct runs north to south through the western part of the site. - The River Mersey flow east west through the central section of the site.	There is significant residential, commercial and industrial development in the area surrounding the site. The principal features are as follows: - Stockport Gas Works is located 50m north west of the northern boundary. - A foundry is located 50m north of the site boundary. - There is a timber yard 230m north of the north site boundary. - A possible quarry noted is as a “bar” 250m north of the site. - There is a cutting running along the viaduct 200m north west of the site - There is a mill located 230m east of the eastern site boundary. - St Peters Church and cemetery is located 50m south east of the site. - Spring Banks Mill is located 30m south of the southern site boundary. - There is a coal depot 100m south west of the southern site boundary. - Stockport Station is located 250m south of the southern boundary.
1851 (1;1,056)	- Two reservoirs are marked in the centre of the site. - Chester Gate Mill and an associated chimney are located on site. - There is a machine shop recorded in the centre of the site. - Two timber yards are recorded on the northern edge of the site. - There is a print works on the southern part of the site - There a reservoir on the southern boundary of the site. - There is a smithy on the western part of the site. - Part of the Chester Gate Print Works is recorded near the western boundary of the site. A further print works is located in the centre of the site.	The surrounding land use remains a mix of residential (predominantly terraced), industrial and commercial development. There are numerous mills of varying sizes recorded throughout the surrounding area, they have not been recorded individually here. Other notable development includes the following: - A coal yard 250m north of the site. - A dye works adjacent to the north western site boundary - The site noted as “bar” is now called Crowther’s Dam - Gasometers are recorded along the north eastern site boundary. With a further a gasometer 100m east of the site. - A pond 50m east of the eastern site boundary. - Four reservoirs are recorded adjacent to the south eastern boundary of the site. - There is a timber yard 70m east of the south eastern site boundary. - A timber yard, smithy and iron foundry are noted 20m, 50m and 100m west of the site respectively.
1873 (1;1,056)	Generally the site development remains unchanged with the exception of the following key features: - The timber mill in the northern section of the site has been demolished. - The reservoirs at the centre of the site are now recorded as a timber yard. - The chimney next to Chester Gate Mill is no longer marked on the historical maps.	- The gas works to the north of the site has expanded and the dye works and several houses have been demolished in this area. - The coal depot to the north is now housing. - The gasometer 100m from site is no longer shown on the map. - Crowther’s Dam is no long noted on the map. - There are a series of tracks leading to the goods yard 150m north west of the site. - There is a timber yard 10m south of the eastern site boundary adjacent to St Peter’s Church. - The pond is no longer recorded and the area is now noted as a bathhouse.

Year [scale]	Features on-site	Features off site
		- The rail tracks to the south now cover a larger area. - There is a mill/works 100m south east of the site.
1874 - 1875 (1;2,500)	The site remains generally unchanged.	The surrounding area remains generally unchanged with the exception of the addition of Stockport infirmary 250m south east of the site.
1895 (1;1,056, 1;2,500, & 1;10,560)	There has been some demolition of residential, commercial and industrial properties. The principal changes to site features during this time are as follows: - Wellington Road now has a tramline running north to south - The printing works adjacent to the River Mersey is now noted as a chemical works	- There is now an iron and brass foundry 100m east of the site. - The reservoir on the south eastern boundary is now a coal yard. - The works south east of the site is now a hat works. -
1899 (1;2,500 & 1;10,560)	Generally the site remains unchanged with the exception of the following: - There is a new bridge crossing the River Mersey in the east of the site. - The timber yard at the centre of the site is no longer marked on the site. - There is now a timber yard adjacent to Wellington road 5m north of the south eastern boundary.	- The coal depot to the south is now noted as an electrical works. - There is now a timber yard 230m south west of the site. - The mills adjacent to the south east site boundary are now a hat factory.
1907 (1;2,500)	Generally the site remains unchanged with the exception of the following: - The addition of a tramline in the northern part of the site which leads to a tram depot located just offsite. - There is a fire station located in the north of the site.	Generally the surrounding land remains unchanged with the exception of a tunnel recorded 50m north of the site which is shown to run west to east.
1910 (1;2,500 & 1;10,560)	Generally the site remains unchanged with the exception of a tin works adjacent to Astley Street.	Generally the surrounding land remains unchanged with the exception of the following: - The smithy is no longer marked on the map. - A mechanical works is noted 70m east of the south eastern boundary. - The tanks to the south are no longer marked on the map. - All the timber yards to the west are no longer marked on the map. - There is a clothing works on the western boundary of the site.
1922 (1;2,500)	Generally the site remains unchanged.	Generally the surrounding land remains unchanged with the exception of the following: - The foundry to the north of the site is now noted as a brass and copper foundry. - The timber yard adjacent to St Peters Church is no longer evident. - The mechanical works is now a public library.
1934 (1;2,500 & 1;10,560)	Generally the site remains unchanged with the exception of the following: - The timber yard at the centre of the site has expanded. - The print works at the southern boundary is now noted as exchange	Generally the surrounding land remains unchanged with the exception of the following principal observations: - The gas works is now a tram and bus depot.

Year [scale]	Features on-site	Features off site
	building. - The reservoir at the south of the site is no longer evident. - The map indicates a slope at the south of the site. -	- The tram depot has expanded. - The mill on the south eastern boundary has been demolished. - There are two saw mills approximately 150m west and south west of the site. - There is hat factory 150m west of the western site boundary. - There is a works 150m south west of the western site boundary.
1959 (1; 2,500)	Generally the site remains unchanged with the exception of the following: - There is a bus station where the tram lines and fire station were at the northern part of the site. - The exchange building has been demolished. - The timber yard is now noted as a works. - The mill is now noted as a works. - The tramline is no longer evident. - There is a car park adjacent to the bus station. - There is a garage next to the work/mill. -	Generally the surrounding land remains unchanged with the exception of the following - Timber yards to the north are no longer evident. - The tram and bus station is now noted as a bus station. - The hat factory is now noted as a depot. - The mill 50m south east of the site is now recorded a depot. - There is garage 30m east of the south east site boundary. - There are now several works adjacent to the western site boundary. - The electrical works has been demolished. - The foundry is no longer marked on the map. - The saw mills are now depots. - The tram depot is now recorded as a bus depot
1965 - 1973 (1;1,250, 1;2,500 & 1;10,000)	Generally the site remains unchanged with the exception of the following: - Several buildings have been demolished in the centre of the site. - By 1971 it appears the River Mersey has been built over and possibly culverted up to Wellington Road. - The bus station has expanded. -	Generally the surrounding land remains unchanged with the exception of the following: - A lubricants works is recorded 150m south west of the site. - The depot next to the south eastern boundary is now noted as Wellington Mill. - Several houses and works have been demolished to the west of the site and the area is now part of a bus depot. - The saw mill 150m west is now a steel warehouse.
1980 (1;250, 1;10,000)	Stockport Bus Station has been constructed and generally appears in its current configuration. The remainder of the site appears relatively unchanged.	The bus depot at Heaton Lane has been demolished. Generally the surrounding land remains unchanged.
1984 - 1991 (1;1,250	A car park and stairs /path have been constructed on the slope in the south of the site. Generally the site remains unchanged. -	Generally the surrounding land remains unchanged with the exception of the following: - The baths are now a leisure centre. - The bus depot is now a multi-storey car park. - There is a garage 50m north west of the site. - The sidings and the coal yards south of the site are no longer evident.
1990 - 1995 (1;1,250 & 1;10,00)	Generally the site remains unchanged.	Generally the surrounding land remains unchanged with the exception of the following: - Highgate House and a substation have been built next to the south eastern boundary of the site. - The garage to the south east of the site has been demolished.

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Year [scale]	Features on-site	Features off site
2006 - 2015 (1;10,000)	The site appears to remain relatively unchanged.	- The surrounding area appears to remain relatively unchanged.

2.4 Geology

The published 1:50,000 scale geological map of the area produced by the British Geological Survey (BGS) (Sheet 98, Stockport, 1971 and 1977) indicates that the site is underlain by the geological strata presented in Table 2.3. Made Ground associated with the historical land uses across the site is anticipated to be present at the surface.

Table 2.3. BGS Geological Strata.

Age	Group	Geological Stratum
Devensian	-	Glacial Till
	Glaciofluvial Deposits	Glaciofluvial Sheet Deposits
Quaternary	-	River Terrace Deposits
Triassic	Sherwood Sandstone Group	Chester Pebble Beds Formation

A summary of the geological strata is given below.

2.4.1 Glacial Till

Glacial Till is unsorted, heterogeneous sediment deposited by glaciers. Glacial Till may contain clays, silts, sands, gravels and boulders. The thickness and continuity of the Glacial Till in the vicinity of the site is unknown.

2.4.2 Glaciofluvial Sheet Deposits

The Glaciofluvial Sheet Deposits are sediment deposited by glacial rivers. The strata may consist of sands and gravels with lenses of silt and clay. The thickness and continuity of the Glaciofluvial Sheet Deposits is not known.

2.4.3 River Terrace Deposits

The River Terrace Deposits is sediment deposited by rivers. The stratum consists of sands and gravels with lenses of silt, clay and peat.

2.4.4 Chester Pebble Beds Formation

The strata consists of fine to coarse grained Sandstone, it is commonly pebbly with conglomerates and sporadic siltstones. Thickness is variable but may be up to 1,500m. The geological maps indicate two fault lines crossing the site both running north west to south east.

2.4.5 Made Ground

The review of historical mapping for the site suggests that in addition to these natural strata Made Ground will present at the surface. Made Ground deposits are likely to be of variable composition, depth, nature and distribution.

A number of historical exploratory hole locations are available on the BGS website; these are summarised in Table 2.4.

Table 2.4. Historical BGS Boreholes.

Borehole Reference NGR Distance from the site (Date)	Stratum	Description	Depth to Top of Stratum (m bgl)	Level of Top of Stratum (m OD)	Thickness (m)
SJ89SE32 389152,390206 On site (Unknown)	**Made Ground**	Made Ground	G.L	42.67	0.3
	Glaciofluvial Deposits	Red Sand	0.3	42.37	0.91
	Glaciofluvial Deposits	Grey Sand	1.21	41.46	0.92
	Glaciofluvial Deposits	Gravel	2.13	40.54	1.52
	Chester Pebble Beds Formation	Red Sandstone rock	3.65	39.02	5.8
SJ89SE789 389270, 390090 On site (31/3/1988)	**Made Ground**	Medium dense brown clayey silty sandy brick gravel	GL	Unknown	1.0
	Glaciofluvial Deposits	Medium dense reddish brown very silty gravelly SAND	1.0	Unknown	0.5
	Sandstone	Reddish brown slightly to moderately weather SANDSTONE	1.5	Unknown	1.5
SJ89SE790 389270, 390120 On site (1/4/1988)	**Made Ground**	Medium dense brown silty brick gravel and cobbles	GL	Unknown	2.4
	Chester Pebble Beds Formation	Reddish brown slightly to moderately weathered SANDSTONE	2.4	Unknown	1.25
SJ89SE91 389230,390120 On site (1/4/1988)	**Made Ground**	Loose brown brick gravel and cobbles	GL	Unknown	1.3
	River Terrace deposits	Soft brown CLAY	1.3	Unknown	0.6
	Glaciofluvial Deposits	Dense to very dense reddish brown very silty sandy GRAVEL	1.9	Unknown	0.9
	Chester Pebble Beds Formation	Reddish brown slightly to moderately weathered SANDSTONE	2.8	Unknown	3.3
SJ89SE792 389230, 390110 On Site (31/3/1988)	**Made Ground**	Loose dark grey to dark brown silty sandy ash and brick gravel and cobbles (rubble)	GL	Unknown	1.2
	Made Ground	Very loose dark grey to dark brown silty sandy ash and brick gravel and cobbles (rubble) Made round with some to occasion off white gravel sized particles with a limey odour possible chemical waste	1.2	Unknown	3.3
	Chester Pebble Beds Formation	Reddish brown slightly to moderately weathered SANDSTONE	4.5	Unknown	3.1

2.5 Mining and Quarrying

The Coal Authority website (www.coal.gov.uk) indicates that the site is outside of a Coal Mining Reporting Area. Given the urban nature of the site, it is unlikely to be impacted by any historical underground or surface mining activity.

Information included in the Envirocheck Report (Ref. 02) and on the EA website indicates there are four closed clay/sand pits between 650 and 860m from the site. These are located to the east and west/northwest of the site north of the River Mersey.

2.6 Hydrology and Hydrogeology

The EA website shows the Chester Pebble Beds Formation is classified as a Principal Aquifer. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

The Glacial Fluvial Deposits are classed as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The Glacial Till is classed as an Unproductive Strata. These are drift deposits with low permeability that have negligible significance for water supply or river base flow.

The site is not located within a Groundwater Source Protection Zone.

The nearest surface water course is the River Mersey which is culverted under the eastern section of the site and runs from east to west. The EA graded the Water Quality as Fair.

The River Tame lies to the north east of the site running from north east to south west. The River Tame meets the River Goyt, approximately 750m north east of the site, to form the River Mersey, which flows from east to west through the site.

A single surface water abstraction point has been identified within 1km of the site. The abstraction is located approximately 850m to the north east and is operated by Salpa Kay Ltd for cooling purposes, with the abstraction taken from the River Tame.

The indicative floodplain map for the area, published by the EA, shows that the site lies within the predicted flood plain of River Mersey, Flood Risk Zone 2. Therefore the site is considered to be susceptible to fluvial flooding.

2.7 Preliminary Risk Assessment

2.7.1 Introduction

This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered. It is based on the proposed site redevelopment which will comprise a new interchange which a rearrangement of the current road layout including the building of a new bridge across the River Mersey and an expansion of Mersey Square as identified in Section 1.1

The legislative framework for land contamination risk assessment and the principle of contaminant linkages to derive a Conceptual Site Model (CSM) are described in Appendix B.

2.8 Potential Sources of Contamination

2.8.1 Historical Usage

A review of historical OS maps of the area revealed that the site was formerly occupied by a combination of residential commercial and industrial development and associated infrastructure. Industrial development included. but was not limited to. mills, gas works, hat manufacturers, print works and timbers yards. Demolition and redevelopment of sections of the site is also recorded. Possible releases of contamination may therefore have historically taken place on the site and may have included the following:

- Petroleum hydrocarbons;
- Solvents (including chlorinated hydrocarbons);
- Phenols;
- Polycyclic Biphenyls (PCBs);
- Organic and inorganic pigments;
- Inorganic compounds including cyanide (gas work waste);
- Polycyclic aromatic hydrocarbons (PAHs);
- Heavy metals (including mercury and arsenic);
- Sulphates; and
- Asbestos.

In addition to the schedule given above, the land may have become contaminated by filling and/or other construction activities, or by illegal dumping. Soil gases and or other mobile contaminants may also potentially be present.

2.8.2 Recent and Current Usage

The current site use is an operational bus station and commercial properties, there is the possibility that there will be release of hydrocarbons into the ground.

Contamination may have arisen through leaks and spills of fuels and oils around storage areas where bunding has not been provided.

2.8.3 Off Site Sources of Contamination

The site is located in an urban area which includes a variety of historical and recent potentially contaminating land uses. It is possible that any potential contamination associated with these land uses has resulted in the contamination of soils and groundwater and resulted in the generation of potential ground gas. These sources have the potential to migrate onsite via aerial deposition and lateral sub-ground migration of contaminated groundwater and/or ground gas. As such off site sources of contamination may have the ability to effect the site and future developments.

The landfill (former clay/sand pit) is considered to be of sufficient distance, over 600m to the north east, from the site and is not to be considered a potential source of contamination.

2.8.4 Summary

The potential sources of contamination can be summarised as follows:

S1 – Potentially contaminated Made Ground and shallow natural soils; and

S2 – Potentially contaminated groundwater flowing onto site from off site sources;

2.9 Potential Pathways

Potential pathways for contamination present include the following:

P1 – Direct contact with soil (ingestion and dermal);

P2 – Inhalation of dust and/or vapours;

P3 – Ingress and /or accumulation of ground gas /vapours;

P4 - Inhalation of ground gas;

P5 – Surface water run-off;

P6 – Leaching of contaminants and vertical migration into groundwater;

P7 – Lateral migration of groundwater providing base flow to watercourses;

P8 – Direct contact of contaminated ground with in-ground structures and ecological receptors; and

P9 – Plant uptake.

2.10 Potential Receptors

Human Health Receptors

R1 – Construction workers;

R2 – Maintenance workers;

R3 – Final end users; and

R4 – Adjacent site users.

Controlled Waters

R5 – Primary /Secondary Aquifers underlying the site; and

R6 – Surface Water in the vicinity of the site (River Mersey).

Ecological Receptors

R7 – Future planting and landscaping.

Property

R8 – Future proposed services and structures.

2.11 Preliminary Risk Assessment

A qualitative ‘source–pathway–receptor’ approach has been used to assess the potential risks of harm being caused to human, environmental, or controlled water receptors from contamination sources on or in the vicinity of the site, via transport pathways. Risks to receptors have been assessed using the guidelines given in CIRIA document 552 ‘Contaminated Land Risk Assessment, A Guide to Good Practice’ (Ref. 06), where the probability and consequences of

contamination risks being realised are evaluated. The tables presented in Appendix B summarise the elements of the risk assessment process.

A Conceptual Site Model (CSM) illustrating plausible contaminant linkages has been formulated for this site. The qualitative risk assessment of the possible linkages of the above sources (S1 to S2), transport pathways (P1 to P9) and receptors (R1 to R8) is provided in the Table 2.5.

Table 2.5. Preliminary Risk Assessment.

Source	Transport Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Justification	Contaminant Linkage ID
S1: Potentially contaminated Made Ground and shallow natural soils	P1: Direct contact with soil (ingestion and dermal)	R1: Construction workers	Medium	Likely	Moderate Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and groundwater. If the site is contaminated, appropriate mitigation measures will be required, including the use of PPE and good hygiene practises, to ensure that health and safety risks are minimised during construction.	1
		R2: Maintenance workers	Medium	Likely	Moderate Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and groundwater. If the site is contaminated and remediation is not deemed necessary, appropriate mitigation measures will be required, to ensure that health and safety risks to maintenance workers are managed by appropriate facility health and safety plans.	2
		R3: Final end users	Medium	Unlikely	Low Risk	It is assumed that the site will be covered in either structures and /or hardstanding, therefore there will be no pathway between end users and potentially contaminated soils.	No contaminant linkage
	P2: Inhalation of dust and / or vapours	R1: Construction workers	Medium	Likely	Moderate Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and groundwater. If the site is contaminated, appropriate mitigation measures will be required, including the use of PPE and good hygiene practises, to ensure that health and safety risks are minimised during construction.	3
		R2: Maintenance workers	Medium	Likely	Moderate Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and groundwater. If the site is contaminated and remediation is not deemed necessary, appropriate mitigation measures will be required, to ensure that health and safety risks to maintenance workers are	4

Source	Transport Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Justification	Contaminant Linkage ID
						managed by appropriate facility health and safety plans.	
		R3: Final end users	Medium	Likely	Moderate	Vapours may migrate into building via preferential pathways in service trenches and through foundations. It is assumed that the site will be covered in either structures and /or hardstanding, therefore there will be no pathway between end users and potentially contaminated dust. An intrusive ground investigation will be necessary to determine the potential for volatile contaminants in soils and groundwater.	5
		R4: Adjacent site users	Medium	Low Likelihood	Moderate / Low Risk	Adjacent site users may be at risk during the construction phase, when potentially contaminated soils will be excavated and stockpiled. If necessary implement appropriate mitigation measures during the construction phases to minimise the risk to adjacent site users from wind blow dust. An intrusive ground investigation will be necessary to quantify and characterise possible contamination.	**6**
	P4: Inhalation of ground gas	R1: Construction workers	Severe	Likely	High Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and the monitoring of potential ground gases. If the site is contaminated, appropriate mitigation measures will be required including the use of PPE and good hygiene practises, to ensure that health and safety risks are minimised during construction.	**7**
		R2: Maintenance workers	Severe	Likely	High Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and the monitoring of potential ground gases. If the site is contaminated and remediation is not deemed necessary, appropriate mitigation measures will be required, to ensure that health and safety risks to maintenance workers are managed by appropriate facility health and safety plans.	**8**

Source	Transport Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Justification	Contaminant Linkage ID
		R3: Final end users	Severe	Likely	High Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and the monitoring of potential ground gases.	**9**
	P6: Surface water run-off and/or direct percolation from surface	R6: Surface water (River Mersey)	Medium	Low Likelihood	Moderate /Low Risk	Exposure of potentially contaminated soils during the construction phase may results in contaminated run-off entering the river. Following construction it is assumed that the site will be covered in hard standing minimising the risk of contaminated run off. An intrusive ground investigation may be necessary to characterise possible contamination in the soils and allow appropriate mitigation to be implemented during the construction phase.	**10**
	P5: Leaching of contaminants	R5: Principal Aquifer/Secondary Aquifer	Medium	Low Likelihood	Moderate /Low Risk	Leaching of contaminants may occur during the construction phase. Mitigation measures may be necessary during the construction phase to minimise the risk of leaching. It is assumed that following construction the site will be covered in relatively impermeable hard standing. An intrusive ground investigation may be necessary to characterise possible contamination in the soils and groundwater.	**11**
	P8: Direct contact with in-ground structures and services.	R8: Proposed services and structures	Mild	Likely	Moderate /Low Risk	An intrusive ground investigation will be necessary to further quantify and characterise possible contamination.	**12**
	P9: Plant uptake	R7: Proposed planting	Minor	Likely	Low Risk	An intrusive ground investigation will be necessary to further quantify and characterise possible contamination.	**13**
	P8: Migration and accumulation of gases	R8: Proposed services and structures	Severe	Low Likelihood	Moderate Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination including chemical testing of soils and the monitoring of potential ground gases.	**14**

Capabilities on project:
Environment

Source	Transport Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Justification	Contaminant Linkage ID
S2: Potentially contaminated groundwater	P7: Vertical and lateral migration of groundwater	R5: Principal Aquifer/Secondary Aquifer	Medium	Low Likelihood	Moderate /Low Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination in groundwater.	**15**
	P7: Vertical and lateral migration of groundwater	R6: Surface waters	Medium	Low Likelihood	Moderate /Low Risk	An intrusive ground investigation will be necessary to quantify and characterise possible contamination in groundwater.	**16**

Ground Investigation

Capabilities on project:
Environment

3 Ground Investigation

3.1 Overview

An intrusive ground investigation was carried out by Geotechnics Ltd between 30 November and 18 December 2015. The investigation comprised the following elements:

- 21 No. boreholes progressed to a depth between 0.5 and 6.5m below ground level (m bgl) using cable percussion techniques;
- 10 No. boreholes extended by up to 15m into bedrock, to depths between 7.8 and 22.3m bgl, using rotary coring techniques;
- 13 No. hand dug trial pits excavated to depths between 0.24 and 1.30m;
- 10 No. dynamic probes progressed to depths between 3.45 and 4.98m;
- 19 No. window samples undertaken to between 0.30 and 5.45m bgl;
- 24 No. exploratory holes (9 No. in boreholes, 15 No. in window sample holes) had 50mm dual gas and groundwater monitoring wells installed; and
- 3 No. gas and groundwater monitoring rounds.

The findings of the ground investigation (GI) are presented in Geotechnics' Ground Investigation Factual Report for Stockport Bus Station (Ref. 07) (hereafter, Factual Report), included in Appendix C. The exploratory hole location plan is shown on Drawing 60340298-ACM-00-GEO-DR-0001, with the geological sections presented on Drawing 60340298-ACM-00-GEO-DR-0002.

3.2 Boreholes

A summary of the boreholes is presented in Table 3.1.

Capabilities on project:
Environment

Table 3.1. Borehole Summary.

Borehole	Drilling method	Completion Depth (m bgl)	Borehole Level (m OD)	Installation details	Response Zone (m bgl)	Water Strike (m bgl)	
						Initial strike	After 20 mins
BH101	CP/RC	15.30	45.22	50mm dia. dual groundwater/ground gas standpipe.	5.00-7.00	1.20	No rise
BH102	CP/RC	14.70	43.35	50mm dia. dual groundwater/ground gas standpipe.	8.00-10.00	-	-
BH103	CP/RC	14.70	42.42	50mm dia. dual groundwater/ground gas standpipe.	11.00-14.00	-	-
BH104	CP/RC	15.00	42.47	50mm dia. dual groundwater/ground gas standpipe.	1.00-3.50	-	-
BH105	CP/RC	15.20	42.62	50mm dia. dual groundwater/ground gas standpipe.	9.50-12.00	-	-
BH106	CP/RC	15.00	42.45	50mm dia. dual groundwater/ground gas standpipe.	5.00-7.00	-	-
BH107 *	CP/RC	7.80	42.27	No installation.	-	-	-
BH108	CP/RC	22.30	42.72	50mm dia. dual groundwater/ground gas standpipe.	18.00-21.00	-	-
BH109	CP/RC	20.70	42.36	50mm dia. dual groundwater/ground gas standpipe.	18.00-20.00	-	-
BH111	CP	1.55	50.92	No installation.	-	-	-
BH112	CP/RC	14.80	43.70	50mm dia. dual groundwater/ground gas standpipe.	12.80-14.80	-	-
CT1	N/A	1.20	42.24	No installation.	-	-	-
CT1A	CP	4.32	42.19	No installation.	-	-	-
CT3	CP	4.35	42.11	No installation.			

CT4	CP	3.30	42.07	No installation.	-	-	-
CT5	CP	5.15	42.73	No installation.	-	-	-
CT6	CP	0.50	42.60	No installation.	-	-	-
CT6A	CP	1.00	42.59	No installation.	-	-	-
CT6B	CP	5.50	42.66	No installation.	-	-	-
CT7	CP	5.50	42.75	No installation.	-	-	-
CT8	CP	6.50	42.72	No installation.	-	-	-

CP= Cable Percussion, RC= Rotary Coring.

* BH107 terminated at 9.1m bgl, after encountering a void from 7.8m bgl. The void was later identified as a sewer. The hole encountered Made Ground from surface to 0.9m bgl, Glacial Sand and Gravel from 0.9 to 3.0m bgl, weathered Sherwood Sandstone 3.0 to 4.0m bgl, Sherwood Sandstone (cored) from 4.0 to 7.5m bgl and tunnel brick lining from 7.5 to 7.8m bgl.

3.3 Window Samples

A summary of the window sample holes is presented in Table 3.2.

Table 3.2. Window Sample Summary.

Window Sample	Depth (m bgl)	Ground Level (m OD)	Installation details	Response Zone (m bgl)	Water Strike (m bgl)	
					Initial strike	After 20 mins
WS201	4.27	45.61	50mm dia. dual groundwater/ground gas standpipe.	3.50-4.00	-	-
WS203	3.34	43.01	50mm dia. dual groundwater/ground gas standpipe.	2.00-3.00	-	-
WS204	2.86	42.85	50mm dia. dual groundwater/ground gas standpipe.	1.50-2.45	-	-
WS205	2.38	42.39	50mm dia. dual groundwater/ground gas standpipe.	1.50-2.00	-	-

Window Sample	Depth (m bgl)	Ground Level (m OD)	Installation details	Response Zone (m bgl)	Water Strike (m bgl)	
					Initial strike	After 20 mins
WS206	2.34	48.13	50mm dia. dual groundwater/ground gas standpipe.	1.00-2.00	-	-
WS208	3.20	42.35	50mm dia. dual groundwater/ground gas standpipe.	1.70-2.80	-	-
WS209	3.26	42.67	50mm dia. dual groundwater/ground gas standpipe.	1.00-3.00	-	-
WS210	5.09	44.43	50mm dia. dual groundwater/ground gas standpipe.	3.00-5.00	-	-
WS211	4.67	44.88	50mm dia. dual groundwater/ground gas standpipe.	1.00-2.00	-	-
WS212	4.43	45.74	50mm dia. dual groundwater/ground gas standpipe.	2.50-3.50	-	-
WS214	5.45	46.35	50mm dia. dual groundwater/ground gas standpipe.	0.50-1.00	-	-
WS217	2.68	42.30	50mm dia. dual groundwater/ground gas standpipe.	1.50-2.50	-	-
WS218	1.70	42.75	No installation.	-	0.9	0.8
WS218A	3.17	42.71	50mm dia. dual groundwater/ground gas standpipe.	1.00-2.50	0.9	Damp
WS219	2.45	45.13	No installation.	-	-	-
WS220	4.07	44.69	50mm dia. dual groundwater/ground gas standpipe.	1.20-1.70	-	-
WS221	0.30	51.03	No installation.	-	-	-
WS223	3.72	43.39	50mm dia. dual groundwater/ground gas standpipe.	0.50-1.40	1.20	Slow inflow
WS224	1.70	53.31	No installation.	-	-	-

3.4 Dynamic Probe

A summary of the dynamic probe holes is presented in Table 3.3.

Table 3.3. Dynamic Probe Summary.

Dynamic Probe	Completion Depth (m bgl)	Ground Level (m OD)
DP1	3.40	42.30
DP2	3.80	42.13
DP3	3.90	42.13
DP4	4.30	42.07
DP5	3.90	42.73
DP6	4.70	42.62
DP7	4.40	42.59
DP8	4.00	42.85
DP9	4.10	42.71
DP10	4.90	42.65

3.5 Trial Pits

A summary of the hand dug trial pits is presented in Table 3.4.

Table 3.4. Trial Pit Summary.

Trial Pit	Depth (m bgl)	Ground Level (m OD)	Stability of Trial Pit Walls	Water Strike (m bgl)	
				Initial strike	After 20 mins
HP01	1.2	48.58	Stable	-	-
HP02	1.2	52.84	Stable	-	-
TP1	0.65	42.25	Stable	-	-
TP2	1.10	42.09	Stable	-	-
TP3	0.85	42.07	Stable	-	-
TP4	0.80	42.12	Stable	-	-
TP5	1.20	42.16	Stable	-	-
TP6A	1.25	-	Stable	-	-
TP6B	0.40	-	Stable	-	-
TP7A	1.30	-	Stable	-	-
TP7B	0.33	-	Stable	-	-
TP8	0.80	42.80	Stable	-	-
TP9	0.24	42.79	Stable	-	-

3.6 In-situ Testing

Standard Penetration Tests (SPTs) were undertaken in the cable percussion holes, rotary holes and window sample holes. The tests were undertaken generally at 1m intervals within the first 5m in soils and weathered Sherwood Sandstone and in rotary holes where core recovery was less than 80%.

Hand shear vane tests were not undertaken due to the granular nature of the Made Ground.

3.7 Laboratory Testing

3.7.1 Geotechnical Testing

Soil samples were obtained from the boreholes, window samples and within the trial pits. Selected soil samples were scheduled for a range of the following geotechnical tests;

- Natural moisture content (12 No.);
- Atterberg Limits (11 No.);
- Particle Size Distribution (11 No.);
- pH (35 No.);
- Organic matter content, Total Acid Soluble Sulphate (Total Sulphate BRE) and Water Soluble Sulphate (Sulphate as SO4 (2:1 Ext)) (35 No.);
- Dry Density, Moisture Content Relationship (1 No.);
- Unconfined Compressive Strength (No. TBC.); and
- Point Load Testing (54 No.).

3.7.2 Contamination Testing

Soil samples for contamination testing were taken from the exploratory holes at 0.3m bgl, 0.5m bgl, and 1.0m bgl, and thereafter in metre intervals within the Made Ground deposits and strata where visual or olfactory evidence of contamination was encountered. Water samples from boreholes were obtained during post investigation groundwater and gas monitoring visits.

Based on the potential contaminants identified on site and with AECOMs Desk Study (Ref. 12), selected soil and groundwater samples were analysed by Jones Laboratories for the determinants as listed in Table 3.5.

Capabilities on project:
Environment

Table 3.5. Chemical Testing Suites.

Determinand	Total Soils analytical suite	Total Leachate analytical suite	Total Waters analytical suite
Arsenic	✓	✓	✓
Cadmium	✓	✓	✓
Chromium (Total)	✓	✓	✓
Chromium III	✓	✓	✓
Chromium VI	✓	✓	✓
Copper	✓	✓	✓
Lead	✓	✓	✓
Nickel	✓	✓	✓
Mercury	✓	✓	✓
Selenium	✓	✓	✓
Zinc	✓	✓	✓
Vanadium	✓	✓	✓
pH	✓	✓	✓
Total/Dissolved Organic Carbon	✓	✓	✓
Cyanide (total)	✓	✓	✓
TPH UK-CWG Banding incl. BTEX *	✓	✓	✓
PAH Speciated 16 UESPA	✓	✓	✓
Phenols	✓	✓	✓
PCBs (7 congeners)	✓	✓	✓
Asbestos Screen	✓		
Asbestos Quantification	✓		
Chloride	✓		
VOCs	✓	✓	✓
SVOCs (incl. 16 USEPA speciated PAHs and total phenols)	✓	✓	✓
Boron (Water Soluble)	✓		
Sulphate (total)	✓		
Sulphur (total)	✓		
Ammoniacal Nitrogen			✓
Sulphate (Soluble)			✓
Sulphide		✓	✓
SVOCs (excl. 16 USEPA speciated)		✓	✓
Total	**41 Samples**	**17 Samples**	**9 Samples**

3.8 Gas and Groundwater monitoring.

A summary of the installation details is included in Table 3.1 and 3.2.

Capabilities on project:
Environment

Gas and groundwater monitoring was completed on 9 February 2016. To date, monitoring of groundwater and ground gas has been undertaken at the time of installation and on three occasions post site works, on 11 and 25 January and 9 February 2016.

A Gas Data LMSxi portable gas analyser was used to record the levels of oxygen, carbon dioxide, methane, carbon monoxide and hydrogen sulphide. In addition differential pressure and flow rates were recorded at each reading.

Ground Conditions and Material Properties

4 Ground Conditions and Material Properties

4.1 Introduction

The following section provides a review of the results of the ground investigation information. The factual data is included within Geotechnics' Factual Report (Ref. 07).

A summary of the ground conditions encountered across previous ground investigation works undertaken in the wider area surrounding the site is presented as part of the AECOM Desk Study (Ref. 01).

Geological long sections across the proposed Stockport Interchange development and proposed bridge are shown on Drawing 60340298-ACM-00-GEO-DR-0002.

4.2 Stratigraphy

A summary of the ground conditions encountered across the site is presented in Table 4.1.

Table 4.1. Ground Conditions Encountered during the Ground Investigation.

Geological Unit	Typical Description	Range of depths to top of stratum (m bgl)	Range of levels to top of stratum (m OD)	Range of thickness (m)	Comments
Made Ground – Other [1]	Grey concrete paving slab. Black tarmacadam. Grey subangular granite cobble setts	0.00 to 0.95	41.64 to 51.03	0.05 to 1.20	Widespread.
Made Ground - Cohesive	MADE GROUND: Soft brown sandy gravelly clay, locally silt. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.	0.30 to 1.00	42.70 to 50.62	0.30 to 1.20	Four holes.
Made Ground - Granular	MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone with a medium angular cobble content. (Sub base). MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick. Some wood.	0.00 to 2.60	41.65 to 53.31	0.05 to 4.95	Widespread.
Alluvial Clay	Soft dark brown and black very organic CLAY, locally sandy silt, with organic remains.	1.40 to 1.60	41.99 to 42.10	0.40 to 0.60	Two holes.
Glacial Clay	Soft brown slightly gravelly sandy CLAY, locally silt. Gravel is subangular to subrounded fine to	1.30 to 2.40	41.05 to 43.62	0.40 to 1.50	Four holes.

Geological Unit	Typical Description	Range of depths to top of stratum (m bgl)	Range of levels to top of stratum (m OD)	Range of thickness (m)	Comments
	coarse of various lithologies.				
Glacial Sands and Gravels [1]	Dense yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL of limestone, quartzite, granite and basalt. Dark brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies.	0.50 to 3.20	38.91 to 52.11	1.0 to 1.72	Widespread.
Weathered Sherwood Sandstone [1]	Extremely weak to very weak dark red fine to medium grained SANDSTONE recovered as silty sand. Very dense reddish brown fine to coarse SAND.	0.85 to 5.00	37.72 to 50.07	0.12 to 2.35	Widespread.
Sherwood Sandstone [1]	Extremely weak to weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are subhorizontal, very closely spaced, rough and clean. Very weak to medium strong reddish brown medium grained SANDSTONE with abundant micaceous minerals and rare fine to coarse rounded gravel. Discontinuities are very closely to medium spaced horizontal to subvertical smooth planar and undulating.	3.40 to 6.55	35.81 to 41.16	9.35 to 16.15 (unproven)	Widespread.

[1] Strata not fully explored in some exploratory holes

4.2.1 Made Ground - Other

Made Ground – Other was recorded from the surface in nearly all exploratory holes across the site. The descriptions are generally either concrete/paving slabs or black tarmacadam. The material ranged in thickness between 0.05 and 1.20m. The thickest deposit was in exploratory hole CT1 where black tarmacadam (0.1m thick) was underlain by a strata described as ‘brick wall onto obstruction’ to the base of the hole at 1.20m. The full thickness of the strata was not proved.

The Made Ground - Other material has not been subject to any field or laboratory testing and is not discussed further.

Surface deposits of Made Ground – Other are expected to be removed during site works. It is likely that this material when crushed and screened will be suitable for re-use as capping or as an aggregate in the pavement construction, subject to appropriate testing.

4.2.2 Made Ground – Cohesive

Made Ground – Cohesive was recorded in four holes from 0.3 to 2.00m depth. The material is generally described as soft/firm brown slightly gravelly/gravelly slightly sandy/ sandy clay. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete. The material was recorded in four holes, BH111, BH112, WS201 ans WS211. These are located across the site with WS211 located to the north east, BH112 located to the east, WS201 to the south west and BH111 to the south. There does not appear to be any geographical link with the locations.

Laboratory testing was undertaken on one sample from WS201 from 1.2 to 1.65m bgl. Moisture content and Atterberg Limit testing was undertaken with the sample recorded to have a moisture content of 33% and liquid limit of 33%. The determination for the plastic limit found the sample to be non-plastic. Although the sample was described as a clay, the laboratory described the sample as brown sandy gravely silt (noted the in the stratum description).

Two SPTs were undertaken in the Made Ground – Cohesive. The first in BH112 at 1.2m recorded a value of 4 and the second in WS201 also at 1.2m bgl recorded a value of 28. The SPT values are very different as are the locations of the holes; no trend or inference of the results is noted, besides the variability of the material.

A review of the suitability of the Made Ground – Cohesive for re-use should be undertaken during detailed design and once an earthworks specification has been prepared. The current design does not have any significant earthworks. However, based on the descriptions from the ground investigation and due to the limited presence of the material across the site, the volume of material may not be economic to separate out for re-use.

4.2.3 Made Ground – Granular

Made Ground – Granular was recorded from the surface to 2.6m bgl in the majority of exploratory holes. The maximum thickness of 4.95m was recorded in BH108 from 0.05 to 5.00m depth; with the majority of the fill described as 'loose reddish grey mottled black sandy angular to subangular fine to coarse gravel of brick and concrete. With a medium angular cobble content of brick and pockets of clay'.

The material is generally described as one of the following three sub-divisions

- a sub-base with a general description of grey sandy angular to subangular fine to coarse gravel of limestone/dolerite with a medium angular cobble content;
- a sand with a general description of dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies, fragments of granite, concrete, timber and plastic; or
- a gravel with a general loose reddish grey mottled black sandy angular to subangular fine to coarse gravel of brick and concrete. With a medium angular cobble content of brick and pockets of clay.

Other minor constituents noted include ash, clinker, glass and wood.

A strong hydrocarbon odour and organic remains were recorded in a clayey gravelly sand stratum in WS211 from 1.20 to 1.80m bgl. The hole is located to the north east of the site. Black organic matter is recorded in WS212 and WS220 from 1.50 to 1.70m bgl and from 1.20 to 1.70m bgl respectively. The strata are both described as gravelly sand. WS212 is located to the north of the site and WS220 to the west of the site.

Engineering properties of Made Ground – Granular cannot be relied upon and are not discussed in detail in this report. However, material described as sub-base should be able to be re-used a sub-base, depending upon environmental testing.

Laboratory testing was undertaken on five samples described as Made Ground – Granular. Moisture content and Atterberg Limit testing was undertaken, with the results presented in Table 4.2.

Table 4.2. Laboratory Testing Summary – Made Ground Granular.

Exploratory Hole	Depth (m bgl)	Strata Description	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)
BH108	2.00 to 2.50	MADE GROUND: Loose reddish grey mottled black sandy angular to subangular fine to coarse gravel of brick and concrete. With a medium angular cobble content of brick and pockets of clay.	22.2	34	NP
	3.00 to 3.45		16.3	32	NP
WS208	1.20 to 1.65	MADE GROUND: Dark brownish grey gravelly sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick.	12.4	29	NP
WS220	1.30 to 1.70	MADE GROUND: Very loose/loose dark brown gravelly fine to medium sand of ash. Gravel is subangular to subrounded fine to coarse of various lithologies, fragments of brick and concrete.	33.2	69	NP
WS223	1.20	MADE GROUND: Loose brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of sandstone and fragments of brick.	19.9	29	NP

The results show a range in moisture content between 12.4% in WS208 and 33.2% in WS220. Liquid limits are generally between 29 and 34%, with one higher value of 69% in WS220. Black organic matter was identified in WS220 from 1.20 to 1.70m bgl and may account for the significantly higher liquid limit.

SPTs were undertaken in Made Ground – Granular, 37 No., see Figure 1. The values ranged between 0 and >50, indicative of very loose to very dense material. 19 tests were <10 blows indicating that the material was very loose/loose. The majority of the 19 tests were undertaken at the base of inspection pits and some disturbance of the material at the base of the pit may have caused the lower numbers. 6 tests were 50 or greater indicating very dense conditions or the presence of an obstruction. The remaining 12 tests fell between 10 and 44 blows, i.e. indicative of medium dense or dense material.

The range of SPT values indicates that the Made Ground - Granular material is unlikely to have been compacted or engineered and as such the SPT values are likely to represent the local level of compaction; indicating that the relative density of the Made Ground - Granular across the site is likely to vary significantly.

A review of the suitability of the Made Ground – Granular for re-use should be undertaken during detailed design and once an earthworks specification has been prepared. The current design does not have any significant earthworks. The material described as sub-base may be able to be re-used, but as it is not present across the site as a thick stratum, the volume of material may not be economic to separate out for re-use. The Made Ground – Granular material should be assessed when excavated and may be able to be re-used as a general fill, depending upon environmental and geotechnical testing.

4.2.4 Alluvial Clay

Alluvial Clay was encountered in two exploratory holes, BH112 and WS223. Alluvial clay has been identified as natural clay deposits with the presence of organic material. The strata in BH112, 1.60 to 2.0m bgl, is described as 'soft dark brown and black very organic CLAY, locally sandy silt, with organic remains' and the strata in WS223, 1.40 to 2.00, is described as 'firm grey mottled dark brown slightly gravelly slightly sandy CLAY with organic traces. Gravel is subangular to subrounded fine to coarse of various lithologies'.

BH112 is located to the east of the site and WS223 is located in the centre of the site.

Laboratory testing was undertaken on one sample from BH112 at 1.80m depth. A moisture content of 109% was determined and a liquid limit of 77%. The plastic limit was not determined and the sample classed as non-plastic. The higher moisture content and liquid limit is indicative or the presence of organic material.

SPTs were not undertaken in the material.

The alluvial clay material was only encountered in two locations. As the volume of this material is likely to be low, and its organic matter high, then where the material is encountered it should be removed and replaced with suitably compacted fill.

4.2.5 Glacial Clay

Glacial Clay was encountered in five exploratory holes, BH101, WS201, WS208, WS211 and WS212, generally above the weathered Sherwood Sandstone, except for WS2211 where is was encountered within the Glacial Sand and Gravel. It was overlain by Made Ground in WS210 and WS208 and by Glacial Sand and Gravel in BH101 and WS212.

This stratum was typically described as soft to stiff grey/greyish brown/brown slightly gravelly sandy clay, locally silty / laminated. It was encountered at depths from 1.3m (WS208) to 3.8m (WS211). The thickness of strata ranged from 0.20m (WS211) to 1.50m (WS201). The materials have been classified together based on their descriptions as clay and the absence of organic material.

The strata are described as 'locally silt' in BH101, WS211and WS212. BH101, WS211and WS212 are located in the centre, east and north east respectively, and not geographically close to each other. BH101 and WS201 are located close to each other and both have clay between 2.0 and 3.0m bgl; BH101 from 1.6 to 3.00m bgl and WS201 from 2.0 to 3.5m bgl. However the sample in BH101 is described as laminated and locally silt, and the sample in WS201 in not described as either laminated or silty.

Laboratory testing was undertaken on four samples described as Glacial Clay. Moisture content and Atterberg Limit testing was undertaken, with the results presented in Table 4.3.

Table 4.3. Laboratory Testing Summary – Glacial Clay.

Exploratory Hole	Depth (m bgl)	Strata Description	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)
BH101	2.20 to 2.65	Firm grey thinly laminated sandy CLAY, locally silt.	23.3	26	NP
WS201	2.40 to 3.00	Firm greyish brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies.	22.9	33	18
WS211	3.80 to 4.00	Soft dark grey sandy CLAY, locally silt.	42.5	38	NP
WS212	3.00 to 3.45	Soft brown slightly gravelly sandy CLAY, locally silt. Gravel is subangular to subrounded fine to coarse of various lithologies.	21.9	37	NP

The results show a narrow range in moisture content generally between 21.9% in WS212 and 23.3 in BH101. The tested sample from WS211 had a significantly higher moisture content of 42.5%. Liquid limits are between 26 and 38%. Three of the four samples were described as non-plastic, with one plastic limit determined; 18% for WS201. This classifies the sample in WS201 as a clay with low plasticity. Correlation of the laboratory data for undrained shear strength data infers a strength for the sample in WS201 of low strength, i.e. between 20 and 40kPa.

Four SPTs were undertaken in the Glacial Clay. The values ranged between 5 (BH101 at 2.20m) and 25 (WS212 at 3.00m); with the other tests both undertaken in WS201 being 10 (3.00m) and 11 (2.00m). The lower SPT value of 5 in BH101 at 2.20m bgl was undertaken with a water level of 1.5m bgl. This water level may have led to an imbalance of water pressures leading to local softening of the soils at the testing level.

Empirical relationships (cu=f1*N values from Stroud, 1975 (Ref. 08)) have been applied to derive the undrained shear strength (cu) of the Glacial Clay from SPT N values. A conservative factor, f1, of 5 has been used, considering the plasticity index values recorded during the laboratory testing. cu values were also derived from empirical correlations with Liquidity Index (Wroth, 1979 (Ref. 09)).

The cu values range between 25kPa (SPT correlation in BH101) and 125kPa (SPT correlation in WS212). The other values 33 (Liquidity Index), 50 and 55kPa (both SPTs) indicate the material is generally a low to medium strength material (20 to 40kPa and 40 to 75kPa respectively).

BS8004 (2015) (Ref. 10) presents a correlation between plasticity index and values of phi cv. For the plasticity index of 15 determined in WS201 a phi cv value of 27.3° is determined. As only one phi cv value is determined and due to the limited presence of the Glacial Clay across the site recommendations are not discussed. As the volume of this material is likely to be low, then where the material is encountered, and depending upon location, it should be removed and replaced with suitably compacted fill.

4.2.6 Glacial Sands and Gravel

Glacial Sands and Gravels were recorded in nearly all exploratory holes, generally beneath the surface Made Ground and above the weathered Sherwood Sandstone.

The stratum is typically comprised of a very loose to very dense brown / yellowish brown / reddish brown / grey slightly gravelly / gravelly, sometimes clayey, fine to medium sand. The material was also described as a sandy / very sandy gravel. It was encountered at depths ranging between 0.50 and 3.2m bgl, with thicknesses proved ranging between 0.5 and 3.0m. Where sands were recorded, which would generally be interpreted as weathered Sherwood Sandstone, if the descriptions of the gravels, if present, included anything apart from sandstone, i.e. granite, limestone, mixed lithologies, etc. these were interpreted as Glacial Sand and Gravel.

Figure 1 presents the SPT 'N' values for the strata, with SPT'N' values ranging between 4 and >50, with a mean of 31 (>50 blows assumed to be 50 blows). Of the 49 tests undertaken 8 were <10, 15 between 10 and 30, 9 between 30 and 50, and 17 were 50 or greater. Low SPT 'N' valued may an indication of the presence of water. Only in BH101 at 1.2m bgl where an SPT test recorded 6 blows is a waterstrike recorded; the waterstrike was also recorded at 1.2m bgl with no water level rise recorded. The SPT test of 4 blows in WS214 at 3.0m bgl, may have been affected by the layer of dark brown mottled black sand with black organic remains present between 3.70 and 4.00 m depth. The remaining tests all show a large scatter of values indicated by the range from 4 to >50. In general the deposits are generally spread between being medium dense (10 to 30 blows), dense (30 to 50 blows) or very dense (>50 blows).

The drained internal (peak) angle of friction for the material has been estimated from uncorrected SPT N values by applying the correlation proposed by Peck et al. (1974) [(Ref. 11)]. The values range between 28° and 40°, with a mean of 36°. A conservative value of 34° will be used in design to account for variability of the material.

4.2.7 Weathered Sherwood Sandstone

Weathered Sherwood Sandstone was recorded in nearly all exploratory holes above the Sherwood Sandstone; it was generally found below Glacial Sand and Gravel, but also directly below Made Ground.

The stratum is typically described as extremely weak / weak dark red fine to medium grained sandstone recovered as silty sand. The material was also described as loose to very dense sometime clayey sometimes gravelly sand. It was encountered at depths ranging between 0.85 and 5.0m bgl, with thicknesses proved ranging between 0.12 and 2.35m.

Figure 1 presents the SPT 'N' values for the strata, with SPT'N' values ranging between 2 and >50, with a mean of 44. 44 SPTs were undertaken with 37 tests 50 or greater and three tests <10 blows. The lowest values of 2 was recorded in WS214 at 4.0m bgl at the base of a layer described as dark brown mottled black sand with black organic remains present between 3.70 and 4.00 m depth. This is likely to have affected the SPT result. Low SPT 'N' values maybe also be an indication of where the holes were not completely topped up with water during drilling, and may not be representative of the strata.

The drained internal (peak) angle of friction for the soil mass has been estimated from uncorrected SPT N values by applying the correlation proposed by Peck et al. (1974) [(Ref. 11)]. The values range between 27° and 41°, with a mean of 39°. A conservative value of 36° will be used in design to account for variability of the material.

4.2.8 Sherwood Sandstone

Sherwood Sandstone was recorded below weathered Sherwood Sandstone in nearly all exploratory holes. The exception is BH111, which encountered weathered Sherwood Sandstone from 0.85 to 1.55m bgl. BH111 is located to the south of the proposed development and rotary coring was not undertaken.

The strata is typically described as extremely weak to weak greyish / reddish brown fine to coarse sandstone with occasional subrounded fine to coarse gravel. Discontinuities are subhorizontal, very closely spaced, rough and clean. The material was also described as a gravelly sand where it was recovered in a weathered state. It was encountered at depths ranging between 3.40 and 6.55m bgl, with cored thicknesses ranging between 9.35 and 16.15m. The base of the sandstone was not proved.

The stratum was also described as mudstone in two boreholes; BH104 from 9.10 to 9.80m bgl (32.67 to 33.37m OD) and BH108 from 6.15 to 6.82m bgl (35.90 to 36.57m OD). BH104 is located to the west of the site and BH108 was undertaken on the south bank of the River Mersey. Given the local occurrence and thickness of the mudstone, it has been included as part of the Sherwood Sandstone stratum.

Figure 1 presents the SPT 'N' values for the strata, with SPT 'N' values all 50 or greater. Assuming the bedrock is a very dense soil, the drained internal (peak) angle of friction for material has been estimated from uncorrected SPT N values by applying the correlation proposed by Peck et al. (1974) [(Ref. 11)]; the value is 41°. A conservative value of 40° will be used in design to account for variability of the material.

BS5930 (2015) [(Ref. 12)] indicates unconfined compressive strengths of 0.6 to 1MPa for rocks described as extremely weak, increasing to 1 to 5MPa for rocks described as very weak, 5 to 25MPa for rocks described as weak, 25 to 50MPa for rocks described as medium strong, increasing to 50 to 100MPa for rocks described as strong and 100 to 250MPa for rocks described as very strong.

Rock strength testing was undertaken on selected samples. UCS testing has been undertaken on nine rock core samples. Six of the nine tests were undertaken beneath the footprint of the proposed River Mersey crossing, BH108 and BH109. The sample strengths ranged between 4MPa (BH108 at 19.0m bgl, BH109 at 9.4m bgl and BH112 at 9.6m bgl) and 12MPa (BH105 at 13.0m bgl), i.e. indicating very weak to weak rock strengths. The tests were undertaken at as received moisture contents, which ranged between 11.7 and 16.1%.

Point load testing was also performed on rock core samples. Testing was undertaken at 24 locations; with testing undertaken in the diametral direction, i.e. parallel to planes of weakness and axial direction, i.e. perpendicular to planes of weakness. The reported Is50 values are summarised in Table 4.4.

Table 4.4. Laboratory Testing Summary – Sherwood Sandstone.

Test Type / Direction	Is50 (MN/m^2)		
	Min	Max	Average
D / PL	0.016	0.162	0.06
A / PD	0.039	0.281	0.13

Notes:

Test Type D - diametral

A – axial

Direction PL – parallel to planes of weakness

PD – perpendicular to planes of weakness

Point load testing was completed on samples of rock core. The tests were performed at as received moisture contents. The point load strength test is frequently used to determine crushing strength through established empirical relationships like those proposed by Broch and Franklin (1972) (Ref. 13). Johnston (1991) (Ref. 14) suggests typical multiplication factors to convert from point load strength index to uniaxial compressive strength; typical values between 20 and 25 are applied to diametral tests for unweathered rocks. For weak and destructured rocks, values as low as 7 to 15 are often adopted. CIRIA 181 (Ref. 15) states that the development of site specific or formation specific correlations based on UCS and $Is_{(50)}$ values is essential. An assessment of the UCS and point load data has been undertaken for the available information. A correlation factor of 20 has been assumed. This correlation calculates rock strengths in the range 0.78 to 5.6MPa with an average of 2.6MPa. 22 of the 31 samples (71%) have values between 1 and 3MPa. The rock description are predominantly extremely weak, i.e. 0.6 to 1MPa. The point load tests for the sandstone indicate strengths that are higher than anticipated from the sample descriptions.

Maximum past pre-consolidation pressures, pc' for the materials has not been determined; a conservative value of 150kPa is adopted for design.

4.3 Geotechnical Parameters

The geotechnical parameters used in design are presented in Table 4.5.

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Table 4.5. Summary of Geotechnical Parameters

	Parameter							
	γ_b	c_u	c'	ϕ'_{crit}	ϕ'_{peak}	c_c	c_s	UCS
Geological Unit	**kN/m^3**	**kPa**	**kPa**	**°**	**°**	**-**	**-**	**MPa**
Made Ground - Other	-	-	-	-	-	-	-	-
Made Ground - Cohesive	-	-	-	-	-	-	-	-
Made Ground - Granular	19	N/A	0	-	30	0.10	0.010-	N/A
Alluvial Clay	-	-	-	-	-	-	-	-
Glacial Clay	20	40	0	26	-	0.20	0.020	N/A
Glacial Sand and Gravel	20	N/A	0	-	34	0.10	0.010	N/A
Weathered Sherwood Sandstone	22*	N/A	0	-	36	0.05	0.005	N/A
Sherwood Sandstone	24*	N/A	0	-	40	0.01	0.001	0.6

* Assumed value.

4.4 Organic Matter Content

Organic matter content was determined on 36 samples; with values ranging between <2 and 56.5%. A summary of the testing is presented in Table 4.6.

Table 4.6. Summary of Organic Matter Testing.

Strata (No.)	Organic Matter Content (%)		
	Min	Maximum	Average
Made Ground – Cohesive (2)	1.3	14.1	7.7
Made Ground – Granular (27)	<0.2	56.5	10.2
Alluvial Clay (1)	21.7	21.7	21.7
Glacial Sand and Gravel (6)	<0.2	3.1	1.6
All Samples (36)	<0.2	56.5	9.8

A summary of the organic contents greater than 10% and their exploratory hole log descriptions are presented below:

- 56.5% - WS212 1.5 to 1.7m bgl - MADE GROUND: Loose dark brown gravelly fine to medium sand with black organic matter. Gravel is angular to subangular fine to coarse of various lithologies.
- 30.9% - WS211 0.2 to 0.5m bgl - MADE GROUND: Dark brown gravelly fine to medium sand with ash present. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete.
- 21.7% - BH112 1.8m bgl - Soft dark brown and black very organic CLAY, locally sandy silt, with organic remains.
- 18.3% - CT8 1.2 to 1.65m bgl - MADE GROUND: Loose blackish brown sandy fine to coarse angular to subangular gravel of brick, concrete and ash with a high cobble content and a high boulder content.
- 15.1% - WS214 0.5 to 1.0m bgl - MADE GROUND: Dark brown gravelly fine to coarse sand with ash. Gravel is subangular to subrounded fine to coarse of various lithologies, ceramic, brick fragments and concrete.
- 14.8% - WS209 0.6 to 1.0m bgl - Medium dense reddish brown gravelly fine to coarse SAND with a low cobble content of sandstone. Gravel is subangular to subrounded fine to coarse of various lithologies.
- 14.6% - BH108 0.8m bgl - MADE GROUND: Loose reddish grey mottled black sandy angular to subangular fine to coarse gravel of brick and concrete. With a medium angular cobble content of brick and pockets of clay.
- 14.1% - WS201 1.0 to 1.2m bgl - MADE GROUND: Soft brown sandy gravelly clay, locally silt. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.
- 12.1% - WS214 0.5 to 1.0m bgl - MADE GROUND: Dark brown gravelly fine to coarse sand with ash. Gravel is subangular to subrounded fine to coarse of various lithologies, ceramic, brick fragments and concrete.

Only two samples specifically mention organic content; WS212 – 56.5%, BH112 – 21.7%; this is considered unusual given the high organic matter values. This means that either the organic content was not obvious to the logging

engineer or the sample was mis-logged. Any organic matter or material containing organic matter encountered on site should be removed and replaced with suitable material.

4.5 Groundwater

Groundwater monitoring installations are installed in nine boreholes and fifteen window sample holes. Details of the recorded groundwater levels are presented in Table 4.7.

Table 4.7. Groundwater Level Monitoring Results.

Exploratory Hole	Ground Level (m OD)	Response Zone (m bgl)	Response Zone Stratum	Installation Details	Ground Water Depth (m bgl) and Level (m OD)					
					11/01/16	25/01/16	09/02/16	22/02/16	08/03/16	18/03/16
BH101	45.22	5.00-7.00	Sherwood Sandstone	50mm standpipe	6.17	5.83	5.79	5.54	6.03	5.72
					39.05	39.39	39.43	39.68	39.19	39.50
BH102	43.35	8.00-10.00	Sherwood Sandstone	50mm standpipe	5.42	5.46	5.35	5.45	5.47	5.52
					37.93	37.89	38.00	37.90	37.88	37.83
BH103	42.42	11.00-14.00	Sherwood Sandstone	50mm standpipe	6.60	6.20	6.50	6.66	6.67	6.73
					35.82	36.22	35.92	35.76	35.75	35.69
BH104	42.47	1.00-3.50	Glacial Sand and Gravel	50mm standpipe	3.56	DRY	3.57	DRY	DRY	DRY
					38.91	-	38.90	-	-	-
BH105	42.62	9.50-12.00	Sherwood Sandstone	50mm standpipe	6.41	6.49	6.40	6.48	6.50	6.56
					36.21	36.13	36.22	36.14	36.12	36.06
BH106	42.45	5.00-7.00	Sherwood Sandstone	50mm standpipe	5.41	5.46	5.20	5.45	5.50	5.54
					37.04	36.99	37.25	37.00	36.95	36.91
BH108	42.72	18.00-21.00	Sherwood Sandstone	50mm standpipe	6.68	6.86	6.35	6.72	6.84	6.95
					36.04	35.86	36.37	36.00	35.88	35.77
BH109	42.36	18.00-20.00	Sherwood Sandstone	50mm standpipe	5.18	5.29	4.83	5.16	5.24	5.37
					37.18	37.07	37.53	37.20	37.12	36.99
BH112	43.70	12.80-14.80	Sherwood Sandstone	50mm standpipe	5.02	5.05	4.96	5.07	5.06	5.09
					38.68	38.65	37.74	38.63	38.64	38.61
WS201	45.61	3.50-4.00	Weathered Sherwood Sandstone	50mm standpipe	3.85	DRY	DRY	DRY	DRY	DRY
					41.76	-	-	-	-	-
WS203	43.01	2.00-3.00	Glacial Sand and Gravel	50mm standpipe	CAR	DRY	CAR	2.66	2.67	2.62
								40.35	40.34	40.39
WS204	42.85	1.50-2.45	Made Ground Granular/ Weathered Sherwood Sandstone	50mm standpipe	2.45	DRY	DRY	DRY	CAR	DRY
					40.40	-	-	-	-	-
WS205	42.39	1.50-2.00	Made Ground Granular/ Glacial Sand and Gravel	50mm standpipe	1.94	DRY	DRY	DRY	DRY	1.93
					40.45	-	-	-	-	40.46
WS206	48.13	1.00-2.00	Made Ground Granular	50mm standpipe	1.82	DRY	DRY	DRY	DRY	DRY
					46.31	-	-	-	-	-

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Exploratory Hole	Ground Level (m OD)	Response Zone (m bgl)	Response Zone Stratum	Installation Details	Ground Water Depth (m bgl) and Level (m OD)					
					11/01/16	25/01/16	09/02/16	22/02/16	08/03/16	18/03/16
WS208	42.35	1.70-2.80	Weathered Sherwood Sandstone	50mm standpipe	2.72	DRY	DRY	DRY	DRY	DRY
					39.63	-	-	-	-	-
WS209	42.67	1.00-3.00	Glacial Sand and Gravel	50mm standpipe	2.91	DRY	DRY	DRY	DRY	DRY
					39.76	-	-	-	-	-
WS210	44.43	3.00-5.00	Glacial Sand and Gravel	50mm standpipe	5.00	DRY	DRY	DRY	DRY	DRY
					39.43	-	-	-	-	-
WS211	44.88	1.00-2.00	Made Ground Granular	50mm standpipe	1.87	1.92	1.90	1.87	1.87	1.90
					43.01	42.96	42.98	43.01	43.01	42.98
WS212	45.74	2.50-3.50	Glacial Clay	50mm standpipe	3.16	3.20	3.20	3.18	3.18	3.16
					42.58	42.54	42.54	42.56	42.56	42.58
WS214	46.35	0.50-1.00	Made Ground Granular	50mm standpipe	0.93	DRY	DRY	DRY	DRY	DRY
					45.42	-	-	-	-	-
WS217	42.30	1.50-2.50	Glacial Sand and Gravel	50mm standpipe	2.50	DRY	DRY	DRY	DRY	DRY
					39.80	-	-	-	-	-
WS218A	42.71	1.00-2.50	Made Ground Granular/ Glacial Sand and Gravel	50mm standpipe	2.50	DRY	DRY	DRY	DRY	DRY
					40.21	-	-	-	-	-
WS220	44.69	1.20-1.70	Made Ground Granular	50mm standpipe	1.60	1.65	1.60	1.65	1.67	1.67
					43.09	43.04	43.09	43.04	43.02	43.02
WS223	43.39	0.50-1.40	Made Ground Granular	50mm standpipe	1.60	1.60	1.50	1.53	DRY	DRY
					41.79	41.79	41.89	41.86	-	-

4.6 Aggressiveness of Ground to Concrete

BRE testing was undertaken on 35 samples recovered during the ground investigation. The samples tested include material classified as Made Ground Cohesive, Made Ground Granular and Glacial Sand and Gravel; due to the test result values they have all been classified together. A summary of the results is presented in Table 4.8.

Table 4.8. Summary of Sulphate (2:1 water:soil extract) & pH Results.

Determinand		Count	Min	Max
pH	Soils	35	7.86	12.40
Sulphate as SO4 (2:1 Ext) (g/l)	Soils	35	<0.0015	1.76 (0.31)*
Total Acid Soluble Sulphate (%)	Soils	35	<0.01	2.26

*The water soluble sulphate as SO4 results generally classify for sulphate class DS-1, i.e. <0.5g/l (Ref. 16). However, one sample, WS212 at 1.5 to 1.7m bgl, has a sulphate at SO4 value >1.5g/l. This value (1.76g/l) infers a sulphate class of DS-3. The remainder of the samples have a maximum sulphate as SO4 of 0.31g/l, indicating a sulphate class of DS-1.

WS212 is located to the north east of the site and the sample is taken from a stratum described as 'MADE GROUND: Loose dark brown gravelly fine to medium sand with black organic matter. Gravel is angular to subangular fine to coarse of various lithologies'.

WS212 is located away from the Interchange development area, presumably in an area of pavement widening. Made Ground adjacent to any concrete in this area should be removed and replaced with clean compacted granular fill.

The recorded pH values are all >7.5; therefore the site classifies as an ACEC Class of AC-1 (Ref. 16).

Contamination Assessment

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5 Contamination Assessment

5.1 Introduction

This assessment has been carried out in order to identify potential contamination issues associated with the proposed development of the site. As outlined in Section 1, the objective of the assessment was to obtain ground condition information to inform the design of the proposed modifications to the site. It should be noted that the risk assessment may require updating should there be any changes to the overall design.

5.2 Basis of Assessment

5.2.1 Human Health

AECOM has a prescribed methodology for assessing risks to human health at a generic level termed 'generic quantitative risk assessment' (GQRA) or 'Stage 2' in CLR11.

For sites where the conceptual site model has identified one or more complete contaminant linkage to human health it is often necessary to clarify the risk posed by that contaminant linkage by comparison of reported concentrations with guideline values that represent acceptable concentrations.

The procedures outlined in Environment Agency Science Reports SC050021/SR2 (Ref.17), SR3 (Ref. 18), SR4 (Ref. 19) and SR7 (Ref. 20) have been adopted in conjunction with the amendments to generic land-use exposure models published in DEFRA research report SP1010 (Ref. 21) detailing the derivation of Category 4 Screening Levels (C4SSL) to select and develop generic assessment criteria (GAC) for soil. This approach has also been adapted to develop assessment criteria for groundwater and soil vapour.

AECOM utilises a hierarchy of published sources for Stage 2 generic assessment criteria for soil. The hierarchy of published sources are as follows:

- Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) Suitable for Use Levels (S4UL) for Sandy loam soil;
- CL:AIRE Environmental Industries Commission (EIC) GAC;
- AECOM derived GAC (AGAC);
- Dutch Intervention Values (IV) and Serious Risk Concentrations (SRC); and
- United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSL).

No LQM or EIC values are available for lead, and therefore the published C4SLs for lead are the default soil GAC. Further consideration of Defra SP1010 C4SLs for other substances is made where appropriate, subject to the current limited availability to six substances.

There are no published sources of relevant GAC for non-potable groundwater and soil vapour.

Application of GAC to Site Data

A typical first step is to compare individual soil, groundwater, and/or soil vapour concentrations to the GAC in order to establish whether further more detailed assessment and/or potentially remediation is required. This comparison can be expressed numerically as a Hazard Quotient (HQ):

HQ=Sample Concentration GAC

Dependent on the assessment assumptions and uncertainties, a HQ< 1 indicates an acceptable level of risk from the substance being evaluated. The assessment of cumulative risk from multiple substances is not required at a GQRA level with the exception of TPH. In accordance with Environment Agency science report P5-080/TR3 (Ref.

[22)],a hazard index (HI) is calculated for each individual sample based on the summation of the HQ for each TPH fraction.

Statistical analysis may be warranted, if justified by the available data, to support initial GAC comparisons to individual reported concentrations.

In accordance with Environment Agency guidance co-authored by AECOM, GAC can be used as a starting point for evaluating long-term risks to human health from substances in soil. They address one specific consideration – long-term adverse effects on human health – and are designed to indicate where long-term (chronic) human health soil exposure risks are considered to be tolerable or minimal. They do not represent the "trigger" for an unacceptable risk under Part 2A of EPA 1990, and they do not address risk related to construction workers, acute exposure, ecology, controlled waters or building materials, they do not inform on the geotechnical suitability of the soil, and they do not inform on the aesthetic quality of the soil – both visual and olfactory. Therefore the GAC have not been explicitly derived to define remediation standards and are just one component in the assessment of whether soil is suitable for use.

It is good practice to use multiple lines of evidence to support GQRA conclusions.

Proposed Land Use Scenario

The proposed development is modifications to the existing Stockport bus station, on this basis a commercial end use has been specified as the most suitable AGAC.

Exposure Scenario Modelling Parameters

The following default exposure pathways have been modelled by specifying a commercial end use:

Soil and indoor dust ingestion;
Soil and indoor dust dermal contact;
Dust inhalation (indoor and outdoor);
Soil vapour inhalation (indoor and outdoor); and
Groundwater vapour inhalation (indoor and outdoor).

5.2.2 Controlled Waters

The recorded leachable soil concentrations have been assessed in accordance with the Environment Agency "Technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environmental Protection Act 1990, V.2" (Ref. 23) and The River Basin Districts Typology, Standards and Groundwater threshold values (Water framework Directive) (England and Wales) Directions 2010 (Ref. 24).

Section 2.6 identifies the site as being located above a Principal (bedrock) and Secondary A Aquifer (superficial deposits). The most stringent of the UK Drinking Water Standards (DWS) and Environmental Quality Standards for freshwater (EQS-F) have been used to assess the leachable soil concentrations and groundwater testing results.

The UK DWS are derived from (Water Supply (Water Quality) Regulations 1989 & 2000) and the EQS are listed under the Surface Waters (Dangerous Substances) (Classification) Regulations (1989, 1997, and 1998).

5.2.3 Ecological Systems

It is understood that planting and landscaping is not proposed as part of the development. However, should planting and /or landscaping be incorporated in the future, a landscape architect should be provided with the chemical analysis in order to establish suitable plant species. Ecological receptors are not considered further.

5.2.4 Property: Buildings and Services

It is recommended that the potential risk to water supply pipes and any necessary mitigation measures should be determined in accordance with the water supply company's risk assessment guidelines. Agreement with the local water supply company should be sought prior to placement of water supply pipes.

The recorded ground gas concentrations were assessed against the guidelines presented in CIRIA Report C665 (2007) [(Ref. 25)] '. Assessing risks posed by hazardous ground gases to buildings' and BS8485 'Code of practice for the characterisation and remediation from ground gas in affected developments' [(Ref. 26)].

5.3 Total Soil Concentrations

The majority of determinants were detected in concentrations below the commercial end use screening criteria for soils. However several determinants exceeded the chosen screening criteria, including Phenols, PAHs, SVOCs and VOCs. All of these exceedances occurred in Made Ground. A summary of the exceedances found in the Made Ground is included as Table 5.1. The full screening assessment for total soils is included in Appendix D.

Table 5.1. Summary of Elevated Total Soil Concentrations.

Determinant	Unit	Minimum	Maximum	Count	Screening Value	Exceedances in Made Ground	Exceedances in Natural Strata
Phenols							
4-Methylphenol	µg/kg	<LOD	2907	40	LOD	4	0
Poly Aromatic Hydrocarbons							
Benzo (a) Anthracene	mg/kg	<LOD	591.71	35	170	1	0
Benzo (a) Pyrene	mg/kg	<LOD	649.52	35	35	2	0
Benzo(b)fluoranthene	mg/kg	<LOD	577.17	35	44	1	0
Chrysene	mg/kg	<LOD	628.96	35	350	1	0
Dibenzo (ah) Anthracene	mg/kg	<LOD	58.58	35	3.5	2	0
SVOCs							
Carbazole	µg/kg	<LOD	50353	22	LOD	12	0
Benzo(b)fluoranthene	mg/kg	<LOD	577.17	35	44	1	0
VOCs							
Trichloroethene (TCE)	µg/kg	<LOD	11	22	LOD	1	0
4-Isopropyltoluene	µg/kg	<LOD	10	22	LOD	1	0
Isopropylbenzene	µg/kg	<LOD	16	22	LOD	2	0
Dichloromethane (DCM)	µg/kg	<LOD	100	22	LOD	2	0

Asbestos was encountered in the form of chrysotile in exploratory holes BH112, WS201 and WS206 at 0.20m bgl, 0.50m bgl and 0.50m bgl respectively. Asbestos quantification on these samples found that the level of asbestos was below the laboratory limit of detection.

5.4 Controlled Waters

5.4.1 Leachate Concentrations

The majority of the determinants were detected below the Screening Criteria in the majority of the samples. However, several determinants exceeded the chosen screening criteria for metals, non-metals, TPH compounds, PAH's and SVOCs. The details are summarised as Table 5.2 and the complete screening assessment is included as Appendix E.

Table 5.2. Summary of Elevated Leachate Concentrations.

Determinant	Unit	Minimum	Maximum	Total No. of Tested Samples	Screening Value	Exceedances in Made Ground	Exceedances in Natural Strata
Metals							
Arsenic	µg/l	<LOD	79.1	18	10	6	0
Hexavalent Chromium	mg/l	<LOD	0.02	8	0.0034	2	0
Chromium III	mg/l	<LOD	0.013	8	0.0047	4	0
Chromium	µg/l	<LOD	25.4	18	4.7	8	0
Copper	µg/l	<LOD	22	18	1	2	0
Lead	µg/l	<LOD	23	18	1.2	5	0
Nickel	µg/l	<LOD	6	18	4	3	0
Vanadium	µg/l	<LOD	39.8	15	10.9	2	0
Non Metals							
Total Cyanide	mg/l	<LOD	0.08	12	0.001	1	0
TPH compounds						1	
Aliphatics >C21-C36	µg/l	<LOD	120	18	LOD	1	0
Aliphatics >C35-C44	µg/l	<LOD	20	18	LOD	1	0
Aromatics>EC12-EC17	µg/l	<LOD	170	18	90	1	0
Aromatics>EC16-EC22	µg/l	<LOD	790	18	90	1	0
Aromatics>EC21-EC36	µg/l	<LOD	1330	18	90	1	0
Aromatics >EC35-EC44	µg/l	<LOD	270	18	90	1	0
Poly Aromatic Hydrocarbons							
Anthracene	µg/l	<LOD	0.32	12	0.1	1	0
Benzo(a)pyrene	µg/l	<LOD	1.82	12	0.00017	10	0
Benzo(k)fluoranthene	µg/l	<LOD	0.91	12	0.017	9	0
Benzo(bk)fluoranthene	µg/l	<LOD	3.24	12	0.017	11	0
Benzo(b)fluoranthene	µg/l	<LOD	2.33	12	0.017	10	0
Benzo(ghi)perylene	µg/l	<LOD	0.65	12	0.0082	9	0
Dibenzo(ah)anthracene	µg/l	<LOD	0.16	12	0.07	1	0
Fluoranthene	µg/l	<LOD	2.93	12	0.0063	11	0
Indeno(123cd)pyrene	µg/l	<LOD	0.71	12	LOD	9	0
SVOCs						1	
Carbazole	µg/l	<LOD	8	18	LOD	1	0

5.4.2 Groundwater Concentrations

The majority of determinants were detected below the selected screening criteria. However, several of the groundwater determinants exceeded the screening criteria; these are summarised in Table 5.3. The complete screening assessment for groundwater samples is included in Appendix F.

Table 5.3. Summary of Elevated Groundwater Concentrations from Water Samples from Site.

Determinant	Unit	Minimum	Maximum	Total No. of Tested Samples	Screening Value	Exceedances in Made Ground	Exceedances in Natural Strata
Nickel	µg/l	<LOD	8	9	4	0	3
TPH compounds						1	
Aliphatics > C12-C17	µg/l	<LOD	1280	9	300	0	1
Aliphatics > C16-C22	µg/l	<LOD	10	9	LOD	0	1
Aliphatics > C35-C44	µg/l	<LOD	1299	9	LOD	0	1
VOCs						1	
Chloroform	µg/l	<LOD	5	9	2.5	0	1

5.5 Ground Gas

The ground gas assessment is based on the 3 No. ground gas monitoring visits undertaken to date. The maximum recorded and the maximum concentration of either methane or carbon dioxide has been used to derive the gas screening values in combination with the rate of flow at the time of each measurement.

The results of the ground gas assessment is summarised in Table 5.4.

Table 5.4. Summary of Ground Gas Assessment.

Exploratory Hole	Date	Flow rate (l/h)	Barometric Pressure (mb)	Max 02%	C0	H2S	Peak CH4 (% vol)	GSV (l/hr)	Characteristic Situation CH4	Peak CO2 (% vol)	GSV	Characteristic Situation CO2
BH101	11/01/2016	-2.0	969	21	<1	<1	0.0	0	1	0.1	0.002	1
	25/01/2016	-0.5	1001	16.7	<1	<1	0.0	0	1	4	0.02	1
	09/02/2016	-2.1	969	17.6	<1	<1	0.0	0	1	3.8	0.0798	2
BH102	11/01/2016	0.1	969	20.8	<1	<1	0.0	0	1	0.1	0.0001	1
	25/01/2016	0.1	1001	20.9	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	21.1	<1	<1	0.0	0	1	0.1	0.0001	1
BH103	11/01/2016	-0.1	969	20.9	<1	<1	0.0	0	1	0.1	0.0001	1
	25/01/2016	1.0	1001	20.8	<1	<1	0.0	0	1	0.1	0.001	1
	09/02/2016	6.4	969	20.6	<1	<1	0.0	0	1	0.1	0.0064	1
BH104	11/01/2016	0.1	969	18.9	<1	<1	0.0	0	1	2.2	0.0022	1
	25/01/2016	1.2	1001	19.5	<1	<1	0.0	0	1	1.5	0.018	1
	09/02/2016	0.1	969	19.1	<1	<1	0.0	0	1	2.4	0.0024	1
BH105	11/01/2016	0.4	969	21	<1	<1	0.0	0	1	0.1	0.0004	1
	25/01/2016	0.3	1001	20.7	<1	<1	0.0	0	1	0.1	0.0003	1
	09/02/2016	0.1	969	20.8	<1	<1	0.0	0	1	0.1	0.0001	1
BH106	11/01/2016	-0.9	969	20.9	<1	<1	0.0	0	1	0.1	0.0009	1
	25/01/2016	-0.5	1001	20.6	<1	<1	0.0	0	1	0.1	0.0005	1
	09/02/2016	-0.2	969	18.8	<1	<1	0.0	0	1	0.7	0.0014	1
BH108	11/01/2016	0.1	969	20.5	<1	<1	0.0	0	1	0.5	0.0005	1
	25/01/2016	0.1	1001	20.7	<1	<1	0.0	0	1	0.3	0.0003	1
	09/02/2016	0.1	969	19.9	<1	<1	0.0	0	1	1.9	0.0019	1
BH109	11/01/2016	-0.1	969	20.5	<1	<1	0.0	0	1	1.3	0.0013	1
	25/01/2016	0.1	1001	20.5	<1	<1	0.0	0	1	0.4	0.0004	1
	09/02/2016	0.1	969	18.4	<1	<1	0.0	0	1	2.4	0.0024	1
BH112	11/01/2016	-0.1	969	21.1	<1	<1	0.0	0	1	0.1	0.0001	1
	25/01/2016	0.1	1001	21.1	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	21.2	<1	<1	0.0	0	1	0.1	0.0001	1
WS201	11/01/2016	-0.3	969	21	<1	<1	0.0	0	1	0.1	0.0003	1
	25/01/2016	0.1	1001	18.2	<1	<1	0.0	0	1	3.6	0.0036	1
	09/02/2016	0.1	969	16.5	<1	<1	0.0	0	1	6.1	0.0061	2

Capabilities on project:
Environment

Exploratory Hole	Date	Flow rate (l/h)	Barometric Pressure (mb)	Max 02%	C0	H2S	Peak CH4 (% vol)	GSV (l/hr)	Characteristic Situation CH4	Peak CO2 (% vol)	GSV	Characteristic Situation CO2
WS203	11/01/2016	Location not monitored on this date – access to exploratory hole blocked.										
	25/01/2016	0.1	1001	14.4	<1	<1	0.0	0	1	2	0.002	1
	09/02/2016	Location not monitored on this date – access to exploratory hole blocked.										
WS204	11/01/2016	0.1	969	11.8	<1	<1	0.0	0	1	7.1	0.0071	2
	25/01/2016	0.1	1001	20.9	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	19.9	<1	<1	0.0	0	1	1.8	0.0018	1
WS205	11/01/2016	0.1	969	21	<1	<1	0.0	0	1	0.1	0.0001	1
	25/01/2016	0.1	1001	20.9	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	18.4	<1	<1	0.0	0	1	2.3	0.0023	1
WS206	11/01/2016	-0.3	969	20.5	<1	<1	0.0	0	1	0.4	0.0012	1
	25/01/2016	0.1	1001	20.8	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	21.1	<1	<1	0.0	0	1	0.2	0.0002	1
WS208	11/01/2016	0.1	969	18.6	<1	<1	0.0	0	1	2.5	0.0025	1
	25/01/2016	0.1	1001	20.7	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	18.5	<1	<1	0.0	0	1	3.6	0.0036	1
WS209	11/01/2016	0.1	969	19.6	<1	<1	0.0	0	1	2.6	0.0026	1
	25/01/2016	0.1	1001	19.8	<1	<1	0.0	0	1	2.3	0.0023	1
	09/02/2016	0.1	969	20.3	<1	<1	0.0	0	1	1.8	0.0018	1
WS210	11/01/2016	0.1	969	20.4	<1	<1	0.0	0	1	1	0.001	1
	25/01/2016	1.4	1001	20.7	<1	<1	0.0	0	1	0.2	0.0028	1
	09/02/2016	0.1	969	20.8	<1	<1	0.0	0	1	0.4	0.0004	1
WS211	11/01/2016	-0.1	969	20.3	<1	<1	0.0	0	1	0.3	0.0003	1
	25/01/2016	-0.2	1001	20	<1	<1	0.0	0	1	0.6	0.0012	1
	09/02/2016	0.1	969	19.8	<1	<1	0.0	0	1	0.7	0.0007	1
WS212	11/01/2016	0.1	969	7.2	<1	<1	0.0	0	1	4	0.004	1
	25/01/2016	1.4	1001	15.1	<1	<1	0.0	0	1	1.4	0.0196	1
	09/02/2016	0.1	969	8.5	<1	<1	0.0	0	1	3.5	0.0035	1
WS214	11/01/2016	0.1	969	20.6	<1	<1	0.0	0	1	0.3	0.0003	1
	25/01/2016	0.1	1001	20.9	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	18.1	<1	<1	0.0	0	1	3	0.003	1
WS217	11/01/2016	0.1	969	18.6	<1	<1	0.0	0	1	3.2	0.0032	1
	25/01/2016	0.1	1001	79.9	<1	<1	0.0	0	1	19.4	0.0194	2
	09/02/2016	0.1	969	18.9	<1	<1	0.0	0	1	3	0.003	1

Exploratory Hole	Date	Flow rate (l/h)	Barometric Pressure (mb)	Max 02%	C0	H2S	Peak CH4 (% vol)	GSV (l/hr)	Characteristic Situation CH4	Peak CO2 (% vol)	GSV	Characteristic Situation CO2
WS218A	11/01/2016	0.1	969	20.4	<1	<1	0.0	0	1	0.4	0.0004	1
	25/01/2016	-0.5	1001	20.7	<1	<1	0.0	0	1	0.1	0.0005	1
	09/02/2016	0.1	969	20.8	<1	<1	0.0	0	1	0.1	0.0001	1
WS220	11/01/2016	0.1	969	19.4	<1	<1	0.0	0	1	0.6	0.0006	1
	25/01/2016	0.1	1001	20.8	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	17.2	<1	<1	0.0	0	1	2.5	0.0025	1
WS223	11/01/2016	0.1	969	18.9	<1	<1	0.0	0	1	0.1	0.0001	1
	25/01/2016	0.1	1001	18.3	<1	<1	0.0	0	1	0.1	0.0001	1
	09/02/2016	0.1	969	20.2	<1	<1	0.0	0	1	0.1	0.0001	1
Maximum	n/a	6.4	1001.0	79.9	0.0	0.0	0.0	0.0	1	19.4 (WS217 on 25/01/16)	0.0196	2
Minimum	n/a	-2.1	969.0	7.2	0.0	0.0	0.0	0.0	1	0.1	0.0001	1

During the monitoring exploratory holes adjacent to proposed main building (WS204 and WS217) recorded elevated carbon dioxide levels. Elevated carbon dioxide levels were found elsewhere onsite in locations BH101 and WS201. In accordance with CIRIA Report C665 (Ref. 25) the ground gas regime for the site has been categorised as Characteristic Situation 2.

There are a number of potential sources of the ground gas, including Made Ground and organic material within natural strata. However, the available information cannot provide a basis for determining the actual source of the ground gas at this stage.

Refined Conceptual Site Model

6 Refined Conceptual Site Model

6.1 Introduction

A refined conceptual site model (CSM) has been developed on the basis of the AECOM Desk Study Report (Ref 01) and the findings of the Geotechnics' ground investigation factual report (Ref. 07) and contamination assessment (Section 5). The CSM has been developed on the understanding that the site will developed for a commercial end use in line with the development proposal outlined in Section 1.1.

To assess the potential geo-environmental impacts associated with contamination at the site, the conceptual model has been revised using the source pathway receptor approach, promoted by DEFRA and the Environment Agency. For there to be an identifiable risk, not only must there be contaminants present on the site (source) there must also be a receptor and a pathway which allows the source to impact on the receptor.

6.2 Contamination Sources

6.2.1 Sources Based on the contamination assessment

Potential on site contamination sources include:

S1 – Potentially contaminated Made Ground and shallow natural soils; and

S2 – Potentially contaminated groundwater.

6.2.2 Contaminants of Concern

Table 6.1. Contaminants of Concern Encountered within Made Ground.

Determinand	Human Health	Controlled Waters	Property/Ecological Receptors
Metals			
Arsenic		✓	✓
Chromium III		✓	✓
Chromium VI		✓	✓
Chromium Total		✓	✓
Lead		✓	✓
Nickel		✓	✓
Vanadium		✓	✓
Non Metals			
Total Cyanide		✓	✓
Asbestos	✓		
TPH Compounds			
Aliphatic >C21-C36		✓	✓
Aliphatic >C35-C44		✓	✓

Capabilities on project:
Environment

Determinand	Human Health	Controlled Waters	Property/Ecological Receptors
Aromatic >EC12-EC17		✓	✓
Aromatic >EC16-EC22		✓	✓
Aromatic >EC21-EC36		✓	✓
Aromatic >EC21-EC36		✓	✓
Phenol			
4-methylphenol	✓		✓
PAHs			
Acenaphthene		✓	✓
Benzo(a)anthracene	✓		✓
Benzo(a)pyrene		✓	✓
Benzo(b)fluoranthene	✓	✓	✓
Benzo(k)fluoranthene		✓	✓
Benzo(bk)fluoranthene		✓	✓
Benzo(g,h,i)perylene		✓	✓
Carbazole	✓		✓
Dibenz(a,h)anthracene		✓	✓
Fluorene			✓
Fluoranthene		✓	✓
Indeno(1,2,3-cd)pyrene		✓	✓
VOCS			
Trichloroethene (TCE)	✓		
4-isopropyltoluene	✓		
Isopropylbenzene	✓		
Dichloromethane (DCM)	✓		

Capabilities on project:
Environment

Table 6.2. Contaminants of Concern Encountered within Natural Ground.

Determinand	Human Health	Controlled Waters	Property/Ecological Receptors
Nickel		✓	
TPH Compounds			
Aliphatic >C12-C17		✓	
Aliphatic >C16-C22		✓	
Aliphatic >C35-C44		✓	
VOCS			
Chloroform		✓	

6.3 Receptors

6.3.1 Human Health Receptors
R1 – Construction workers
R2 – Maintenance workers
R3 – Final end users
R4 – Adjacent site users

6.3.2 Controlled Waters
R5 – Primary /Secondary Aquifers underlying the site
R6 – Surface Water in the vicinity of the site (River Mersey)

6.3.3 Ecological Receptors & Property
R7 – Future planting and landscaping
R8 – Future proposed services and structures

6.4 Refined Conceptual Site Model

The refined conceptual site model is summarised in Table 6.3.

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Table 6.3. Refined Conceptual Site Model.

Source	Transport Pathway	Receptor	Preliminary Risk Assessment	Comment	Revised Consequence of risk being realised	Revised Probability of risk being realised	Revised Risk Classification	Contaminant Linkage ID
S1: Potentially contaminated Made Ground and shallow natural soils	P1: Direct contact with soil (ingestion and dermal)	R1: Construction workers	Moderate Risk	The majority of the determinants were detected below the AECOM Screening Value. Only PAHs in Made Ground were detected in concentrations exceeding specific generic assessment criteria value. Several VOCs and SVOCs were detected above the LOD used in the absence of a screening value. Asbestos has been identified onsite albeit in concentrations below the LOD of (0.001 % of mass). The majority of the site is covered in Hard standing breaking the pathway from the elevated concentrations in the Made Ground and end users. It is recommended that landscaped areas on Made Ground should be covered in an appropriate geo membrane and at least 600mm of clean topsoil to break any contaminant linkage. Precautions should be taken to reduce the risk of exposure of construction and maintenance staff to contaminants and asbestos through appropriate health and safety risk assessment processes, which are likely to require the adoption of appropriate health and safety measures such as adequate personal protective equipment (PPE), damping down for dust suppression and other normal safe practices for on-site workers. Asbestos has been identified onsite although testing has not been able to quantify the amount in given samples. An asbestos watching brief should be undertaken by site staff and should If asbestos is encountered again onsite it should be handled and disposed of appropriately by a specialist asbestos contractor. The risk to final end users from inhalation of vapours is unlikely to occur due to the end use being that of a bus station which is largely open space with structures being underlain by generally impermeable hardstanding. End users are also expected to be largely transient not spending large amounts of time onsite.	Minor	Low Likelihood	Very Low Risk	1
		R2: Maintenance workers	Moderate Risk		Minor	Low Likelihood	Very Low Risk	2
	P2: Inhalation of dust and / or vapours	R1: Construction workers	Low Risk		Minor	Low Likelihood	Very Low Risk	3
		R2: Maintenance workers	Moderate Risk		Minor	Low Likelihood	Very Low Risk	4
		R3: Final end users	Moderate Risk		Minor	Unlikely	Very Low Risk	5

Source	Transport Pathway	Receptor	Preliminary Risk Assessment	Comment	Revised Consequence of risk being realised	Revised Probability of risk being realised	Revised Risk Classification	Contaminant Linkage ID
		R4: Adjacent site users	Moderate	The risk of adjacent site users is only likely to occur during the development phase. Precautions should be taken to minimise the spread of dust from the site, such as damping down and wheel washes. Should asbestos be encountered during the works a specialist asbestos contractor should be consulted and additional control measures should be implemented.	Minor	Unlikely	Very Low Risk	**6**
	P4: Inhalation of ground gas	R1: Construction workers	Moderate / Low Risk	Elevated concentrations of ground gases have been recorded. The recorded levels are above published HSE Workplace Exposure Limits. Precautions should be taken to reduce the risk of exposure of construction and maintenance staff to ground gas through appropriate health and safety risk assessment processes. Anyone undertaking works in a confined space should be appropriately trained and wear suitable RPE and PPE, as per confined space regulations.	Severe	Low Likelihood	Moderate Risk	**7**
		R2: Maintenance workers	High Risk		Severe	Low Likelihood	Moderate Risk	**8**
		R3: Final end users	High Risk	Elevated concentrations of ground gases have been recorded. The gas screening values indicate the site is representative of Characteristic Situation 2 meaning gases are recorded at levels considered significant enough to require gas protection measures appropriate to the proposed development and Characteristic Situation as specified CIRIA Report C665 (2007)'Assessing risks posed by hazardous ground gases to buildings' and BS8485 'Code of practice for the characterisation and remediation from ground gas in affected developments.'	Severe	Low Likelihood	Moderate Risk	**9**
	P6: Surface water run-off and/or direct percolation from surface	R6: Surface water (River Mersey)	High Risk	Elevated levels of contaminants have been identified in leachate samples above the chosen screening criteria. Following construction the site is expected to be generally covered in relatively impermeable hardstanding minimising infiltration and the contact of contaminated soils with surface run-off.	Medium	Likely	Moderate Risk	**10**

Source	Transport Pathway	Receptor	Preliminary Risk Assessment	Comment	Revised Consequence of risk being realised	Revised Probability of risk being realised	Revised Risk Classification	Contaminant Linkage ID
	P5: Leaching of contaminants	R5: Principal Aquifer/ Secondary Aquifer	Moderate /Low Risk	The risk to controlled waters from surface run-off and direct percolation is expected to occur primarily during the development phase. Measures should be employed during construction to limit surface water run/off and percolation such as minimising soil exposure and covering of soil stockpiles. Following construction the site is expected to be generally covered in relatively impermeable hardstanding minimising the contact of contaminated soils with surface run-off. The site will be covered with relatively impermeable hard standing which will minimise infiltration and leaching of contaminants from the soils.	Medium	Low Likelihood	Moderate/Low Risk	**11**
	P8: Direct contact with in-ground structures and services.	R8: Proposed services and structures	Moderate /Low Risk	Potentially harmful chemicals and elements have been encountered in both total soils testing and leachate samples taken from the site. Advice should be sought from the local water supply companies to assist in the specification of drinking water supply pipes before emplacement.	Mild	Low Likelihood	Low Risk	**12**
	P9: Plant uptake	R7: Proposed planting	Moderate /Low Risk	Whilst landscaping and planting is not currently expected to be part of the proposed development, potentially phytotoxic chemicals have been encountered onsite. If planting is used onsite a geo-membrane should be used and covered within at least 600mm of clean imported topsoil	Minor	Unlikely	Very Low Risk	**13**
	P8: Migration and accumulation of gases	R8: Proposed services and structures	Low Risk	Elevated concentrations of ground gases have been recorded. The gas screening values indicate the site is representative of Characteristic Situation 2 meaning gases are recorded at levels considered significant enough to require gas protection measures appropriate to the proposed development and Characteristic Situation. Any works undertaken in a confined space should be undertaken in accordance with the current confined space regulations and appropriate PPE and RPE worn	Severe	Unlikely	Moderate/Low Risk	**14**

Source	Transport Pathway	Receptor	Preliminary Risk Assessment	Comment	Revised Consequence of risk being realised	Revised Probability of risk being realised	Revised Risk Classification	Contaminant Linkage ID
S2: Potentially contaminated groundwater	P7: Vertical and lateral migration of groundwater	R6: Principal Aquifer/ Secondary Aquifer	Moderate Risk	Elevated levels of contaminants are present within groundwater samples taken from wells with their response zones situated in natural strata. These are not expected to pose a significant risk to controlled waters receptors for the following reasons: - Metal concentrations only marginally exceed screening values and as such are not deemed to pose a significant risk to their receptors and are expected to be generally reflective of natural background levels. -The elevated levels of Aliphatic TPHs and chloroform encountered in BH109 are considered to be isolated and not widespread across the site, furthermore these determinants were not matched by similarly high levels in soils testing. It is therefore considered that the source of impact is from current or historical off site land uses.	Medium	Low Risk	Moderate/Low Risk	**15**
	P7: Vertical and lateral migration of groundwater	R6: Surface waters	Moderate /Low Risk		Medium	Low Risk	Moderate/Low Risk	**16**

Table 6.4. Residual pollutant linkages.

Source	Contaminants of Potential Concern	Transport Pathway	Receptor	Contaminant Linkage ID	Remedial Action
S1: Potentially contaminated Made Ground and shallow natural soils	PAHs, SVOCs, and VOCs	P1: Direct contact with soil (ingestion and dermal)	R3: Final End users		It is recommended that landscaped areas on Made Ground should be covered in an appropriate geo membrane and at least 600mm of clean topsoil to break any contaminant linkage.
	Ground Gas	P4: Inhalation of ground gas	R1: Construction workers	7	Elevated concentrations of ground gases have been recorded. The recorded levels are above published HSE Workplace Exposure Limits. Precautions should be taken to reduce the risk of exposure of construction and maintenance staff to ground gas through appropriate health and safety risk assessment processes. Anyone undertaking works in a confined space should be appropriately trained and wear suitable RPE and PPE, as per current confined space regulations.
			R2: Maintenance workers	8	
			R3: Final end users	9	The gas screening values indicate the site is representative of Characteristic Situation 2 meaning gases are recorded at levels considered significant enough to require gas protection measures appropriate to the proposed development and Characteristic Situation.
	- Arsenic - Chromium III - Chromium VI - Chromium Lead - Nickel - Vanadium - Cyanide - TPHs - PAHs - SVOCs	P6: Surface water run-off and/or direct percolation from surface	R5: Surface water (River Mersey)	**10**	The risk to controlled waters from surface run-off and direct percolation is expected to occur primarily during the development phase. Measures should be employed during construction to limit surface water run/off and percolation such as minimising soil exposure and covering of soil stockpiles.

Engineering Assessment of Ground Conditions

7 Engineering Assessment of Ground Conditions

7.1 Proposed Development

Stockport bus station is proposed to be re-developed by TfGM. The proposed scheme includes the demolition of the existing bus station, building of a new Interchange, realignment of the current road layout, expansion of Mersey Square and the construction of a bridge across the River Mersey.

7.2 Seasonal Shrinkage

The potential for shrinkage and swelling of the potentially 'shrinkable' soils underlying the site has been considered based on NHBC Standards Chapter 4 (2007) (Ref. 27).

Due to the nature of the underlying soils only one Plasticity Index was determined. The modified Plasticity Index for the Glacial Clay deposits was <20%, these indicate that this material is likely to have a low potential for volume change.

7.3 Groundwater

Groundwater monitoring instruments have been installed within the various geological units encountered beneath the site. It should be noted that possible fluctuations in groundwater levels seasonally or due to climatic effects have not been determined within the limited monitoring period.

Groundwater levels are included in Geotechnics' factual report (Ref. 07) and are presented on the geological sections, Drawing 60340298-ACM-00-GEO-DR-0002. A number of the installations only recorded a small quantity of water at the base of the installation or were not accessible at the time of the monitoring visit. The anticipated low permeability of the Glacial Clay deposits is such that a longer monitoring period is likely to be required to assess equilibrium groundwater levels within the clays.

Groundwater within the more permeable strata, i.e. Made Ground Granular, Glacial Sands and Gravels and Sherwood Sandstone, would expect a quicker response and equalisation of water pressures would be anticipated.

7.4 Drainage – Soakaway Drainage

The ground conditions on the site appear to be suitable for soakaway drainage, i.e. Glacial sands and gravels overlying Sherwood Sandstone. Once the site levels and location of any soakaways have been determined this should be confirmed in accordance with BRE Digest 365, Soakaway Design 2007. The sensitivity of the underlying Principal Aquifer and final end use of the site should be taken into consideration when designing the soakaway to ensure ground and surface waters are not impacted. Approval from the Environment Agency (EA) is likely to be required for the use of soakaways, and, where necessary, the EA will issue permits or notices in order to control the risk to groundwater from contaminated discharges.

7.5 Shallow Foundations

7.5.1 General

The Interchange is proposed to be a lightly loaded structure, i.e. station canopy with isolated single storey walls for offices/retail outlets, and may be supported by a raft foundation, subject to detailed design. Preliminary details of structural loading have been provided with maximum loading around 60 to 66kPa anticipated below the canopy

external support columns. The majority of the concourse area will have contact stresses of 15kPa or lower. The foundation geometries and structural tolerance to differential settlement will be confirmed at detailed design.

It is anticipated that the underlying medium dense Glacial Sands and Gravels will provide adequate bearing stratum for lightly loaded spread foundations, subject to detailed design.

Foundations should be located within natural ground below any fill and below the depth of effect of variations due to vegetation, seasonal and climatic change.

Due to the localised nature of the Glacial Clay deposits encountered during the ground investigation, it is recommended that if this fine grained material is encountered it should be removed and replaced with suitably compacted granular fill. For the Glacial Sand and Gravel deposits using minimum shear strength in terms of effective stress, c'0, ø' 34°, presumed bearing values (net) of the order 300kPa may be adopted in preliminary design . The bearing capacity calculations are undertaken presuming a 2m by 2m foundation at 1.0m depth, with groundwater at 1.0m bgl. Additional consideration of bearing capacity and settlement will be required at detailed design stage when details of structural tolerance to movement, foundation layout and geometry are available.

7.6 Piled Foundations

7.6.1 Types of Pile

Piled foundations may be considered for heavy structures and/or to minimise size and number of discrete spread foundations given the limited working area as the bus station may still be working during the construction period. Piles may derive capacity from a combination of skin friction and end bearing in the superficial soils and in rock. Pile diameters and lengths will be dictated by design loads. Non displacement, bored cast in situ concrete piles or small displacement driven steel systems are likely to provide optimum performance.

7.6.2 Preliminary Pile Design

The SPT N values for the superficial soils and underlying bedrock are presented on Figure 1. The variation in the Glacial deposits level across the site is shown on the geological cross sections presented on Drawing 60340298-ACM-00-GEO-DR-0002.

A detailed pile design is outside the scope of this report. The design procedure for piles varies considerably, depending on the proposed type of pile. However, for illustrative purposes only, the safe geotechnical axial capacity of a single 600mm diameter bored cast-in-situ concrete pile, 5m long pile and toed into the weathered Sherwood Sandstone. The ground model used was BH108 located on the south side of the proposed River Mersey crossing. The model assumed a 1.0m pile cap, Made Ground Granular to 5.0m bgl, with weathered Sherwood Sandstone to 6.8m bgl with Sherwood Sandstone below. Groundwater is assumed at 5.5m bgl. Based on calculations using Eurocode partial factors the modelled pile is estimated to have a load carrying capacity of 480kN. This value will be reviewed during the detailed design stage depending upon the location of any proposed structures. If an increase in load carrying capacity is required, the piles should be extended and toed into the Sherwood Sandstone. Consideration of pile capacity will be required at detailed design stage when details of structural tolerance to movement, foundation layout and geometry are available.

It should be noted that no reduction in load capacity due to pile group effects has been taken into account in the above value.

7.7 Subgrade Conditions for Road Pavements

The pavement subgrade will predominantly be Made Ground Granular deposits, with localised areas of Made Ground Cohesive material. Natural subgrade soils, if present, will generally be granular sand deposits with localised areas of low plasticity cohesive materials. Pavement design requires prediction of long term stiffness of the subgrade soils under road loading and under equilibrium groundwater condition. In order to avoid subgrade damage design will need to be based on the lower of the undrained in situ condition and longer term equilibrium values.

If the localised cohesive materials are removed and replaced with compacted granular fill, the Made Ground Granular and Glacial Sands and Gravels, expected to be present across the majority of the site, would allow for a preliminary design CBR value of 5%. This value assumes that during construction the formation level will be carefully compacted and any soft spots, i.e. localised cohesive material only, dug out and replaced by suitable compacted granular material. Made Ground present at formation level should be excavated, graded and recompacted to form a suitable foundation material.

7.8 Excavations & Earthworks

All temporary excavations should be battered back to a safe angle as determined on site, or provided with close/continuous support.

Considering the limited and variable groundwater information obtained from installations within the exploratory holes and the presence of groundwater within the Made Ground deposits; it is recommended that provision is made for pumping from sumps to control ingress of groundwater into excavations in the event that water bearing granular bodies are encountered.

The current design does not have any significant earthworks. Significant arisings from drainage excavations may occur during construction; these are likely to require off-site disposal. Re-use of material on site will require a Materials Management Plan if the material to be re-used exceeds 1000 tonnes. Excavation should be possible using conventional site plant.

7.9 Slope stability

Permanent slopes of significant height have not been identified during preliminary design.

Side slopes of 1v:2h within the Glacial Sands and Gravels are likely to provide an adequate factor of safety where slopes are not saturated. It is recommended that slope stability analyses are undertaken at detailed design stage to establish maximum permissible slope angles.

7.10 Utilities

A strategy to deal with the existing and proposed underground and overhead utilities across the site in relation to the proposed development is being progressed by others.

A United Utilities' sewer is to underlie the proposed Stockport Interchange building footprint. The sewer was encountered in BH107 at 7.5m bgl, with Sherwood Sandstone bedrock encountered at 4.0m bgl. The location and

level of this sewer, apart from at BH107, is unknown. A condition survey and position/level survey should also be undertaken to confirm the sewer's condition, depth and location.

In BH107 the sewer was encountered over 3m below the bedrock surface. The Interchange is proposed to be a lightly loaded structure, i.e. station canopy with isolated single storey walls for offices/retail outlets, and may be supported by a raft foundation on the Glacial Sands and Gravels above the sewer, subject to detailed design.

Approval from United Utilities will be required to confirm the proposed building does not affect their asset; United Utilities may have further modelling/ confirmation requirements in order to allow construction over their asset.

7.11 Geotechnical Risk Register

Table 7.1 summarises the key geotechnical hazards and risk.

Table 7.1. Geotechnical Risk Register.

HAZARD RISK	CAUSE	BEFORE CONTROL			CONSEQUENCE	AFFECTED	MITIGATION MEASURES
		P	I	R			
Buried utilities	Disruption	4	3	12	Unexpected utility exposed during excavations. Cutting modification/construction may lead to restricted access to utility provider.	Proposed works.	Confirm status of all utilities – undertake utilities search. Utility diversions / construction amendment. Consultation with United Utilities regarding sewer under proposed building footprint.
Settlement (buildings, bridge)	Soft ground, loose deposits present	4	4	16	Settlement of structures. Possible differential settlement.	Proposed works.	Allowance for risk item in construction and design life /maintenance costs. Adequate design. Piled foundation design.
Foundation failure (buildings, bridge)	Soft ground, loose deposits present	4	4	16	Failure of structure foundation.	Proposed works.	Allowance for risk item in construction and design life /maintenance costs. Conservative parameters used in analyses. Adequate design. Piled foundation design.
Concrete attack	High soluble sulphate	1	5	5	Reduction in concrete strength / structural damage.	Retaining wall / foundation materials.	Ground investigation undertaken and chemical classification undertaken to BRE SD1. Use appropriate concrete class required.

Material reuse	Limited cut and fill proposed	3	3	9	Disposal offsite.	Excavations.	Cut and fill design to minimise excavation. Chemical analysis for materials to be disposed of.
Groundwater contamination	Migration of contaminated water	3	3	9	Contamination of groundwater. Prosecution as a result of pollution event.	Proposed works and drainage.	High standard of construction practice on site. Adequate design.
Pavement Failure	Failure of pavement surface	2	4	8	Pavement requires replacement/ regular maintenance. Bus station movements affected.	Proposed works.	Conservative parameters used in analyses. Adequate design.

Conclusions and Recommendations

8 Conclusions and Recommendations

	Conclusions	Recommendations
Infrastructure	Potential contaminants which can impact water supply pipes have been identified in recovered samples.	- Once the location of water supply pipes has been confirmed, it is recommended that the potential risk and any necessary mitigation measures should be determined in accordance with the water supply company's risk assessment guidelines. Agreement with the local water supply company should be sought prior to placement of the pipes.
Ground Gas	- Elevated concentrations of ground gases have been recorded. The recorded levels are above published HSE Workplace Exposure Limits. - Elevated concentrations of ground gases have been recorded. The gas screening values indicate the site is representative of Characteristic Situation 2.	- Precautions should be taken to reduce the risk of exposure of construction and maintenance staff to ground gas through appropriate health and safety risk assessment processes. Furthermore any confined space working should be undertaken in accordance with the confined space regulations. Gas protection measures appropriate to the proposed development and Characteristic Situation should be implemented within the design as specified in CIRIA Report C665 (2007)) 'Assessing risks posed by hazardous ground gases to buildings' and BS8485 'Code of practice for the characterisation and remediation from ground gas in affected developments'.
Human Health	- It is considered that future site users will generally not be exposed to levels of contaminants considered to pose a risk to human health. - Construction and maintenance workers could encounter unidentified isolated areas of potentially impacted ground during the proposed development works.	- It is recommended that landscaped areas on Made Ground should be covered in an appropriate geo membrane and at least 600mm of clean topsoil to break any contaminant linkage. - Precautions should be taken to reduce the risk of exposure of construction and maintenance staff to contaminants through appropriate health and safety risk assessment processes, which are likely to require the adoption of appropriate health and safety measures such as adequate PPE and normal safe practices for on-site workers. - Material encountered that is considered to be potentially contaminated through visual or olfactory evidence, or different to that assessed in the ground investigation will require appropriate assessment to be undertaken to determine if remedial works are required. - It is recommended that during construction appropriate control measures are implemented in order to reduce the risk of off-site migration of

	Conclusions	Recommendations
		contaminants, in particular dust and surface water run off.
Surface Waters	- Elevated concentrations above the chosen Screening Values have been detected in both leachate testing and groundwater samples taken during the ground investigation.	- The risk to controlled waters from surface run-off and direct percolation is expected to occur primarily during the development phase. - Measures should be employed during construction to limit surface water run/off and percolation such as minimising soil exposure and covering of soil stockpiles. - Any water removed during excavation works should be tested and disposed of appropriately.
Suitability for Reuse	- It is understood that ground levels will remain generally unchanged and cut and fill across this site will be minimal. - An initial assessment of soil results to date suggests that material on site is unlikely to be classified as hazardous waste.	Materials encountered during the ground investigation may be reused on site providing that it is excavated and placed in a controlled manner as to not create any contaminant linkages. - Material encountered during construction works that is considered to be potentially contaminated through visual or olfactory evidence, or different to that assessed in the ground investigation will require chemical testing to confirm suitability for reuse.
Unforeseen Contamination	- Due to the historical use of the site and heterogeneous nature of the Made Ground there is the potential for significant hydrocarbon contamination to be present on the site.	A watching brief should be maintained on site and if identified suitable sampling and risk assessment will be required.
Waste Issues, Disposal of Material (Duty of Care, sustainability, waste acceptance criteria)	- Made Ground has been identified at the site. Excavated Made Ground may be considered to be a Controlled Waste by the Environment Agency.	- Any cut and fill works required at the site are likely to be considered to fall under the Environmental Permitting Regulations 2010 by the Environment Agency and may require an Environmental Permit. However, it may be possible to apply for a waste exemption under the Environmental Permitting Regulations. - Alternatively, it may be possible to re-use material on site under the CL:AIRE Code of Practice 'The Definition of Waste: Development Industry Code of Practice (CL:AIRE 2011)', if agreed with the Environment Agency. - Material encountered during construction works that is considered to be potentially contaminated through visual or olfactory evidence will require

	Conclusions	Recommendations
		chemical testing to confirm the waste classification. - If excavated, hazardous material should either be treated on site for re-use or should be removed from site and taken to a suitable licensed receiving facility. All waste classifications should be confirmed by the receiving facility.
Foundations & Floor Slabs	- Both shallow and piled foundation solutions may be considered for the proposed structures on site. Foundation selection will depend on design loads, foundation geometry and structural tolerance to total and differential settlement. - Presumed bearing values of the order 300kPa are suggested for shallow foundations bearing with the natural glacial sand and gravels soils below any made ground and below the depth of effect of variations due to vegetation, seasonal and climatic changes. - Piled foundations may be considered for heavy structures and/or to minimise size and number of discrete spread foundations. Piles may derive capacity from a combination of skin friction and end bearing in the superficial soils. Pile diameters and lengths will be dictated by design loads and third party requirements. Non displacement, bored cast in situ concrete piles or small displacement driven steel systems are likely to provide optimum performance. - The results indicate that the Glacial Clay deposits typically have a low potential for volume change.	- If piling is considered, advice should be obtained from a specialist piling contractor. - If any soft, loose or deleterious deposits are encountered at formation level, these should be removed and backfilled with suitable engineered fill or mass concrete. - The use of ground bearing floor slabs will require the removal of existing topsoil, Made Ground, and soft clay deposits and its replacement to proposed formation levels with suitably engineered selected granular fills placed to an end product specification.
Excavations & Earthworks	- Significant earthworks are not proposed.	- All excavations should be battered back to a safe angle as determined on site or be provided with close/continuous support. - If earthworks are proposed it is recommended that slope stability analyses are undertaken at detailed design stage to establish maximum permissible slope angles.

	Conclusions	Recommendations
Infrastructure	- Levels of Sulphate and pH which can aggressively attack concrete have not been identified at the site.	- A Design Sulphate Class of DS-1 and ACEC Classification of AC-1 are recommended for concrete structural elements in contact with the Made Ground and Glacial deposits.
United Utilities Sewer	- A United Utilities' sewer is to underlie the proposed Stockport Interchange building footprint. The sewer was encountered in BH107 at 7.5m bgl, with Sherwood Sandstone bedrock encountered at 4.0m bgl. - Approval from United Utilities will be required to confirm the proposed building does not affect their asset.	- The sewer is located over 3m below the bedrock surface in BH107. A condition survey and position/level survey should also be undertaken of the sewer to confirm its depth and location. - Lightly loaded structures may be supported above the sewer, subject to detailed design. Approval from United Utilities will be required.

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Capabilities on project:
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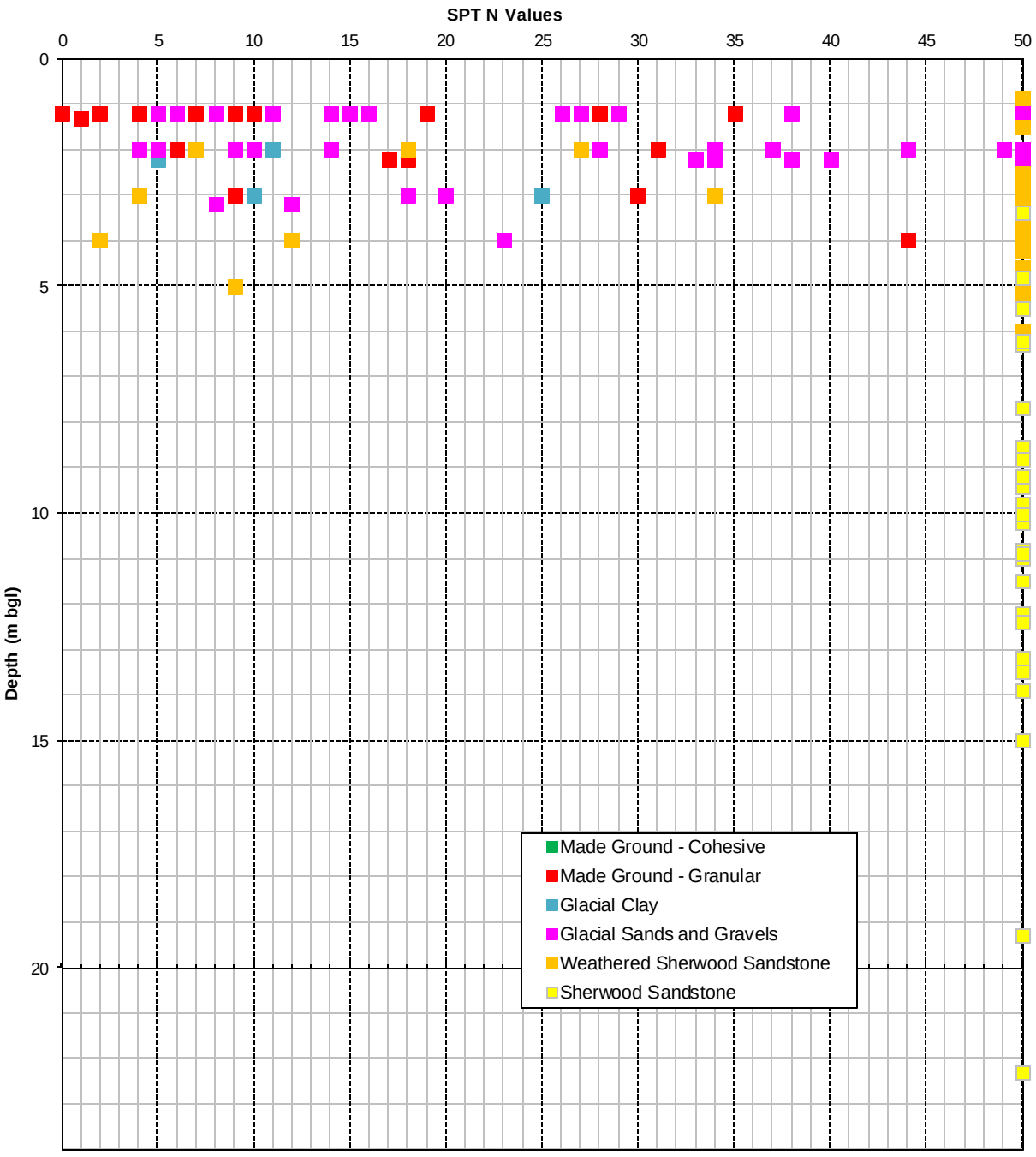
Figures



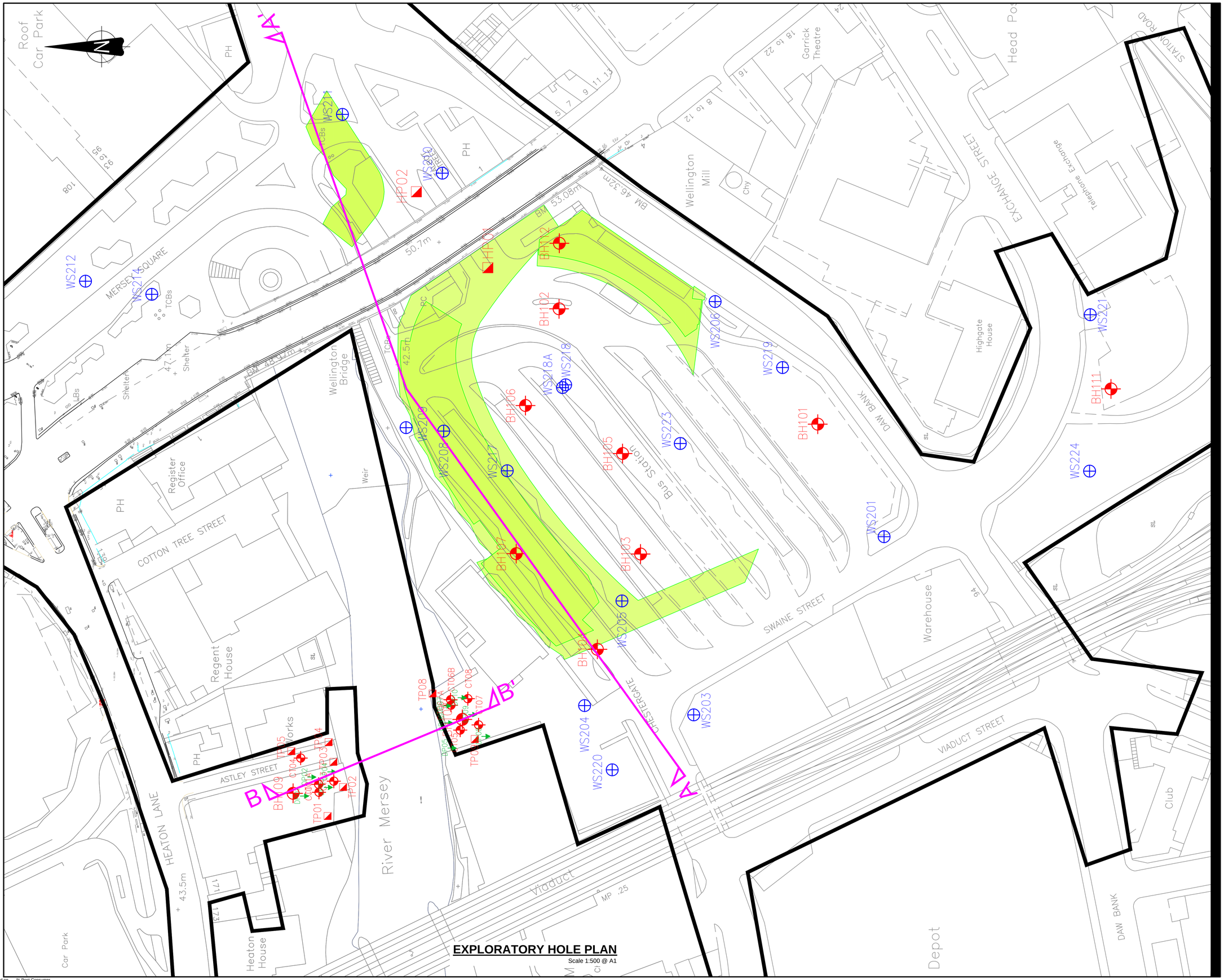
PROJECT TITLE:- **Stockport Bus Station**	ORIGINATOR:- AECOM
SKETCH / FIG TITLE:- SPT N Values versus depth Made Ground, Glacial Clay, Glacial Sand and Gravels and Sherwood Sandstone	SKETCH / FIG No.:- Figure 1 DATE:- Mar-16

Transport for Greater Manchester

Capabilities on project:
Environment

Drawings

Project Management Initials: Designer: RPA Checked: DCG Approved: MdK ISO A1 594mm x 841mm



EXPLORATORY HOLE PLAN

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6. EXPLORATORY HOLE LOCATIONS TAKEN FROM DRAFT FACTUAL REPORT PREPARED BY GEOTECHNICS LTD ON STOCKPORT BUS STATION, REF PN153428, DATED FEBRUARY 2016.

KEY

- BH104 — BOREHOLE
- WS220 — WINDOW SAMPLE
- TP09 — TRIAL PIT
- HP02 — HAND DUG PIT
- DP08 — DYNAMIC PROBE
- EXTENTS OF PROPOSED BUILDING
- EXTENTS OF PROPOSED ROOF
- A A' — GEOLOGICAL SECTIONLINE

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P01	MAR 2016	FIRST ISSUE

PROJECT NUMBER

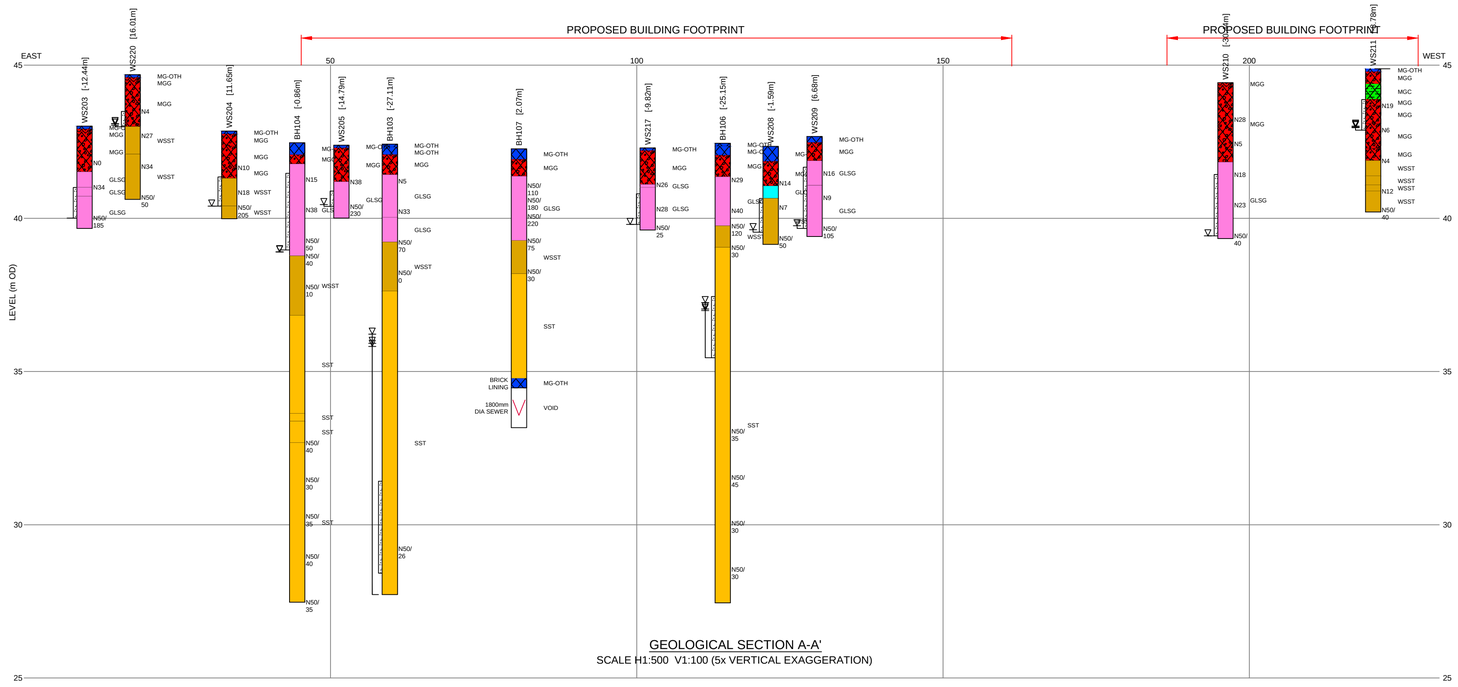
60340298

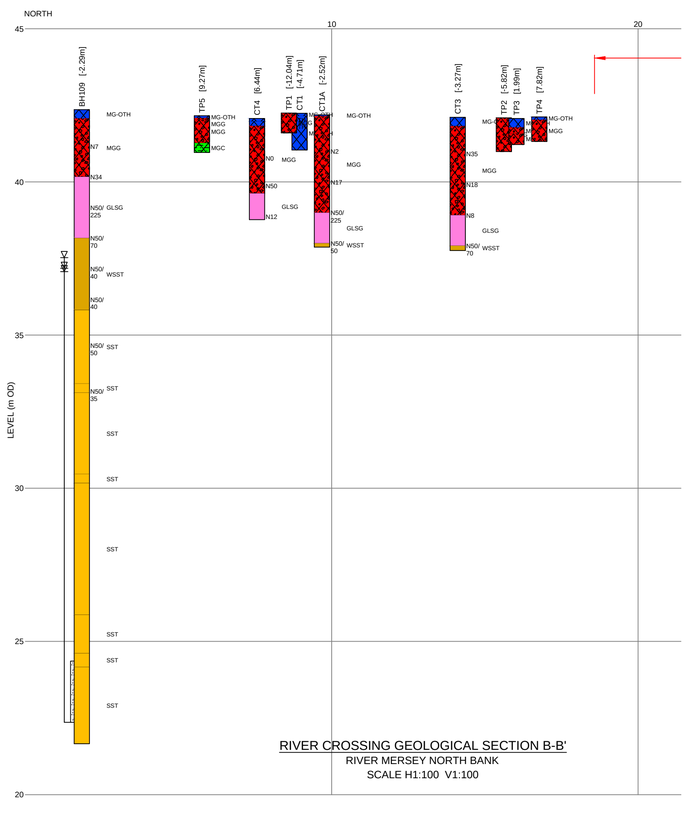
SHEET TITLE

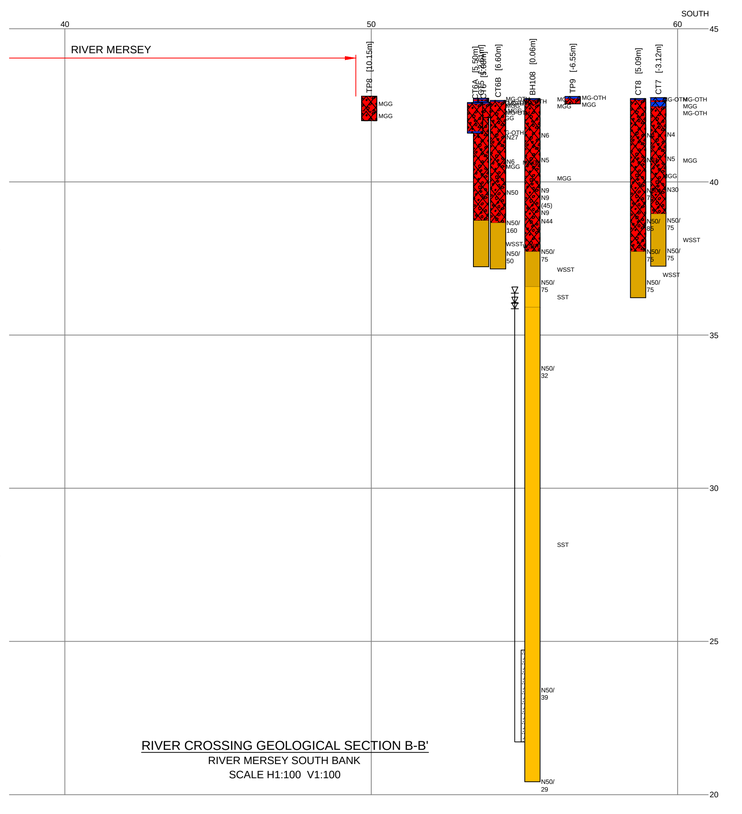
EXPLORATORY HOLE LOCATION PLAN

SHEET NUMBER

60340298-ACM-00-GEO-DR-0001 P01







GEOLOGICAL STRATA KEY

MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
MG-OTH	MADE GROUND - OTHER (TARMAC, CONCRETE ETC)
ALC	ALLUVIAL CLAY
GLC	GLACIAL TILL
GLSG	GLACIAL SAND & GRAVEL
SST	SHERWOOD SANDSTONE
WSST	WEATHERED SHERWOOD SANDSTONE
BH106 [11.3M]	HOLE ID AND PERPENDICULAR DISTANCE FROM SECTION LINE
N9	SPT N VALUE
(34)	U(100) BLOWS
	RESPONSE ZONE, PIEZO TIP AND MAXIMUM WATER LEVEL MONITORED
	WATER STRIKE & RISE LEVEL

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GROUND INVESTIGATION REPORT
GEOLOGICAL SECTIONS A - A' AND B - B'

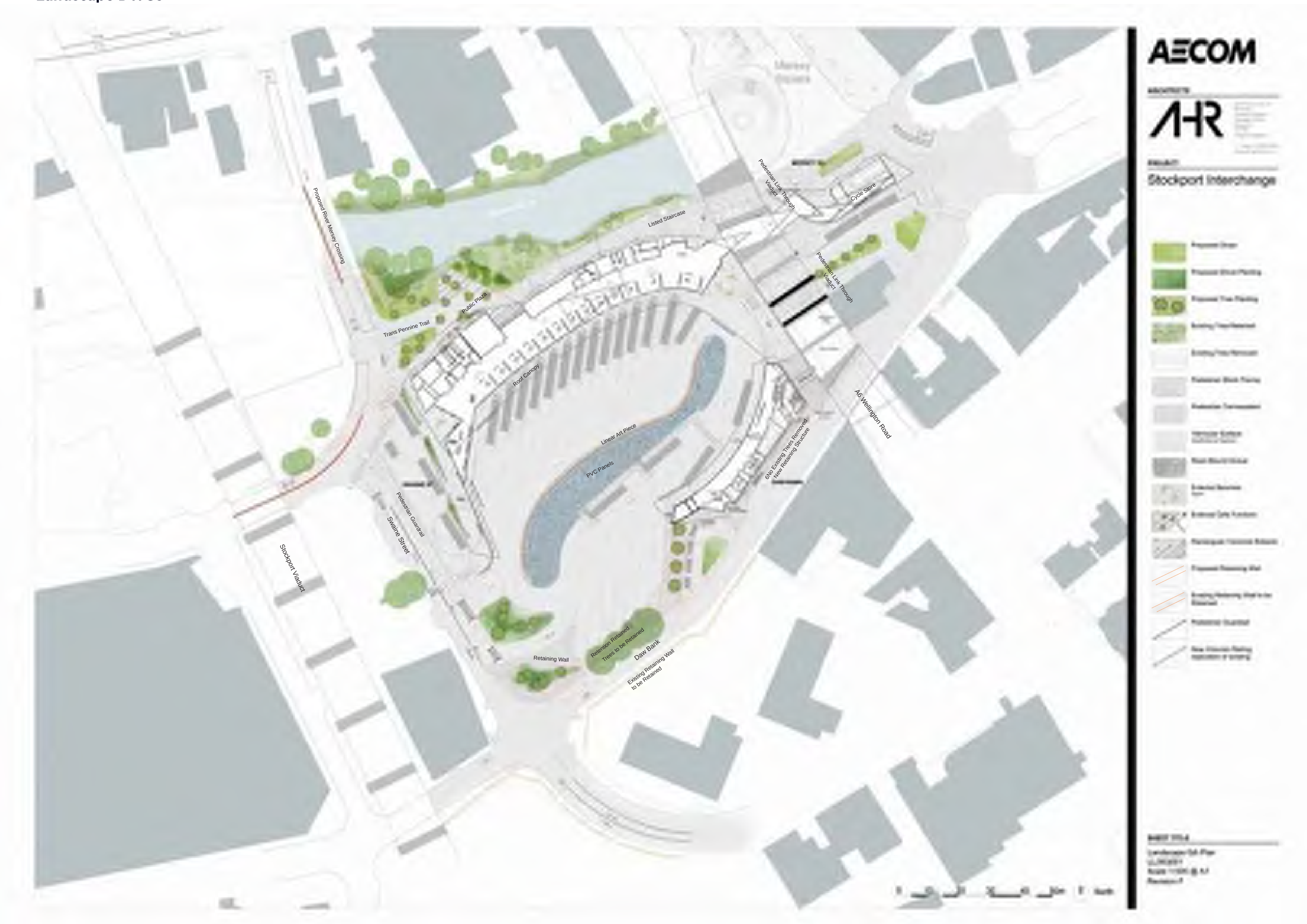
SHEET NUMBER

60340298-ACM-00-GEO-DR-0002 P01

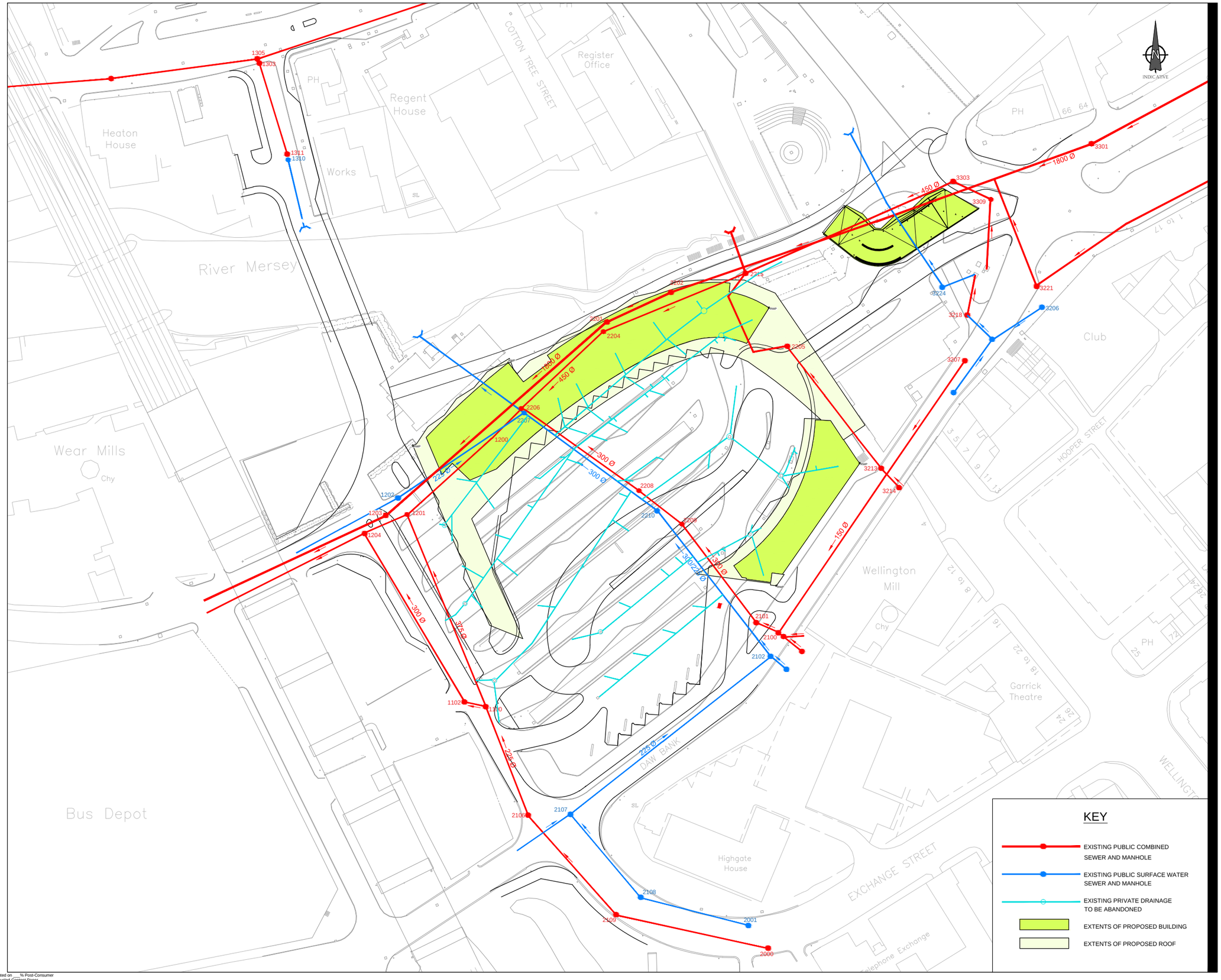
Capabilities on project:
Environment

Appendix A- Proposed Site Layout

Landscape DWGs



LL (90)001 Site Plan



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Designer: PG

Project Management Initials:

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STAGE 3 DRAINAGE STRATEGY
APPENDIX D2
EXISTING DRAINAGE

SHEET NUMBER

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Capabilities on project:
Environment

Appendix B – Legislative Framework for Land Contamination Risk Assessment

Guidance on AECOM's Approach to Contaminated Land Risk Assessment

Legislative Framework

The Contaminated Land Regime in Part IIA of the Environment Protection Act 1990 was introduced to specifically address the historical legacy of land contamination. Part IIA of the Environmental Protection Act 1990 (Amended April 2012) has introduced the following statutory definition for 'Contaminated Land':

'any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on, or under the land, that:

(a) significant harm is being caused or there is significant possibility of such harm being caused; or

(b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.

The Process of Risk Assessment

The assessment of contaminated land can be seen as a two phase risk based process, comprising:

(1) A qualitative assessment of the likelihood of plausible contaminant linkages, i.e. there must not only be a source of contamination, but a pathway and a receptor; and

(2) A quantitative element which will seek to determine the degree of harm and the significance of such harm on a receptor.

A 'contaminant' is a substance which is in, on or under the land and which has the potential to cause significant harm to a receptor or to cause significant pollution of controlled waters.

A 'pathway' is a route by which a receptor is or might be affected by a contaminant.

A 'receptor' is something that could be adversely affected by a contaminant, for example a person, an organism, an ecosystem, property or controlled waters.

The term 'contaminant linkage' indicates that all three elements (i.e. a contaminant, a pathway and a receptor) have been identified. The term 'significant contaminant linkage' means a contaminant linkage which gives rise to a level of risk sufficient to justify a piece of land being determined as Contaminated Land. The term 'significant contaminant' means the contaminant which forms part of a significant contaminant linkage.

Significant Harm to Human Health

The following health effects constitute significant harm: death, life threatening diseases (cancers), other diseases likely to have a serious impact on health, serious injury, birth defects and impairment of reproductive functions.

Significant Possibility of Significant Harm to Human Health

In deciding whether or not land is Contaminated Land on the grounds of significant possibility of significant harm to human health, the local authority use the following categorisations:

Category 1: Human Health

Land should be deemed to be a Category 1: Human Health case where:

(a) the authority is aware that similar land or situations are known, or are strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere; or

(b) the authority is aware that similar degrees of exposure (via any medium) to the contaminant(s) in question are known, or strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom, or elsewhere;

(c) the authority considers that significant harm may already have been caused by contaminants in, on or under land, and that there is an unacceptable risk that it may continue or occur again if no action is taken.

Category 2: Human Health

Land should be placed into Category 2 if the authority concludes, on the basis that there is a strong case for considering that the risks from the land are of sufficient concern, that the land poses a significant possibility of significant harm. Category 2 may include land where there is little or no direct evidence that similar land, situations or levels of exposure have caused harm before, but nonetheless the authority considers on the basis of the available evidence, including expert opinion, that there is a strong case for taking action under Part 2A on a precautionary basis.

Category 3: Human Health

Land should be place into Category 3 if the authority concludes that the strong case of Category 2 does not exist. Category 3 may include land where risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted. This recognises that placing land in Category 3 would not stop others, such as the owner or occupier of the land, from taking action to reduce risks outside of the Part 2A regime if they choose.

Category 4: Human Health

The local authority should consider that the following types of land should be placed into Category 4: Human Health:

(a) Land where no relevant contaminant linkage has been established.

(b) Land where there are only normal levels of contaminants in the soil.

(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed generic assessment criteria.

(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

"Normal" Presence of Contaminants

"Normal" levels of contaminants in soils should not be considered to cause land to qualify as contaminated land, unless there is particular reason to consider otherwise. "Normal" levels of contaminants in soils may result from:

(a) The natural presence of contaminants (e.g. caused by underlying geology) at levels that might reasonably be considered typical in an area and have not been shown to pose an unacceptable risk.

(b) The presence of contaminants caused by low level diffuse pollution, and common human activity. For example, this would include diffuse pollution from historic use of leaded petrol and the presence of benzo(a)pyrene from vehicle exhausts and the spreading of domestic ash in gardens that might reasonably be considered typical.

Significant Pollution of Controlled Waters

Pollution of controlled water means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term 'controlled water' is as defined in Part 3 of the Water Resources Act 1991, except that ground waters does not include waters contained in underground strata but above the saturation zone (i.e. perched water).

The following criteria are used to establish whether significant pollution of controlled waters has occurred:

(a) Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009.

(b) Inputs resulting in the deterioration of the quality of water abstracted, or intended to be used in the future.

(c) A breach of a statutory surface water Environmental Quality Standard, either directly or via a groundwater pathway.

(d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants.

The following categories are adopted in relation to determining the significant possibility of significant pollution of controlled waters.

Category 1: Water

This covers land where the authority considers that there is a strong and compelling case for considering that a significant possibility of significant pollution of controlled waters exists. In particular, this would include cases where there is robust science-based evidence for considering that it is likely that high impact pollution would occur if nothing were done to stop it.

Category 2: Water

This covers land where:

(a) The authority considers the strength of evidence to put the land into Category 1 does not exist; but

(b) Nonetheless, on the basis of the available scientific evidence and expert option, the authority considers that the risks posed by the land are of sufficient concern that the land should be considered to pose a significant possibility of significant pollution of controlled waters on a precautionary basis, with all that this might involve (e.g. likely remediation requirements, and the benefits, costs and other impacts of regulatory intervention). Among other things, this category might include land where there is a relatively low likelihood that the most serious types of significant pollution might occur.

Category 3: Water

This covers land where the authority concludes that the risks are such that (whilst the authority and others might prefer they did not exist) the tests set out in Categories 1 and 2 are not met, and therefore regulatory intervention under Part 2A is not warranted. This category should include land where the authority considers that it is very unlikely that serious pollution would occur; or where there is a low likelihood that less serious types of significant pollution might occur.

Category 4: Water

This covers land where the authority concludes that there is no risk, or that the level of risk posed is low. In particular, the authority should consider that this is the case where:

(a) No contaminant linkage has been established in which controlled waters are the receptor in the linkage; or

(b) the possibility only relates to type of pollution that should not be considered to be significant pollution; or

(c) The possibility of water pollution similar to that which might be caused by “background” contamination.

Terminology

The term ‘Contaminated Land’ is used to mean land which meets the Part IIA definition. Other terms, such as ‘land affected by contamination’ or ‘land contamination’ are used to describe much broader categories of land where contaminants are present but usually not at sufficient level of risk to be Contaminated Land.

Planning Policy and Land Contamination

The National Planning Policy Framework has replaced Planning Policy Statement PPS23: Planning and Pollution Control.

The key parts of the policy specifically relating to soils, geology and contamination are summarised below.

Taken from the section **11 Conserving and enhancing the natural environment**

109. The planning system should contribute to and enhance the natural and local environment by:

- *protecting and enhancing valued landscapes, geological conservation interests and soils;*
- *preventing both new and existing development from contributing to or 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.*

111. Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value. Local planning authorities may continue to consider the case for setting a locally appropriate target for the use of brownfield land.

120. To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

121. Planning policies and decisions should also ensure that:

- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
- *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 presented.*

*Site investigation information: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 (2011) Code of Practice for the Investigation of Potentially Contaminated Sites). The minimum information that should be provided by an applicant is the report of a desk study and site reconnaissance.

AECOM's Approach to Screening for Land Affected by Contamination

For a typical ground contamination assessment, principally for planning, AECOM has adopted the following approach to evaluate the results obtained in the investigation.

Where no current UK guideline values are available, professional expertise within AECOM has been used to assess the extent of contamination.

Human Health Risk Assessment

The potential chronic risks to human health have been assessed by comparing the recorded concentrations of contaminants against AECOM Generic Assessment Criteria (AGAC), as an initial screen.

AGAC Generic Screening Values – Modelling Assumptions

1. Calculated Risk Levels

AGACs are calculated for a minimal level of risk in line with SGVs with the current exception of arsenic, which follows alternative SGV guidance. Therefore concentrations found below AGACs are not normally considered any further. However when process based remediation is being considered it would be advantageous to reduce concentrations of index chemicals to a practical minimum. SGVs may sometimes be calculated at an acceptable level of risk which is higher than a minimal risk level. One example of this is the SGV for Arsenic: in order to keep the SGV on a par with standards for water, the oral human health criterion has been based on the UK Drinking Water Standard, which results in a higher SGV for arsenic than would otherwise be indicated.

2. Soil Guideline Values and soil type

SGVs have been reproduced using CLEA1.04 software using the assumptions in the corresponding TOX and SGV reports. However, SGVs have been calculated using a SOM of 6% which is not generally representative of contamination samples taken from development sites. AGACs for chemicals with SGVs have been recalculated with a SOM of 1%. The AGAC's are also calculated for a "sandy loam" rather than "sandy soil" as in the case of the withdrawn SGVs. AGACs are calculated for a sandy soil in order to ensure they are conservative as an initial screen. If AGAC's are exceeded it may be appropriate to recalculate a more site specific GAC based on different soil properties. As new SGVs are issued it is likely that AGACs will need to be revised in light of the revised TOX and SGV reports. AGAC's will also be reviewed as other authoritative peer-reviewed toxicological or chemical data becomes available.

3. Verification and Robustness

In order to have confidence in the screening values produced initially the CLEA 1.04 model was used to reproduce the newly published but limited number of SGVs. Further cross checking has been undertaken on the values generated by the CLEA 1.04 model by comparing the results against values produced by our in-house software program FM-CLaRAT. AECOM is a contributor to the LQM CIEH and EIC working groups who are seeking to publish authoritative peer reviewed screening values for contaminants which currently do not have SGV's. Consequently the invaluable knowledge about the limitations of the model and how it works gained as part of this process has been utilised fully in producing the AGAC. Details of sensitivity analyses undertaken in connection with land use scenarios are described below. It is noted that CLEA 1.05 was released in 2009 with primarily cosmetic changes and the addition of dioxins and dioxin-like PCBs, the release of which resulted in the existing published SGVs being withdrawn. CLEA 1.05 was almost immediately superseded by CLEA 1.06, the only change being the password. Consequently the AGACs produced using CLEA 1.04 (which do

not include values for dioxins and dioxin-like PCBs) are still considered valid as an initial screen.

4. Receptor characteristics

AGAC's are calculated for standard CLEA land use receptors as follows:

Land Use	*Standard Receptor*
Residential with homegrown produce	Female 0-6yrs
Residential without homegrown produce	Female 0-6yrs
Industrial/Commercial	Female 16-65yrs

5. Assumptions for buildings

Contamination is assumed to be at a depth of 65cm below ground level underneath buildings and at surface level external to buildings in line with assumptions for SGVs.

Default gas ingress rates and effective air permeability are also assumed for each building type.

Residential

A sensitivity study of CLEA1.04 residential building types has been carried out to determine the most appropriate setting for calculation of screening values. It transpires that the most sensitive residential building type by a significant margin is a bungalow. The building type used for SGVs is a small terraced house which is not too unusual for high density low cost housing on brownfield sites. The building type used for AGACs is small terraced house in order to avoid too high a degree of conservatism for most developments. It is considered that for this site the selected building type is appropriate.

Commercial and industrial

SGVs and AGAC's are appropriate for screening chemical concentrations for the purpose of obtaining Planning Consent, but are not appropriate for Part IIa determination. A sensitivity study of standard CLEA1.04 commercial and industrial buildings indicates that pre-1970s buildings are more sensitive to contamination than modern buildings. For Planning purposes however it is more appropriate to model risk in modern buildings and so AGACs are based on a post- 1970 office, which is generally slightly more sensitive than a post- 1970 warehouse.

6. Indoor vapour pathway correction factor

Calculation of petroleum hydrocarbon ingress to buildings utilises a "sub-surface soil to indoor air correction factor" of 10 in line with DEFRA guidance on BTEX SGVs. This correction arises from a discrepancy found between observed and predicted hydrocarbon concentrations using the Johnson-Ettinger model in the UK. It is found that indoor concentrations of hydrocarbons are typically at least an order of magnitude lower in practice compared with theory. As it is uncertain whether this discrepancy is due to a difference in the typical foundation design employed in the UK and USA, or results from chemical specific attenuation of contaminants through breakdown, this factor is not included for other species, e.g. elemental mercury and chlorinated hydrocarbons.

7. Soil vapour limit

Risk to human health from soil vapour calculated by CLEA1.04 rises linearly with increasing soil concentration despite the physical limits to concentration in air set by the maximum vapour pressure. A manual procedure has been used to calculate the allowable intake for non-vapour pathways at the limiting soil concentration. The AGAC is calculated to be the soil concentration resulting in the allowable intake for non-vapour pathways. Calculations have been cross-checked with FM-CLaRAT which corrects for soil vapour limit automatically.

8. Saturation limit

Plant uptake may be limited by the concentration of the chemical in the soil pore water. Calculation of GACs using the saturation limit would be a laborious task especially where vapour pressure also limits uptake. Given that plant uptake is only present in one of the current

AECOM scenarios and the reservations expressed by the EA as to whether saturation is always limiting, the current AGACs do not apply an upper limit to plant uptake based on saturation limit. This will be a further option to consider for a more detailed analysis if the initial screen is failed. FMCLaRAT checks have been performed without using the saturation limit in order to maintain consistency with CLEA1.04.

9. Free-phase hydrocarbon limit

SGVs for BTEX compounds have been limited by DEFRA to the limiting upper soil concentration for solubility or maximum vapour pressure, whichever is the lower. Although the reason given for capping SGVs is for protection of human health, no mechanism is elucidated for the increased risk from free-phase hydrocarbons. Heavy hydrocarbons are relatively insoluble and so general adoption of this rule would result in very low GAC values, despite the free-phase being immobile, e.g. solid or bound within the soil particles. Therefore AGAC values have with the exception of BTEX been calculated without this free-phase constraint. If the soil contains a free-phase, consideration should be given as to whether this is acceptable based on human health, ecological, hydrological and aesthetic criteria.

10. Nickel screening values

DEFRA guidance for nickel suggests that risk via inhalation and oral pathways is not additive. AGAC for nickel uses the lower of the inhalation and oral assessment criteria in accordance with the nickel SGV methodology.

11. Asbestos, VOCs, SVOCs and PCBs

The analytical detection limit for PCBs, VOCs and sVOCs has been adopted as an initial screen. The presence of asbestos fibres identified within any of the samples has been adopted as a screen for assessing asbestos.

12. Cyanide

The current CLEA methodology only assesses the chronic risks to human health. Cyanide may also post an acute risk to human health. Where cyanide is present above the detection limit then the risk will be considered on a site specific basis.

Statistical Analysis of Data

Statistical assessment of soil data has been undertaken (where appropriate) in accordance with guidance provided by CL:AIRE/CIEH, Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008. This assessment was undertaken using a propriety software package developed by ESI.

Guidelines for the Assessment of Contamination in Groundwater

The assessment of contamination in groundwater is based on a site-specific approach to assessment and remediation, as outlined in the Environment Agency's (2006) guidance 'Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination'. The EA guidance is based on a risk assessment approach incorporating a contaminant-pathway-receptor analysis. The methodology adopts a tiered approach to determine risk-based remedial targets, involving structured decision-making, cost-benefit considerations and progressive data collection and analysis.

At each level a remedial target is derived, but this is likely to be less onerous at the next level as additional processes (such as dilution and attenuation, degradation) which affect contaminant concentrations along its pathway to the receptor are taken in to account. With successive levels, the data requirements and the sophistication of the analysis increase, and the confidence in the predicted impact also increases. Consequently, the contaminant-pathway-receptor relationship is better defined and remedial requirements are likely to be less onerous, if the risk assessment results are favourable. The tiered approach allows low risk sites to be screened out and attention is focussed on those sites where the risks to water are greatest.

Ground Gas Risk Assessment

The assessment of risk from the presence of ground gas takes account of the nature of the identified gas/vapour, its concentration in air, and its borehole flow rate in litres per hour. The data is used to

produce a gas screening value which is then used to assess the need or otherwise for gas protection measures. In addition the raw data may be used to assess the short term risk of harm to human health or explosive risk to buildings or other built environment.

The assessment of ground gas contamination is based on the following good practice guidance documents and standards:

- British Standards Institution, 2007. BS8485:2007 Code of practice for characterisation and remediation from ground gas in affected developments. London: BSI.

- Building Regulations, 2010.). Approved Document C - Site preparation, resistance to contaminates and moisture, 2004 edition, incorporating 2010 amendments.

- Environment Agency, 2004. Guidance on the management of landfill gas, Landfill Technical Guidance Note (LFTGN) 03. Bristol: Environment Agency.;

- Building Research Establishment (1991). Construction of new buildings on gas-contaminated land, Report 212. Watford: BRE.;

- CIRIA (2007). Assessing risks posed by hazardous ground gases to buildings, Publication C665. London: CIRIA;

- CIRIA (2009). VOCs handbook: investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination, Publication C682. London: CIRIA.

- CIRIA (1995). Protecting development from methane: Methane and associated hazards to construction, Report R 149. London: CIRIA.

- Wilson, S., Card, G., and Haines, S., (2009). Ground gas handbook. London: Whittles Publishing.

Guidance for the selection of typical gas protection measures are provided in some of the above and the following documents:

- Ove Arup & Partners, 1996. Vols I&II, Passive Venting of Soil Gases beneath Buildings Research Report, Design Guide, Partners in Technology;

- Building Research Establishment (1991). Construction of new buildings on gas-contaminated land, Report 212. Watford: BRE.;

After CIRIA document 552: 'Contaminated Land Risk Assessment; A Guide to good practice'.

Table 1: Classification of Consequence

Classification	Definition
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined in the Environmental Protection Act, Part IIA. Short-term risk of pollution of sensitive water resource (note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000)
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act 1991 contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR, 2000)
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the Draft Circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/services or the environment
Minor	Harm, although not necessarily significant, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.). Easily repairable effects of damage to buildings, structures and services.

Table 2: Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 3: Comparison of Consequence against Probability

Probability	Consequence			
	Severe	**Medium**	**Mild**	**Minor**
High Likelihood	Very High Risk	High risk	Moderate risk	Moderate Risk/low risk
Likely	High Risk	Moderate risk	Moderate/ low risk	Low risk
Low Likelihood	Moderate risk	Moderate risk/low risk	Low risk	Very low risk
Unlikely	Moderate/Low risk	Low risk	Very low risk	Very low risk

Table 4: Description of Classified Risks and Likely Actions Required

Risk Descriptor	Definition
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to the designated receptor is currently happening. The risk, if realised, is likely to result in substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required
High risk	Harm is likely to arise to a designated receptor from an identified hazard. The risk, if realised, is likely to result in substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely in the long term.
Moderate Risk	It is possible that harm could arise to a designated receptor for an identified hazard. However, if it is either unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk, and to determine the potential liability. Some remedial works may be required in the long term.
Low Risk	It is possible that harm could arise to a designated receptor for an identified hazard, but it is likely that this harm, if realised, would at worst be mild
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Capabilities on project:
Environment

Appendix C – Ground Investigation Factual Report

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Ground Investigation

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STOCKPORT BUS STATION

Factual Report

for
Transport for Greater Manchester

Engineer : AECOM

Project Number PN153428

March 2016

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Factual Report

STOCKPORT BUS STATION

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Ground Investigation
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1.0 INTRODUCTION

A geotechnical and geo-environmental investigation was undertaken by Geotechnics Limited at the site of proposed redevelopment works at Stockport Bus Station. The investigation was carried out to the instructions of the Engineer, AECOM on behalf of the Client, Transport for Greater Manchester. This report describes the work undertaken and presents the data obtained.

2.0 OBJECT AND SCOPE OF THE INVESTIGATION

The object of the investigation was to obtain information on the ground and groundwater conditions relating to the design of the proposed works within the limitations posed by trial hole numbers, locations, depths, methods adopted and the scope of approved in situ and laboratory testing. The investigation comprised cable percussive boreholes, rotary follow-on boreholes, dynamic sample boreholes, trial pits, dynamic probes and concrete core holes, in situ and laboratory testing and reporting. A Factual Report only was also commissioned.

3.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 4 to 6. The factual data so obtained are presented in Appendices 2 to 13 of this report. Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 14 to aid an understanding of the procedures followed and the context in which the report should be read.

In addition, data in electronic format in accordance with "The Electronic Transfer of Geotechnical Data from Ground Investigations" (Fourth Edition) published by the AGS (the AGS Format) are presented separately on disk together with a copy of the report in electronic PDF format.

4.0 THE SITE

4.1 Location

The site is located in Stockport town centre, extending from Stockport Railway Station northwards to Heaton Lane and from the railway viaduct eastwards to Mersey Square. The approximate Ordnance Survey National Grid Reference for the centre of the site is SJ 892 902 and an extract from the relevant 1:50,000 Scale O.S. Map is included as Appendix 1.

4.2 Description

The site is irregular in shape with maximum dimensions of approximately 350m (north-west to south-east) and 250m (north-east to south-west). The River Mersey flows through the northernmost part of the site from east to west. Ground levels across the site generally fall towards the river, such that levels fall from around 68m AOD at the southern boundary (railway station/Station Road) to around 42m AOD on the banks of the River Mersey before rising again to around 45m AOD at the northern boundary (Heaton Road).

The majority of the site comprises Stockport Bus Station which remained operational at the time of the investigation fieldwork. Some warehouse and office buildings are present adjacent to the bus station. The A6 Wellington Road crosses the easternmost part of the site on a viaduct which trends roughly north-west to south-east. Beyond this viaduct lies the primarily hard landscaped public open space of Mersey Square. The River Mersey flows in culvert below Mersey Square.

To the south of the bus station the site includes the western section of Exchange Street and an area of landscaped ground and car park beyond. The River Mersey bounds the bus station to the north. Between the river and the northern site boundary

(Heaton Lane) the site includes an area of car park to the west of Astley Street.

It is understood that tunnels are present below part of the site. These are presumed to be former mill water race excavations through the rock extending from the site of existing and former mills to the River Mersey.

4.3 Site Geology

The 1:50,000 scale map of Stockport published by the British Geological Survey, Sheet 98 Drift edition dated 1962, shows the southernmost part of the site to be underlain by Glacial Till (shown on the map as Boulder Clay). Towards the River Mersey River Terrace Deposits are indicated (shown on the map as First Terrace) whilst beyond the river Fluvioglacial Sheet Deposits are indicated (shown on the map as Fluvioglacial Gravel).

The 1:50,000 Solid edition map (dated 1977) indicates that the site is underlain by rocks of the Chester Pebble Beds Formation, part of the Sherwood Sandstone Group of Triassic age. The conjectured trace of a north-north-west to south-south-east trending fault is shown approximately 100m to the west of the railway viaduct. The strata to the east of this fault are shown to be downthrown. The conjectured trace of a second fault is shown approximately 200m to the east of the site. This fault trends roughly parallel to the other fault and the strata to the east are again downthrown.

The British Geological Survey maps do not shown the presence of Made Ground below the site. However, Made Ground may be present for which the British Geological Survey have no records or which are too shallow for incorporation into the maps. Given historical land uses of this urban site, a thickness of Made Ground would be anticipated across the site.

5.0 PROCEDURE

5.1 Commissioning

The work was awarded following submission of a tender for work designed by the Engineer for ground investigation of the site in accordance with the Client's requirements.

5.2 General

The procedures followed in this site investigation are based on *BS 5930:1999 + A2:2010 – Code of Practice for Site Investigations* and *BS 10175:2011 Investigation of Potentially Contaminated Sites*. The soils and rocks encountered have been described in accordance with BS5930:1999+A2:2010 and BS EN ISO 14688-1:2002+A1:2013 and BS EN ISO 14689-1:2003. The Cable Percussive/Rotary Borehole, Dynamic Sample Borehole, Trial Pit, Dynamic Probe and Concrete Core Records are included in Appendices 2 to 8 and their approximate positions are shown on the Exploratory Hole Location Plan in Appendix 13.

The Exploratory Hole locations were specified by the Engineer. The co-ordinates and levels shown on the Exploratory Hole Records were measured using a Leica GPS survey device. The depths quoted on the exploratory hole records are in metres below ground level.

At each exploratory hole location with the exception of the concrete cores an inspection pit was excavated using hand tools to a depth of 1.20m below ground level to check for the presence of underground services. Prior to and on completion of the excavation, the location was scanned using a cable avoidance tool (CAT).

5.3 Boreholes

Twenty-one (21 No.), 150mm diameter boreholes (numbered BH101 to BH109, BH111, BH112, CT1, CT1A, CT3 to CT8, CT6A and CT6B) were sunk by Cable Percussion Tool techniques to depths varying between 0.50m (CT6) and 6.50m below ground level. The work was carried out between 30th November and 17th December 2015.

Representative disturbed (D and B) samples of the soils encountered were obtained at regular intervals. A driven open-tube thick-walled (U) sample was attempted but failed in borehole BH108. Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata. In addition, environmental soil samples (ES) were recovered at the depths indicated on the Borehole Records, presented in Appendix 2.

Boreholes BH101 to BH109 and BH112 were continued by rotary coring techniques to depths varying between 7.80m (BH107) and 22.30m (BH108) below ground level. The rotary

coring commenced through the base of the Cable Percussion Boreholes which had been left open and cased to facilitate coring, as instructed by the Engineer. This element of the work was carried out during the period between 1st and 17th December 2015.

The drilling equipment on this particular contract utilised water or polymer foam as the flushing medium. Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata.

Rock cores were extruded horizontally in transparent liners and placed into suitable core boxes. Photographs of the individual core boxes are included in Appendix 3.

Groundwater observations are included on the Borehole Records where appropriate. It should be noted that the addition of water to the borehole as part of the drilling process may have masked the presence of groundwater in the borehole. Where water was added it has been noted on the Borehole Records.

On completion, standpipes were installed in Boreholes BH101 to BH106, BH108, BH109 and BH112 (see Section 5.8). Borehole BH107 was terminated after encountering a brick sewer. The borehole casing was left in this borehole at the instruction of the asset holder and reinstated at the surface with a heavy duty flush cover. The other boreholes were backfilled with bentonite and the surface reinstated.

5.4 Trial Pits

Thirteen (13 No.) Trial Pits (numbered HP01, HP02, TP1 to TP5, TP6A, TP6B, TP7A, TP7B, TP8 and TP9) were excavated to depths varying between 0.24m (TP9) and 1.30m (TP7A) below ground level using hand tools. The work was carried out between 9th and 15th December 2015 and was supervised on site by a geotechnical engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative samples were taken, where appropriate, for laboratory examination and analysis and in addition, environmental soil samples (ES) were recovered at the depths indicated on the Trial Pit Records. Groundwater observations and trench stability notes are included on the Trial Pit Records, presented in Appendix 4. Photographs of the pits are presented in Appendix 5.

5.5 Dynamic Probes

Ten (10 No.) Dynamic Probe Holes (numbered DP1 to DP10) were undertaken at the site to depths varying between 3.45m (DP1) and 4.98m (DP10) below ground level using the super-heavy Dynamic Probe. The work was carried out on 16th and 17th December 2015.

The Probes were taken to the depths at which refusal was achieved for the equipment used. The equipment used conforms to the super heavy (DPSH-B) dynamic probing apparatus as defined in BS EN ISO 22476-2:2005+A1:2011 and effectively drives a 90° cone into the ground using a 63.5 kg automatic trip hammer falling over 750mm. The number of blows required to achieve increments of 100mm penetration is recorded and plotted graphically on the records, presented in Appendix 6.

5.6 Dynamic Sample Boreholes

Nineteen (19 No.) Dynamic Sample Boreholes (numbered WS201, WS203 to WS206, WS208 to WS212, WS214, WS217 to WS221, WS223, WS224 and WS218A) were undertaken at the site to depths varying between 0.30m (WS221) and 5.45m (WS214) below ground level. The work was carried out between 30th November and 16th December 2015.

The Dynamic Samples were taken using the super-heavy Dynamic Probe apparatus which drives lined steel tubes into the ground in 1m lengths. Samples are retrieved in the plastic liners. The hole is not cased and progress depends on the nature of the strata penetrated.

Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata.

Groundwater observations are included on the Borehole Records where appropriate.

On completion, standpipes were installed in each of the boreholes except WS218, WS219, WS221 and WS224 (see Section 5.8). The other boreholes were backfilled with arisings/bentonite.

5.7 Concrete Cores

Ten (10 No.) concrete cores (numbered CC1 to CC6, CC8 to CC10 and CC5A) were carried out using a hand held coring apparatus to depths varying between 0.14m (CC1) and 0.71m (CC10) behind the face of wall. The cores were drilled horizontally. The cores were extracted from the core-barrel, photographed and logged.

The Concrete Core Records are presented in Appendix 8. Photographs of the concrete cores are presented in Appendix 9.

5.8 Instrumentation and Monitoring

Long-term monitoring of the gas and groundwater levels was made possible by the installation of standpipes as follows:

Exploratory Hole	Standpipe Slotted Pipe & Filter Zone (m)
BH101	5.00 to 7.00
BH102	8.00 to 10.00
BH103	11.00 to 14.00
BH104	1.00 to 3.50
BH105	9.50 to 12.00
BH106	5.00 to 7.00
BH108	18.00 to 21.00
BH109	18.00 to 20.00
BH112	12.80 to 14.80
WS201	3.50 to 4.00
WS203	2.00 to 3.00
WS204	1.50 to 2.45
WS205	1.50 to 2.00
WS206	1.00 to 2.00
WS208	1.70 to 2.80
WS209	1.00 to 3.00
WS210	3.00 to 5.00
WS211	1.00 to 2.00
WS212	2.50 to 3.50
WS214	0.50 to 1.00
WS217	1.50 to 2.50
WS218A	1.00 to 2.50
WS220	1.20 to 1.70
WS223	0.50 to 1.40

Monitoring of the gas and groundwater levels at the site commenced on 11th January 2016 with further visits on 25th January, 9th February, 22nd February and 8th March 2016. A sixth (final) monitoring visit is proposed for late March. The results of that monitoring will be issued as an Addendum.

On each of the water monitoring visits a record of the groundwater level in all the standpipes was obtained. On the 25th January visit where water was recorded, samples were obtained following purging of water in the standpipes.

In addition to the groundwater levels, the following parameters were measured and recorded in each standpipe using a Gas Data LMSxi Gas Analyser:-

- Concentrations (% Vol) of CH_4, O_2, CO_2, along with (% LEL) CH_4 and (ppm) H_2S, CO
- Flow Rate
- Barometric Pressure

The results of the monitoring are presented in Appendix 10.

6.0 LABORATORY TESTING

6.1 Geotechnical

The laboratory testing schedule was specified by the Engineer. Unless otherwise stated, the tests were carried out in Geotechnics Limited's UKAS accredited Laboratory (Testing No. 1365) and were undertaken in accordance with the appropriate Standards as indicated below and on the Laboratory Summary Sheets in Appendix 11. Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

BS EN ISO 17892-1:2014

	12 No.	Water Content Determination

BS 1377:1990

Test No.		Test Description
Part 2		
4.3 & 5.3	11 No.	Liquid and Plastic Limit Determination
9.2 & 9.3	11 No.	Mechanical Analysis – Wet Sieving
9.4	1 No.	Mechanical Analysis - Sedimentation
Part 4		
3.3	1 No.	Dry Density/Moisture Content relationship determination. Compaction Test - British Standard (2.5 kg Hammer)

ISRM Testing Methods

24 No. Point Load Determination

The following testing was carried out at the laboratories of Jones Environmental Laboratory Limited (UKAS Accredited Laboratory, No. 4225).

36 No. Organic Content Determination

BRE Special Digest 1 Suite

35 No. Suites comprising:-
Soluble Sulphate
Acid Soluble Sulphate
pH

The following testing was carried out at the laboratories of Celtest Limited (UKAS Accredited Laboratory, No. 0494).

ISRM Testing Methods

2 No. Point Load Determination

9 No. Unconfined Compressive Strength Determination

The results of these tests are also presented in Appendix 11.

6.2 Contamination

Selected samples of soil and groundwater were tested at the laboratories of Jones Environmental Laboratory Limited (UKAS Accredited Laboratory, No. 4225) for a number of determinands in order to check on potential site contamination. The determinands were specified by the Engineer. The specified determinands are detailed on the results sheets in Appendix 12 together with the test result as well as the test method, accreditation and detection limit.

Signed for and on behalf of Geotechnics Limited.

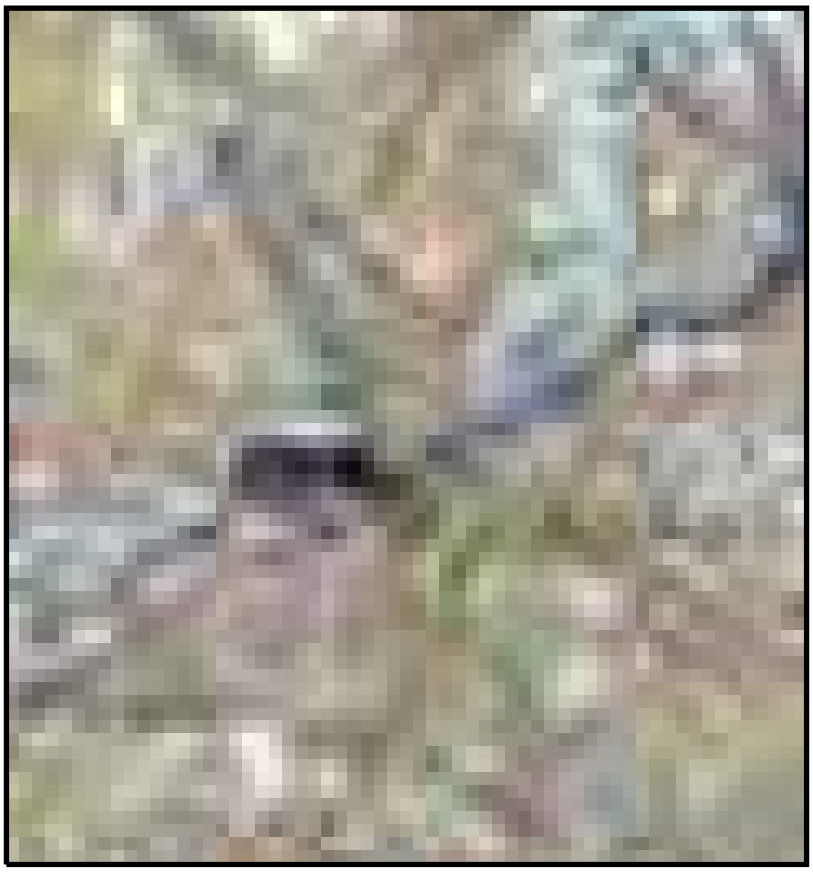
Prepared by: .....
Colin Dodd, BSc (Hons), MSc, CEng, MICE
Principal Engineer

Reviewed by:
John Knowles, BSc (Hons), PGCE, MSc, CGeol, FGS
Principal Engineer

APPENDIX I

Site Location Plan

SITE LOCATION PLAN



STOCKPORT BUS STATION
for
Transport for Greater Manchester

GEOTECHNICS

APPENDIX 2

Borehole Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

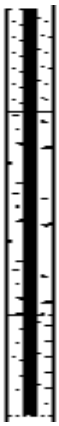
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



Seal

Filter

Seal

Strata

Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

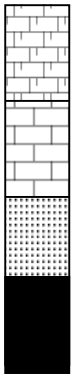
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



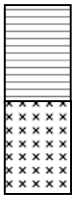
Chalk

Limestone

Sandstone

Coal

Strata, Continued



Mudstone

Siltstone

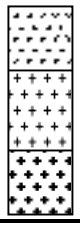
Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH101** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389243.3 E** **390165.1 N** | Ground Level **45.22** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		45.22
0.00	C					MADE GROUND: Grey concrete paving slab.	0.10		45.12
0.20- 0.40	D								
0.20- 0.40	ES					MADE GROUND: Grey concrete.	0.40		44.82
0.50- 0.70	D								
0.50- 0.70	ES					MADE GROUND: Reddish brown sandy angular to subangular fine to coarse gravel of limestone. Low angular to subangular cobble content of limestone. (Sub base).	0.70		44.52
1.00- 1.20	D						1.00		44.22
1.00- 1.20	ES								
1.20- 1.65	B					MADE GROUND: Light grey sandy angular to subangular fine to coarse gravel of limestone. Low angular to subangular cobble content of limestone. (Sub base).			
1.20- 1.65	D	(1.00)			S6		1.60		43.62
2.00- 2.20	D					Loose yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL including limestone, granite and quartzite. High rounded to subrounded cobble content. Below 1.20m, grading to very gravelly sand.			
2.00- 2.20	ES								
2.20- 2.65	B								
2.20- 2.65	D	2.20 (1.50)		23	S5	Firm thinly laminated grey sandy CLAY, locally grading to silt. At 2.20m, soft.			
3.00- 3.12	B						3.00		42.22
3.00- 3.12	D	3.00 (DRY)			S50/50	Weak dark red fine to medium grained SANDSTONE (recovered as gravelly sand).			
4.00- 4.06	#	4.00 (3.60)			C50/25		4.06		41.16

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
4.06- 4.80		0 0		0		Extremely weak to weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are very closely spaced subhorizontal undulating smooth and clean.	
4.80- 6.30		30 9	0.07 0.01	0	(AZCL)		
4.80- 4.84	4.00				C50/25		
					(NI)		
					(33)		
6.30- 7.80		66 44	0.13 0.01	9	(NI)		
6.40- 6.55		C			(44)		Below 6.80m, discontinuities are very closely to closely spaced.
6.30- 6.34	4.00				C50/20		
					(AZCL)		
					(25)		
					(NI)		
7.80- 9.30		84 69	0.26 0.03	48	(AZCL)		Below 8.03m, discontinuities are planar to undulating.
7.80- 7.94		C			(15)		
					(NI)		At 8.70m, subvertical discontinuity.
					(15)		
					(NI)		
					(13)		
9.30-10.80		52 45	0.20 0.05	41	(NI)		
					(66)		
					(AZCL)		

Boring

Depth	Dia	Technique	Crew
1.20	0.50	Inspection Pit	JP
4.06	0.15	Cable Percussion	JP
15.30	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			30/11/15	08:00
4.05	4.00	3.60	30/11/15	18:00
4.05	4.00		01/12/15	08:00
12.36	4.00	Added	01/12/15	18:00
12.36	4.00	Added	02/12/15	08:00
15.30	4.00	Added	02/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20					No rise.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 7.00m with a geowrapped slotted section from 5.00m to 7.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 7.00m, gravel filter up to 5.00m, bentonite seal up to 0.30m, concrete up to ground level.
Flush: 4.06-15.30m, Water, 70% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **SG**

Figure **1 of 2**

11/03/2016

geotechnics

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH101** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389243.3** E **390165.1** N | Ground Level **45.22** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(NI)		Between 10.08m and 10.80m, some sand infill on discontinuities.			
					(11)					
10.80-12.30		0		0						
		0								
10.80-10.85	4.00				C50/25					
					(AZCL)					
12.30-13.80		66	0.15	16						
		40	0.01							
12.30-12.36	4.00				C50/35					
					(NI)					
					(15)					
					(NI)					
13.80-15.30		66	0.17	24	(AZCL)					
		54	0.03				Below 14.30m, discontinuities are closely spaced.			
					(13)					
					(NI)		Between 14.83m and 15.30m, discontinuities are very closely spaced.			
					(20)					
					(23)					
						End of Borehole		15.30		29.92

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **SG**

Figure **2 of 2**

11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH102** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389276.7 E** **390240.0 N** | Ground Level **43.35** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (Fl)	Description	Depth	Legend	Level m OD
							G.L.		43.35
0.10- 0.15	B					MADE GROUND: Grey concrete paving slabs.	0.10		43.25
							0.15		43.20
0.50	ES					MADE GROUND: Brown gravelly fine to medium sand. Gravel is subrounded to rounded fine to medium of sandstone, limestone and quartzite.	0.50		42.85
0.60- 0.80	B								
1.00	ES					MADE GROUND: Grey reinforced concrete.			
1.20- 1.70	B					MADE GROUND: Brown sandy angular to subangular fine to coarse gravel of limestone. Low angular cobble content.	1.20		42.15
1.20- 1.65	D	(DRY)			S4				
1.80	D					MADE GROUND: Very loose/loose black sandy angular to subangular fine to coarse gravel of brick, concrete, ash and clinker. High angular cobble content.			
2.00- 2.38	D	2.00 (DRY)			S50/ 225		2.00		41.35
2.00	ES					Very dense yellowish brown sandy rounded to subrounded fine to coarse GRAVEL of limestone, sandstone, quartzite and granite. High rounded to subrounded cobble content.			
2.80	D								
2.80- 3.03	D	2.80			S50/75				
3.00- 3.50	B	(DRY)							
3.00- 3.15	D	3.00 (DRY)			S50/75				
3.80	D								
4.00- 4.50	B						4.00		39.35
4.00- 4.23	D	4.00 (DRY)			S50/75	Weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
5.00- 5.15	D	4.50 (DRY)			S50/75		5.15		38.20

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (Fl)	Continued by Rotary techniques General	Detail
5.00- 5.54	5.00	96	0.22	22	(AZCL) (NI)	Extremely weak to weak reddish brown fine to medium grained SANDSTONE. Discontinuities are very closely to closely spaced subhorizontal undulating smooth and clean.	At 5.29m, subvertical undulating smooth clean discontinuity. At 5.47m, dark brown sand infill on discontinuities. Between 5.65m and 6.34m, discontinuities become closely to medium spaced and planar. Between 6.34m and 6.38m, discontinuities become extremely to very closely spaced. Between 6.38m and 6.95m, discontinuities become closely to medium spaced. Below 6.95m, discontinuities are very closely to closely spaced. Between 8.18m and 8.38m, discontinuities are medium spaced.
		68	0.01				
5.17- 5.26		C			(22)		
5.54- 7.04	5.00	93	0.43	73	(AZCL)		
		93	0.03		(7)		
					(50)		
					(7)		
7.04- 8.54		58	0.21	13	(44)		
		29	0.01		(AZCL)		
					(NI)		
					(50)		
					(NI)		
8.54- 9.54		0		0	(10)		
		0			(19)		
					(AZCL)		
8.54- 8.60	4.00 (ADDED)				S50/34		
9.54-10.20		9		0			
		9					

Boring

Depth	Dia	Technique	Crew
1.20	0.50	Inspection Pit	HR
5.15	0.15	Cable Percussion	HR
14.70	0.09	Rotary Core	SL

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			30/11/15	08:00
3.03	2.80	DRY	30/11/15	18:00
3.03	2.80	DRY	01/12/15	08:00
7.04	5.00	ADD	01/12/15	18:00
7.04	5.00	ADD	02/12/15	08:00
14.70	5.00	ADD	02/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
Water was added to assist boring between 2.00m and 5.50m.
A 50mm standpipe was installed to 10.00m with a geowrapped slotted section from 8.00m to 10.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 10.00m, fine gravel filter up to 8.00m, bentonite seal up to 0.10m, concrete up to ground level.
Chiselling: 1.80-2.00m for 60 minutes and 2.50-3.00m for 60 minutes.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **1 of 2**

11/03/2016

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BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH102** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389276.7** E **390240.0** N | Ground Level **43.35** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(33)					
10.20-11.70		66 47	0.10 0.04	6	(AZCL) S50/46					
10.20-10.34	4.00 (ADDED)				(NI)					
					(40)					
					(NI)					
11.60-11.70		C			(40)					
11.70-12.70		100 62	0.21 0.01	43	(20)					
					(NI)					
					(14)		Between 12.40m and 12.70m, discontinuities become closely to medium spaced.			
					(NI)					
12.70-13.20		12 12	0.10 0.01	6	(50)		Below 13.02m, discontinuities become closely spaced.			
					(NI)					
13.20-14.70		66 66	0.20 0.03	31	(17)					
					(NI)					
					(10)					
					(AZCL)		Between 14.23m and 14.47m, discontinuities are medium spaced.			
					(11)					
					(AZCL)			14.70		28.65
					(13)	End of Borehole				
					(4)					
					(13)					

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **2 of 2**

11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH103** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389205.7** E **390216.4** N | Ground Level **42.42** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.42
						MADE GROUND: Grey concrete paving slabs.	0.10		42.32
0.35- 0.55	D					MADE GROUND: Grey concrete.	0.35		42.07
0.35- 0.55	ES					MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content. (Sub base).			
1.00- 1.20	D						1.00		41.42
1.00- 1.20	ES					Loose greyish brown silty slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to medium including sandstone, quartzite and limestone.			
1.20- 1.65	B								
1.20- 1.65	D	1.20 (DRY)			S5				
2.00- 2.20	D								
2.00- 2.20	ES								
2.20- 2.65	B								
2.20- 2.65	D	2.20 (DRY)			S33		2.40		40.02
						Dense yellowish brown sandy subrounded to rounded fine to coarse GRAVEL of limestone, granite, quartzite and sandstone. High rounded to subrounded cobble content.			
3.20- 3.27	B						3.20		39.22
3.20- 3.35	D	3.20 (DRY)			S50/70	Weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
4.20- 4.24	D	4.20 (DRY)			S50/0				

Core Run / Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
								4.80		37.62
4.80- 5.70		100	0.14	39	(NI)	Extremely weak to weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are very closely spaced subhorizontal rough and clean.				
	(ADD)	89	0.00		(12)					
5.70- 7.20		90	0.15	40	(NI)		Between 5.90-6.20m, discontinuities are subvertical and rough.			
	(ADD)	90	0.00		(AZCL)					
					(15)					
6.70- 6.86		C								
7.20- 8.70		100	0.18	87	(11)					
	(ADD)	90	0.00							
					(NI)					
					(11)					
					(NI)					
					(15)					
8.70-10.20		87	0.20	40						
	(ADD)	87	0.00		(NI)					
					(15)					
					(12)					
					(14)					

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
4.80	0.15	Cable Percussion	JP
14.70	0.09	Rotary Core	SL

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			08/12/15	08:00
3.27	3.20	DRY	08/12/15	18:00
3.27	3.20	DRY	09/12/15	08:00
4.80	4.20	DRY	09/12/15	18:00
4.80	4.20	DRY	10/12/15	08:00
14.70	4.20	ADD	10/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
Water was added to assist boring between 1.20m and 3.20m.
A 50mm standpipe was installed to 14.70m with a geowrapped slotted section from 11.00m to 14.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 14.00m, gravel filter up to 11.00m, bentonite seal up to 0.50m, sub base up to 0.30m, tarmacadam up to ground level.
Chiselling: 4.00-4.20m for 60 minutes.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **DSA**

Figure **1 of 2**

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geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH103** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389205.7** E **390216.4** N | Ground Level **42.42** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(AZCL)					
10.20-11.70	(ADD)	67 57	0.10 0.00	7	(18)					
					(AZCL)					
11.70-13.20	(ADD)	40 33	0.10 0.00	13	(17)					
					(AZCL)		Between 13.20-14.70m, discontinuities become closely spaced.			
13.20-14.70 13.20-13.39 13.20-13.25	(ADD) 4.20 (DRY)	87 87 C	0.35 0.00	67	(13) S50/26 (8)					
						End of Borehole		14.70		27.72

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **DSA**

Figure **2 of 2**
11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH104** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389178.1** E **390228.9** N | Ground Level **42.47** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.47
						MADE GROUND: Grey reinforced concrete.			
							0.40		42.07
0.40- 0.60	D					MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content. (Sub base).			
0.40- 0.60	ES						0.70		41.77
1.00- 1.20	D					Medium dense yellowish brown sandy subrounded to rounded fine to coarse GRAVEL of limestone, granite, quartzite and sandstone. High rounded to subrounded cobble content.			
1.00- 1.20	ES								
1.20- 1.65	B								
1.20- 1.65	D	1.20 (DRY)			S15				
2.00- 2.20	D								
2.00- 2.20	ES					At 2.20m, dense.			
2.20- 2.65	B								
2.20- 2.65		2.20 (DRY)			C38				
						At 3.20m, very dense.			
3.20- 3.30	B								
3.20- 3.37		3.20 (DRY)			C50/50				
3.70- 3.95	B						3.70		38.77
3.70- 3.77		3.70 (DRY)			C50/40	Weak dark red fine to medium grained SANDSTONE (recovered as sand).			
4.70- 4.74		4.70 (DRY)			C50/10				

Core Run / Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
5.00- 6.50		100 60	0.20 0.00	40	(NI)			5.65		36.82
6.00- 6.10		C			(10)	Weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are very closely spaced subhorizontal and clean.	Between 6.00m and 6.10m, extremely weak. Subvertical discontinuities, rough and clean.			
6.50- 8.00		60 43	0.15 0.00	23	(AZCL)					
					(NI)					
					(15)					
8.00- 8.85		100 100	0.10 0.00	40	(12)					
8.50- 8.65		C					Between 8.50m and 8.65m, extremely weak to very weak.			
8.85- 9.10		71 71	0.15 0.00	35	(AZCL)	Weak greyish brown fine to coarse grained SANDSTONE. Discontinuities are very closely spaced subhorizontal rough and clean.		8.85 9.10		33.62 33.37
9.10- 9.80		43 43	0.05 0.00	0	(18)					
9.80-11.00		38 38	0.09 0.00	0		Extremely weak to weak		9.80		32.67

Boring

Depth	Dia	Technique	Crew
1.20	0.50	Inspection Pit	JP
4.74	0.15	Cable Percussion	JP
15.07	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			01/12/15	08:00
2.00	2.00	DRY	01/12/15	18:00
2.00			02/12/15	08:00
4.74	4.70	DRY	02/12/15	18:00
4.74	4.70	DRY	03/12/15	08:00
15.07	4.70	ADD	03/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jars.
A 50mm standpipe was installed to 3.50m with a geowrapped slotted section from 1.00m to 3.50m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 3.50m, gravel filter up to 1.00m, bentonite seal up to 0.30m, concrete up to ground level.
Chiselling: 3.70-3.95m for 60 minutes.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **1 of 2**

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geotechnics

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH104** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389178.1** E **390228.9** N | Ground Level **42.47** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
9.80- 9.94	4.70 (ADDED)				(AZCL) C50/40	reddish brown MUDSTONE. Discontinuities are very closely spaced subhorizontal and clean.				
					(19)					
11.00-12.20		58	0.13	11		Extremely weak to weak reddish brown fine to coarse grained SANDSTONE. Occasional subrounded clasts (up to 30mm) of quartzite. Discontinuities are very closely spaced subhorizontal rough and clean.				
		58	0.00							
11.00-11.07	4.70 (ADDED)				(17) C50/30					
12.10-12.20		C								
12.20-13.50		23	0.00	0						
		23	0.00							
12.20-12.27	4.70 (ADDED)				(AZCL) C50/35					
					(25)					
13.50-15.00		33	0.09	0						
		33	0.00							
13.50-13.58	4.70 (ADDED)				(AZCL) C50/40					
					(18)					
								15.00		27.47
15.00-15.07	4.70 (ADDED)				C50/35	End of Borehole				

Drilling

Depth	Hole Dia	Technique	Crew

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **2 of 2**

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geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH105** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389234.8** E **390221.6** N | Ground Level **42.62** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
						MADE GROUND: Grey reinforced concrete.	G.L.		42.62
							0.40		42.22
0.50	ES					**MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content. (Sub base).**			
0.70- 0.80	B								
1.00	ES								
1.10	D								
1.20- 1.65	D						1.20		41.42
1.20- 1.65					S8	**Loose yellowish brown very sandy subrounded to rounded fine to coarse GRAVEL of limestone, granite, quartzite and basalt.**			
1.80	D								
2.00- 2.50	B					**At 2.00m, dense.**			
2.00- 2.45	D	1.50			S37				
2.00	ES	(DRY)							
2.80	D								
3.00- 3.50	B						3.00		39.62
3.00- 3.15	D	3.00 (DRY)			S50/75	**Extremely weak dark red fine to medium grained SANDSTONE (recovered as silty sand).**			
3.80	D								
4.00- 4.15	D	4.00 (DRY)			S50/75				
							4.50		38.12

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
4.50- 5.50		30 20	0.08 0.00	0	(AZCL) (16)	**Extremely weak to weak reddish fine to coarse grained SANDSTONE. Discontinuities are very closely spaced subhorizontal rough and clean.**	
5.50- 7.00		67 60	0.10 0.00	13	(AZCL)		
5.50- 5.57	4.00 (ADDED)				C50/30 (15)		
7.00- 8.30		77 70	0.20 0.00	23	(AZCL)		
7.10- 7.29		C			(12) (NI) (12)		**Between 7.80-7.90m occasional subrounded clasts (up to 20mm) of basalt and feldspar.**
8.30- 8.50		100 100	0.08 0.00	0	(20)		
8.50-10.00		68 23	0.13 0.00	9	(AZCL) (30) (NI)		

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	HR
4.50	0.15	Cable Percussion	HR
15.20	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			08/12/15	08:00
1.20		DRY	08/12/15	18:00
1.20		DRY	09/12/15	08:00
4.50	4.00	DRY	09/12/15	18:00
4.50	4.00	ADDED	14/12/15	08:00
15.20	4.00	ADDED	14/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
Water was added to assist boring between 3.00m and 4.50m.
A 50mm standpipe was installed to 12.00m with a geowrapped slotted section from 9.50m to 12.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 12.00m, gravel filter up to 9.50m, bentonite seal up to 0.50m, sub base up to 0.30m, tarmacadam up to ground level.
Chiselling: 1.50-2.00m for 30 minutes and 2.00-2.50m for 30 minutes.
Flush: 4.50-8.50m, Water, 75% returns and 8.50-10.00m, Water, 0% returns and 10.00-15.20m,

Logged in accordance with BS5930:1999 + A2:2010

Logged by **DS**

Figure **1 of 2**

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geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION**

Engineer **AECOM**

Borehole **BH105**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

National Grid Coordinates **389234.8** E **390221.6** N

Ground Level **42.62** m OD

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
10.00-11.50		**23**	**0.10**	**6**	**(15)**					
		23	**0.00**							
					(AZCL)					
10.00-10.07	**4.00**				**C50/35**					
	(ADDED)									
					(20)					
11.50-13.00		**67**	**0.20**	**27**						
		53	**0.00**		**(AZCL)**					
11.50-11.56	**4.00**				**C50/35**					
	(ADDED)				**(NI)**					
					(12)					
13.00-14.35		**74**	**0.36**	**56**	**(AZCL)**					
		74	**0.00**							
13.00-13.34		**C**								
					(25)					
14.35-14.50		**100**	**0.15**	**100**						
		100	**0.00**		**(10)**					
14.50-15.20		**100**	**0.20**	**71**						
		86	**0.00**		**(NI)**					
					(20)	**End of Borehole**		**15.20**		**27.42**

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks **Water, 60% returns.**

Logged by **DS**

Figure **2 of 2**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH106** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389248.7 E** **390249.7 N** | Ground Level **42.45** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.45
						MADE GROUND: Grey concrete paving slabs.	0.10		42.35
						MADE GROUND: Grey concrete.	0.40		42.05
0.40- 0.60	D								
0.40- 0.60	ES					MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content. (Sub base).			
1.10- 1.20	D						1.10		41.35
1.10- 1.20	ES					Medium dense to dense yellowish brown sandy subrounded to rounded fine to coarse GRAVEL of limestone, granite, quartzite and sandstone. High rounded to subrounded cobble content.			
1.20- 1.70	B			5.0					
1.20- 1.65	B								
1.20- 1.65	D	1.20 (DRY)			S29				
2.00- 2.20	ES								
2.00- 2.20	ES								
2.20- 2.65	B								
2.20- 2.65	D	2.20 (DRY)			S40				
2.70- 2.82	B						2.70		39.75
2.70- 2.97	D	2.70 (DRY)			S50/ 120	Extremely weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
3.40- 3.51	#	3.40 (DRY)			C50/30		3.40		39.05

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
3.40- 4.90		77	0.17	19	(AZCL)	Extremely weak to weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are closely spaced, subhorizontal, rough and clean.	
		77	0.01		(17)		
3.70- 3.80		C			(10)		
4.90- 6.40		77	0.10	13	(AZCL)		
		77	0.01		(16)		
					(15)		
6.40- 6.90		90	0.10	20	(AZCL)		
		90	0.01		(12)		
6.90- 7.90		90	0.15	27	(AZCL)		
		85	0.01		(12)		
7.90- 9.40		47	0.12	8			
		40	0.01		(AZCL)		
					(15)		
9.40-10.90		47	0.13	25			
		47	0.01		(AZCL)		
9.40- 9.48	3.40 (ADDED)				C50/35		

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
3.51	0.15	Cable Percussion	JP
15.00	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			14/12/15	08:00
3.51	3.40	DRY	14/12/15	18:00
3.51	3.40	DRY	15/12/15	08:00
15.00	3.40	ADD	15/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
Water was added to assist boring from 2.70m.
A 50mm standpipe was installed to 7.00m with a geowrapped slotted section from 5.00m to 7.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 7.00m, gravel filter up to 5.00m, bentonite seal up to 0.50m, sub base up to 0.30m, tarmacadam up to ground level.
Chiselling: 2.70-3.40m for 60 minutes.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **1 of 2**

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geotechnics

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH106** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389248.7** E **390249.7** N | Ground Level **42.45** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(12)					
10.80-10.90		C			(20)					
10.90-12.40		17	0.80	0						
		17	0.01							
10.90-10.98	3.40 (ADDED)				C50/45					
					(AZCL)					
12.40-13.90		47	0.30	20			Between 12.40 and 13.90m, discontinuities are medium spaced.			
		40	0.01							
12.40-12.48	3.40 (ADDED)				C50/30		Between 13.10 and 13.30m, with subangular to subrounded clasts (up to 50mm) of quartzite.			
					(10)					
					(NI)					
					(5)					
13.90-15.00		73	0.15	36	(AZCL)					
		55	0.01							
13.90-13.97	3.40 (ADDED)				C50/30					
					(10)			15.00		27.45
						End of Borehole				

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks AGS **Flush: 3.40-15.00m, Water, 75% returns.**

Logged by **GT**

Figure **2 of 2** 11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH107** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389205.8** E **390252.4** N | Ground Level **42.27** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.27
						MADE GROUND: Grey reinforced concrete.			
0.35- 0.55	D						0.35		41.92
0.35- 0.55	ES					MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content. (Sub base).			
							0.90		41.37
0.90- 1.10	D					Very dense yellowish brown silty very sandy subrounded to rounded fine to coarse GRAVEL of limestone, granite, quartzite and sandstone. High rounded to subrounded cobble content.			
0.90- 1.10	ES								
1.20- 1.31	B								
1.20- 1.46	D	(DRY)			S50/ 110				
1.31- 1.47	B								
1.31- 1.64	D	1.30 (DRY)			S50/ 180				
2.00- 2.20	D								
2.00- 2.20	ES								
2.20- 2.42	B								
2.20- 2.57	D	2.20 (DRY)			S48/ 220				
3.00- 3.07	B						3.00		39.27
3.00- 3.10	D	3.00 (DRY)			S50/75	Extremely weak to very weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
4.00- 4.08	#	4.00 (DRY)			S50/30				
							4.08		38.19

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
4.00- 5.00	4.00	50 10	0.05 0.01	0	(NR) (NI)	Extremely weak reddish brown fine to medium grained SANDSTONE (recovered as gravel).	
5.00- 6.50	4.00	26 6	0.05 0.01	0	(NR) (NI)		
6.50- 8.00	6.50	0 0	- -	0	(NR)		

		7.50	34.77
MADE GROUND: Strong orangish red brick with well bonded mortar (10mm thick).		7.80	34.47
VOID (Sewer).			
		9.10	33.17
End of Borehole			

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
4.08	0.15	Cable Percussion	JP
7.80	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			07/12/15	08:00
2.42	2.20	DRY	07/12/15	18:00
2.42	2.20	DRY	08/12/15	08:00
7.80	6.50	ADD	08/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
Water was added to assist boring from 1.20m.
During rotary drilling the flush returns were lost at 4.40m with the core barrel flushing in between 5.00m and 6.00m with no rotation. The casing was subsequently advanced to 6.50m.
At 7.50m a brick sewer was encountered and proved using CCTV. Following confirmation the asset holder requested that the casing be left in to provide an access point and re-instated at surface with a heavy duty flush cover.

Logged in accordance with BS5930:1999 + A2:2010

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION**

Engineer **AECOM**

Borehole **BH107**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

National Grid Coordinates **389205.8** E **390252.4** N

Ground Level **42.27** m OD

Scale 1:50

Drilling		Properties/Sampling				Strata				
Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks **Chiselling: 3.00-4.00m for 60 minutes.**

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **2 of 2**
11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH108** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389157.8** E **390268.0** N | Ground Level **42.72** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.72
0.10- 0.20	B					MADE GROUND: Black tarmacadam.	0.05		42.67
0.20	ES						0.20		42.52
0.30- 0.40	B					MADE GROUND: Yellowish brown sandy angular fine to coarse gravel of limestone. Medium angular cobble content of limestone. (Sub base).			
0.50	ES								
0.80	D					MADE GROUND: Loose reddish grey mottled black sandy angular to subangular fine to coarse gravel of brick and concrete. Medium angular cobble content of brick and some pockets of clay.			
1.00	ES								
1.20- 1.65	D	1.20 (DRY)			S6				
1.80	D								
2.00- 2.50	B			22					
2.00- 2.45	D	1.50 (DRY)			S5				
2.00	ES								
2.70	D								
3.00- 3.50	B								
3.00- 3.45	D	3.00 (DRY)		16	S9				
3.00- 3.45	D								
3.00	ES								
3.00- 3.45	UF45	3.00 (DRY)							
3.80	D								
4.00- 4.50	B					At 4.00m, dense.			
4.00- 4.45	D	4.00 (DRY)			S44				
4.00	ES								
5.00- 5.50	B						5.00		37.72
5.00	D					Weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
5.00- 5.15	D	5.00 (DRY)			S50/75				
5.00	ES								
5.80	D								
6.00- 6.15	D	5.00 (DRY)			S50/75				
							6.15		36.57

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail		
6.50- 7.30 (80mm)	6.00 (ADD)	0.85 0.30	0.10 -	0.10	(>25) (NI) (>25)	Very weak thinly laminated brown micaceous MUDSTONE. Discontinuities are very closely spaced planar smooth with some clay infill.		6.82	35.90
7.30- 8.80 (80mm)	6.00 (ADD)	0.45 0.21	0.90 -	-	(14) (16) (AZCL) (NI) (>25)	Very weak to medium strong reddish brown medium grained micaceous SANDSTONE with rare rounded clasts (up to 60mm) of quartzite. Discontinuities are very closely to medium spaced horizontal to subvertical planar and undulating smooth.	Between 8.80m and 10.30m, discontinuities are occasionally stepped.		
8.80-10.30 (80mm)	6.00 (ADD)	1.10 0.72	0.11 -	0.21	(NI) (>25) (1)				
8.80- 8.93	6.70 (ADDED)				S50/32 (AZCL) (18)				

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
6.15	0.15	Cable Percussion	JP
22.30	0.09	Rotary Core	SL

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			02/12/15	08:00
1.20		DRY	02/12/15	18:00
1.20		DRY	03/12/15	08:00
6.15	4.50	DRY	03/12/15	18:00
6.15	6.00	DRY	08/12/15	08:00
7.30	6.70	ADD	04/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
Water was added to assist boring from 5.00m.
During rotary coring there was no flush returns between 6.50m and 7.30m The casing was subsequently advanced to 6.70m.
A 50mm standpipe was installed to 21.00m with a geowrapped slotted section from 18.00m to 21.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 21.00m, gravel filter up to 18.00m, bentonite seal up to 0.50m, sub base up to

Logged in accordance with BS5930:1999 + A2:2010

Logged by **JL**

Figure **1 of 3**

11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH108** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389157.8** E **390268.0** N | Ground Level **42.72** m OD

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(NI)					
10.30-11.80 (80mm)	6.00 (ADD)	1.35 1.12	0.57 -	0.83	(12) (AZCL) (-) (13) (3)		Between 10.30m and 11.80m, discontinuities occasionally have black staining (1mm penetration).			
11.80-13.30 (80mm) 11.80-14.80	6.00 (ADD)	1.20 0.91 C	0.33 -	0.68	(AZCL) (13) (NI) (17)		Between 11.80m and 13.30m, discontinuities infilled with clay in places.			
13.30-14.80 (80mm) 14.35-14.61	6.00 (ADD)	1.40 0.92 C	0.26 -	0.60	(AZCL) (11) (NI) (15)					
14.80-16.30 (80mm) 15.30-15.38	6.00 (ADD)	1.50 1.05 C	0.27 -	0.87	(6) (10) (NI)					
16.30-17.80 (80mm) 17.30-17.58	6.00 (ADD)	1.25 1.04 C	0.33 0.04	0.93	(4) (AZCL) (10) (4)		Between 16.55 and 16.65, sandstone is fine grained. Below 16.90m, becoming occasionally gravelly.			
17.80-19.30 (80mm)	6.00 (ADD)	0.45 0.13	0.13 -	0.13	(AZCL) (NI) (8)		Between 17.80m and 20.80m, discontinuities infilled with clay in places.			
19.30-20.80 (80mm) 19.30-19.37	6.00 (ADD) 6.70 (ADDED)	0.80 0.48	0.12 -	0.33	(AZCL) S50/39					

Drilling

Depth	Hole Dia	Technique	Crew

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
7.30	6.70	ADD	09/12/15	08:00
22.30	6.70	ADD	09/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks **0.30m, tarmacadam up to ground level.**
Chiselling: 4.50-5.00m for 60 minutes and 5.00-6.00m for 60 minutes.

Logged by **JL**

Figure **2 of 3**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH108** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389157.8** E **390268.0** N | Ground Level **42.72** m OD

Drilling | Properties/Sampling | Strata | Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(NI)		Between 20.15m and 20.20m, thin band of weak thinly laminated dark brown mudstone.			
					(8)					
20.80-22.30 (80mm)	6.00 (ADD)	0.80 0.45	0.19 -	0.29	(AZCL)					
					(NI)					
					(6)					
					(4)					
22.30-22.35	6.70 (ADDED)				S50/29	End of Borehole		22.30		20.42

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **JL**

Figure **3 of 3** 11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH109** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389136.4** E **390317.0** N | Ground Level **42.36** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.36
						MADE GROUND: Black tarmacadam.			
0.30- 0.50	D						0.30		42.06
0.30- 0.50	ES					MADE GROUND: Loose blackish brown sandy angular to subangular fine to coarse gravel of brick, concrete and ash. High angular cobble and boulder content of brick.			
1.00- 1.20	D								
1.00- 1.20	ES								
1.20- 1.65	B								
1.20- 1.65	D	(DRY)			S7				
2.00- 2.20	D								
2.00- 2.20	ES								
2.20- 2.65	B						2.20		40.16
2.20- 2.65	D	2.20 (DRY)			S34	Dense yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL of limestone, quartzite, granite and basalt.			
3.00- 3.20	D								
3.00- 3.20	ES					At 3.20m, very dense.			
3.20- 3.42	B								
3.20- 3.58	D	3.20 (DRY)			S50/ 225				
4.20- 4.27	B						4.20		38.16
4.20- 4.36	D	4.20 (DRY)			S50/70	Weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
5.20- 5.32	#	5.20 (DRY)			S50/40				

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
5.20- 6.20 (92mm)		0 0		0						
6.20- 7.70 (92mm)		86 0		0						
6.20- 6.30	5.20 (ADDED)				C50/40			6.55		35.81
					(NI)	Extremely weak reddish brown fine to coarse grained SANDSTONE with closely spaced bands of mudstone. Discontinuities are predominately horizontal with slightly clayey sand infill.				
7.70- 9.20 (92mm)		22 20	0.10 0.01	6						
7.70- 7.81	5.20 (ADDED)				C50/50					
					(>30)	Extremely weak reddish brown fine to coarse grained SANDSTONE.	At 9.10m, slightly gravelly. Gravel is rounded medium to coarse of quartz.	8.95		33.41
9.20-10.70 (92mm)		83 76	0.20 0.01	62				9.25		33.11
9.20- 9.27	5.20 (ADDED)				C50/35					
9.40- 9.60		C			(7)	Extremely weak to very weak reddish brown fine to coarse grained				

Boring

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
5.20	0.15	Cable Percussion	JP
20.70	0.09	Rotary Core	PB

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			15/12/15	08:00
5.20	5.20	DRY	15/12/15	18:00
5.20	5.20	ADD	16/12/15	08:00
16.70	5.20	ADD	16/12/15	18:00
16.70	5.20	ADD	17/12/15	08:00
20.70	5.20	ADD	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A 50mm standpipe was installed to 20.00m with a geowrapped slotted section from 18.00m to 20.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 20.00m, gravel filter up to 18.00m, bentonite seal up to 0.50m, sub base up to 0.30m, tarmacadam up to ground level.
Chiselling: 2.00-2.20m for 60 minutes.
Flush: 5.20-20.70m, Water, 75% returns.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH109** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389136.4** E **390317.0** N | Ground Level **42.36** m OD

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						SANDSTONE. Discontinuities are very closely to closely spaced subhorizontal undulating rough with occasional sand infill (up to 150mm thick).				
10.70-12.20 (92mm)		**51 29**	**0.35 0.01**	**14**	**(8)**					
					(NI)	**Extremely weak reddish brown SANDSTONE (recovered as gravelly sand).**		**11.90**		**30.46**
12.20-13.70 (92mm) 12.30-12.62		**83 75 C**	**0.35 0.01**	**48**	**(8)**	**Extremely weak to very weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are very closely to medium spaced horizontal undulating rough with sand infill (up to 10mm thick).**		**12.20**		**30.16**
13.70-15.20 (92mm) 13.90-14.15		**70 65 C**	**0.20 0.01**	**47**	**(10)**					
15.20-16.70 (92mm)		**60 46**	**0.10 0.01**	**14**	**(14)**					
					(NI)	**Extremely weak reddish brown slightly gravelly fine to coarse grained SANDSTONE with silty bands (recovered as slightly gravelly fine to coarse sand).**		**16.50**		**25.86**
16.70-18.20 (92mm)		**60 14**	**0.07 0.01**	**0**						
					(26)	**Extremely weak reddish brown fine to coarse grained SANDSTONE. Discontinuities are extremely to very closely spaced horizontal undulating rough with sand infill (up to 10mm thick).**		**17.75**		**24.61**
18.20-19.70 (92mm)		**100 98**	**0.34 0.01**	**64**	**(8)**			**18.20**		**24.16**
19.40-19.60		**C**				**Extremely weak to very weak reddish brown fine to coarse grained SANDSTONE with widely spaced slightly gravelly bands (up to 50mm thick). Gravel is fine to medium of quartzite.**				
19.70-20.70 (92mm) 19.70-19.90		**98 92 C**	**0.15 0.01**	**22**						

Drilling

Depth	Hole Dia	Technique	Crew

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION**

Engineer **AECOM**

Borehole **BH109**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

National Grid Coordinates **389136.4** E **390317.0** N

Ground Level **42.36** m OD

Drilling | Properties/Sampling | Strata — Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(12)	**Discontinuations are closely to medium spaced locally very closely spaced subhorizontal undulating rough with sand infill (up to 10mm thick).**		**20.70**		**21.66**
						End of Borehole				

Drilling | Progress | Groundwater

Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **3 of 3**
11/03/2016

geotechnics

BOREHOLE RECORD – Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH111** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389253.5** E **390080.2** N | Ground Level **50.92** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		50.92
0.20- 0.40	D					MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of limestone. Medium angular cobble content.			
0.20- 0.40	ES						0.30		50.62
0.50- 0.70	D					MADE GROUND: Firm dark brown slightly sandy slightly gravelly clay. Gravel is angular to subangular fine to coarse of brick and concrete.			
0.50- 0.70	ES						0.85		50.07
0.85- 1.00	B								
0.85- 1.15	D	(DRY)			S50/ 150	Weak dark red fine to medium grained SANDSTONE (recovered as silty sand).			
1.50- 1.56		1.50 (DRY)			C50/30		1.55		49.37
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
0.85	0.50	Inspection Pit	JP
1.55	0.15	Cable Percussion	JP

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			03/12/15	08:00
1.55	1.50	DRY	03/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 0.85m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
Backfill details from base of hole: bentonite seal up to 0.30m, arisings up to ground level.
Chiselling: 1.50-1.55m for 60 minutes.

Logged by **GT**

Figure **1 of 1**

11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **BH112** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389295.7** E **390239.9** N | Ground Level **43.70** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		43.70
0.20	ES					**MADE GROUND: Grey concrete paving slabs.**	0.15		43.55
0.40- 0.50	B					**MADE GROUND: Light red sandy angular to subangular fine to coarse gravel of limestone. Medium angular to subangular cobble content. (Sub base)**			
0.50	ES								
0.80	D								
1.00	ES						1.00		42.70
1.20- 1.70	B					**MADE GROUND: Firm greyish brown slightly sandy slightly gravelly clay with a medium angular to subangular cobble content. Gravel is angular to subangular fine to coarse of brick and concrete.**			
1.20- 1.65	D	(DRY)			S4		1.60		42.10
1.80	D			109		**Soft dark brown and black very organic CLAY. Locally sandy silt, with organic remains.**			
2.00- 2.45	D	2.00 (DRY)			S49		2.00		41.70
						Dense to very dense yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL of quartzite and sandstone. High rounded cobble content.			
3.00- 3.50	B								
3.00- 3.23		4.00 (DRY)			S50/75				
3.80	D						3.90		39.80
4.00- 4.50	B					**Weak dark red fine to medium grained SANDSTONE (recovered as sand).**			
4.00- 4.15	D	3.00 (DRY)			S50/75				
5.00- 5.15	D	4.50 (DRY)			S50/75		5.15		38.55

Core Run Core Dia	Depth Cased	TCR/SCR %	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
5.50- 5.80	5.50	100	0.10	67	(22)	**Extremely weak to weak reddish brown fine to coarse SANDSTONE with occasional subrounded clasts (up to 50mm) of quartzite. Discontinuities are very closely spaced subhorizontal rough and clean.**	
	(ADD)	100	0.00		(AZCL)		
5.80- 7.30	5.50	93	0.28	33	(16)		
	(ADD)	93	0.00				
6.50- 6.80		C					
					(15)		
7.30- 8.80	5.50	100	0.20	70			
	(ADD)	100	0.00		(9)		
					(10)		
8.80-10.30	5.50	80	0.20	60	(AZCL)		
	(ADD)	80	0.00		(12)		
9.60- 9.80		C			(AZCL)		
					(14)		

Boring

Depth	Dia	Technique	Crew
1.20	0.50	Inspection Pit	HR
5.15	0.15	Cable Percussion	HR
14.80	0.09	Rotary Core	SL

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			01/12/15	08:00
2.50	2.50	DRY	01/12/15	18:00
2.50	2.50	DRY	02/12/15	08:00
5.15	4.50	DRY	02/12/15	18:00
5.15	4.50	DRY	03/12/15	08:00
11.80	5.50	ADD	03/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
Water was added to assist boring between 2.00m and 2.50m, and 3.00m and 5.50m.
A 50mm standpipe was installed to 14.80m with a geowrapped slotted section from 12.80m to 14.80m with flush lockable protective cover. Backfill details from base of hole: gravel filter up to 12.80m, bentonite seal up to 0.30m, concrete up to ground level.
Chiselling: 3.00-3.20m for 90 minutes and 3.20-3.40m for 60 minutes and 4.00-5.00m for 60 minutes.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Cable Percussion and Rotary

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** Project No **BH112** **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389295.7** E **390239.9** N | Ground Level **43.70** m OD

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Properties/Sampling: SPT N (FI)	Strata: Description General	Strata: Description Detail	Depth	Legend	Level m OD
10.30-11.80	**5.50 (ADD)**	**60 47**	**0.35 0.00**	**33**	**(AZCL)**					
					(NI)					
					(11)					
11.80-13.30	**5.50 (ADD)**	**67 53**	**0.17 0.00**	**37**	**(AZCL)**					
					(15)					
					(NI)					
					(13)					
13.30-14.80	**5.50 (ADD)**	**67 57**	**0.15 0.00**	**40**	**(AZCL)**					
					(11)					
						End of Borehole		**14.80**		**28.90**

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
				11.80	**5.50**	**ADD**	**04/12/15**	**08:00**						
				14.80	**5.50**	**ADD**	**04/12/15**	**18:00**						

Remarks

Flush: 5.50-5.80m, Water, 80% returns and 5.80-7.30m, Water, 0% returns and 7.30-8.80m, Water, 50% returns and 8.82-10.30m, Water, 80% returns and 10.30-11.80m, Water, 80% returns and 11.80-13.30m, Water, 80% returns and 13.30-14.80m, Water, 80% returns.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **2 of 2**
11/03/2016

geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION**
Engineer **AECOM**
Borehole **CT1**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**
National Grid Coordinates **389136.7** E **390309.5** N
Ground Level **42.24** m OD

Scale 1:50

Sampling			Properties		Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	Description	Depth	Legend	Level m OD
					MADE GROUND: Black tarmacadam.	**G.L.**		**42.24**
						0.10		**42.14**
					MADE GROUND: **Brick wall onto obstruction at 1.20m.			
					End of Borehole	**1.20**		**41.04**

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	**0.40**	**Inspection Pit**	**JP**	**G.L.**			**16/12/15**	**09:00**						**None**
				1.10			**16/12/05**	**18:00**						**encountered.**

Remarks

The borehole was terminated at the base of the inspection upon encountering a brick obstruction.
**** Driller's description.**
Backfill details from base of hole: bentonite seal up to 0.30m, sub base up to 0.10m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT1A** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389139.0** E **390309.6** N | Ground Level **42.19** m OD

Scale 1:50

Sampling Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		42.19
						MADE GROUND: Black tarmacadam.	0.05		42.14
						MADE GROUND: Very loose dark brown sandy angular to subangular fine to coarse gravel of brick, concrete and ash. High angular boulder and cobble content of brick.			
1.20- 1.65	D				S2				
2.20- 2.65	D	1.20 (DRY)			S17	**At 2.20m, medium dense.**			
3.20- 3.58	D	3.20 (DRY)			S50/ 225	**Very dense yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL of limestone, quartzite, granite and basalt.**	3.20		38.99
4.20- 4.32	D	4.20 (DRY)			S50/50	**Weak dark red fine to medium grained SANDSTONE (recovered as sand).**	4.20		37.99
							4.32		37.87
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	JP
4.32	0.15	Cable Percussion	JP

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
4.32	4.20	DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks **Inspection pit hand excavated to 1.20m depth. Backfill details from base of hole: bentonite seal up to 0.30m, sub base up to 0.10m, tarmacadam up to ground level.**

Logged by **JP**

Figure **1 of 1** 11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT3** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389139.9** E **390305.2** N | Ground Level **42.11** m OD

Scale 1:50

Sampling			Properties			Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
						MADE GROUND: Black tarmacadam.	**G.L.**		**42.11**
						MADE GROUND: Medium dense dark brown sandy angular to subangular fine to coarse gravel of brick, concrete and ash. High cobble content and a high boulder content of brick.	**0.30**		**41.81**
1.20- 1.65	**D**	**(DRY)**			**S35**				
2.20- 2.65	**D**	**2.20 (DRY)**			**S18**				
3.20- 3.65	**D**	**3.20 (DRY)**			**S8**	**Loose brown slightly gravelly silty SAND. Gravel is fine to medium including sandstone, limestone and quartzite.**	**3.20**		**38.91**
4.20- 4.35	**D**	**4.20 (DRY)**			**S50/70**	**Extremely weak dark red fine to medium grained SANDSTONE (recovered as silty sand).**	**4.20**		**37.91**
						End of Borehole	**4.35**		**37.76**

Boring

Depth	Hole Dia	Technique	Crew
1.20	**0.40**	**Inspection Pit**	**JP**
4.35	**0.15**	**Cable Percussion**	**JP**

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			**16/12/15**	**08:00**
4.35	**4.20**	**DRY**	**16/12/15**	**18:00**

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
Water was added to assist boring between 3.20m and 4.20m.
Backfill details from base of hole: bentonite seal up to 0.60m, sub base up to 0.30m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT4** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389146.6** E **390314.8** N | Ground Level **42.07** m OD

Scale 1:50

Sampling: Depth	Sample Type	Depth Cased & (to Water)	Properties: Strength kPa	w %	SPT N	Strata: Description	Depth	Legend	Level m OD
						MADE GROUND: Black tarmacadam.	**G.L.**		**42.07**
							0.10		**41.97**
						MADE GROUND: Stone setts.	**0.25**		**41.82**
						MADE GROUND: Brown slightly clayey sand. Locally grading to very soft slightly gravelly sandy clay. Gravel is angular to subangular medium to coarse of brick fragments.			
1.30- 1.75	**D**	**(DRY)**			**S1**				
2.20- 2.65	**D**	**2.20 (DRY)**			**S50**				
						Dense yellowish brown very sandy rounded to subrounded fine to coarse GRAVEL including sandstone.	**2.45**		**39.62**
3.20- 3.65	**D**	**3.20 (DRY)**			**S12**	**At 3.20m, medium dense.**			
						End of Borehole	**3.30**		**38.77**

Boring

Depth	Hole Dia	Technique	Crew
1.20	**0.40**	**Inspection Pit**	**JP**
3.30	**0.15**	**Cable Percussion**	**JP**

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			**10/12/15**	**08:00**
1.30		**DRY**	**10/12/15**	**18:00**
1.30		**DRY**	**11/12/15**	**08:00**
3.30	**3.20**	**DRY**	**11/12/15**	**18:00**

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
The Borehole was terminated at a depth of 3.30m due to the presence of a potential buried service.
Backfill details from base of hole: bentonite seal up to 0.25m, sub base up to 0.10m, tarmacadam up to ground level.

Logged by **GT**

Figure **1 of 1**
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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT5** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389154.7** E **390268.6** N | Ground Level **42.73** m OD

Scale 1:50

Sampling			Properties			Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
						MADE GROUND: Black tarmacadam.	**G.L.**		**42.73**
							0.05		**42.68**
						MADE GROUND: Yellowish brown sandy fine to coarse angular gravel of limestone (Sub base).	**0.10**		**42.63**
							0.45		**42.28**
						MADE GROUND: Concrete and brick.			
1.20- 1.65	**D**				**S4**	**MADE GROUND: Loose dark brown sandy fine to coarse angular to subangular gravel of brick, concrete and ash. High cobble content and a high boulder content.**			
2.00- 2.45	**D**	**2.00 (DRY)**			**S6**				
3.00- 3.45	**D**	**3.00 (DRY)**			**S10**				
4.00- 4.15	**D**	**4.00 (DRY)**			**S50/75**	**Extremely weak to very weak dark red fine to medium grained SANDSTONE (recovered as silty sand).**	**4.00**		**38.73**
5.00- 5.15	**D**	**5.00 (DRY)**			**S50/75**				
						End of Borehole	**5.50**		**37.23**

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	**0.40**	**Inspection Pit**	**HR**	**G.L.**			**03/12/15**	**08:00**						**None encountered.**
5.50	**0.15**	**Cable Percussion**	**HR**	**3.50**	**3.00**	**DRY**	**03/12/15**	**18:00**						
				3.50	**3.00**	**DRY**	**04/12/15**	**08:00**						
				5.50	**4.50**	**DRY**	**04/12/15**	**18:00**						

Remarks

Inspection pit hand excavated to 1.20m depth.
Water was added to assist boring between 3.50m and 4.00m.
Backfill details from base of hole: bentonite seal up to 0.15m, tarmacadam up to ground level.
Chiselling: 4.00-5.00m for 60 minutes.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION**
Engineer **AECOM**
Borehole **CT6**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**
National Grid Coordinates **389161.9** E **390271.3** N
Ground Level **42.60** m OD

Scale 1:50

Sampling			Properties		Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	Description	Depth	Legend	Level m OD
						G.L.		42.60
					MADE GROUND: Black tarmacadam.	0.05		42.55
					MADE GROUND: Black/brown sandy angular to subangular fine to coarse gravel of brick, ash, and concrete. At 0.50m, brick obstruction.	0.50		42.10
					End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.50	0.40	Inspection Pit	HR	G.L. 0.50			07/12/15 07/12/15	08:00 18:00						None encountered.

Remarks

The Borehole was terminated at a depth of 0.50m within the inspection pit upon encountering a brick obstruction.The rig was moved to BHCT6A.
Backfill details from base of hole: bentonite seal up to 0.10m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT6A** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389162.2** E **390271.7** N | Ground Level **42.59** m OD

Scale 1:50

Sampling			Properties		Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	Description	Depth	Legend	Level m OD
						G.L.		42.59
					MADE GROUND: Black tarmacadam.	0.05		42.54
					MADE GROUND: Black sandy angular to subangular fine to coarse gravel of ash, concrete and brick.			
					MADE GROUND: Metal plate.	0.95		41.64
						1.00		41.59
					End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.00	0.40	Inspection Pit	HR	G.L. 1.00			07/12/15 07/12/15	08:00 18:00						None encountered.

Remarks

The Borehole was terminated at a depth of 1.00m within the inspection pit upon encountering a metal plate obstruction.The rig was moved to BHCT6B.
Backfill details from base of hole: bentonite seal up to 0.10m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD – Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT6B** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389163.5** E **390271.4** N | Ground Level **42.66** m OD

Scale 1:50

Sampling			Properties			Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
						MADE GROUND: Black tarmacadam.	**G.L.** **0.05**		**42.66** **42.61**
						MADE GROUND: Loose to medium dense dark brown sandy angular to subangular fine to coarse gravel of brick, concrete and ash. High cobble content and a high boulder content.			
1.20- 1.65	**D**				**S27**				
2.00- 2.45	**D**	**2.00 (DRY)**			**S6**	**At 2.00m, loose.**			
3.00- 3.45	**D**	**3.00 (DRY)**			**S50**	**At 3.00m, dense.**			
4.00- 4.31	**D**	**4.00 (DRY)**			**S50/ 160**	**Extremely weak dark red fine to medium grained SANDSTONE (recovered as silty sand).**	**4.00**		**38.66**
5.00- 5.14	**D**	**4.00 (DRY)**			**S50/50**				
						End of Borehole	**5.50**		**37.16**

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	**0.40**	**Inspection Pit**	**HR**	**G.L.**			**07/12/15**	**09:00**						**None encountered.**
5.50	**0.15**	**Cable Percussion**	**HR**	**5.50**	**4.00**	**DRY**	**07/12/15**	**18:00**						

Remarks **Inspection pit hand excavated to 1.20m depth.**
Water was added to assist boring between 4.00m and 5.00m.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD – Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT7** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389156.2** E **390263.3** N | Ground Level **42.75** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		42.75
						MADE GROUND: Black tarmacadam.	0.10		42.65
						MADE GROUND: Yellowish brown sandy fine to coarse angular gravel of limestone (Sub base).	0.15		42.60
						MADE GROUND: Concrete.	0.30		42.45
1.20- 1.65	D				S4	MADE GROUND: Loose dark brown sandy angular to subangular fine to coarse gravel of brick, concrete and ash. High cobble content and a high boulder content.			
2.00- 2.45	D	1.50 (DRY)			S5				
3.00- 3.45	D	3.00 (DRY)			S30	At 3.00m, medium dense/dense.			
4.00- 4.15	D	4.00 (DRY)			S50/75	Extremely weak to very weak dark red fine to medium grained SANDSTONE (recovered as silty sand).	3.80		38.95
5.00- 5.15	D	4.50 (DRY)			S50/75				
						End of Borehole	5.50		37.25

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	HR
5.50	0.15	Cable Percussion	HR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			04/12/15	08:00
5.50	4.50	DRY	04/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
Water was added to assist boring between 4.00m and 5.00m.
Backfill details from base of hole: bentonite seal up to 0.10m, tarmacadam up to ground level.
Chiselling: 4.00-5.00m for 60 minutes.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
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geotechnics

BOREHOLE RECORD - Cable Percussion

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **CT8** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389163.8** E **390266.4** N | Ground Level **42.72** m OD

Scale 1:50

Sampling: Depth	Sample Type	Depth Cased & (to Water)	Properties: Strength kPa	w %	SPT N	Strata: Description	Depth	Legend	Level m OD
						MADE GROUND: Black tarmacadam.	**G.L.**		**42.72**
							0.05		**42.67**
						MADE GROUND: Loose dark brown sandy fine to coarse angular to subangular gravel of brick, concrete and ash. High cobble content and a high boulder content.			
1.20- 1.65	**D**				**S4**				
2.00- 2.45	**D**	**1.50 (DRY)**			**S31**	**Boulder of dark red fine to medium grained sandstone.**			
3.00- 3.15	**D**	**3.00 (DRY)**			**S50/75**	**At 3.00m, very dense.**			
4.00- 4.17	**D**	**4.00 (DRY)**			**S50/85**				
5.00- 5.15	**D**	**4.50 (DRY)**			**S50/75**	**Very weak dark red fine to medium grained SANDSTONE (recovered as silty sand).**	**5.00**		**37.72**
6.00- 6.15	**D**	**4.50 (DRY)**			**S50/75**				
						End of Borehole	**6.50**		**36.22**

Boring

Depth	Hole Dia	Technique	Crew
1.20	**0.40**	**Inspection Pit**	**HR**
6.50	**0.15**	**Cable Percussion**	**HR**

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			**07/12/15**	**08:00**
1.20		**DRY**	**07/12/15**	**18:00**
1.20		**DRY**	**08/12/15**	**08:00**
6.50	**4.50**	**DRY**	**08/12/15**	**18:00**

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
Backfill details from base of hole: bentonite seal up to 0.30m, gravel filter up to 0.20m, tarmacadam up to ground level.
Chiselling: 3.00-3.50m for 60 minutes and 5.00-6.00m for 60 minutes.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure **1 of 1**
11/03/2016

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APPENDIX 3

Rotary Core Photographs

PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH101 4.80m - 9.30m

BH101 9.30m - 15.30m

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH102 5.00m - 8.54m

BH102 8.54m - 12.70m

PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH102 12.70m - 14.70m

BH103 4.80 - 7.20

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PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH103 7.20 - 10.20

BH103 10.20 - 14.70

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH104 5.00 - 8.85

BH104 8.85 - 15.00

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH105 4.50-8.30

BH105 8.30 - 14.35

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH105 14.35 - 15.20

BH106 3.40 - 6.90

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH106 6.90 - 12.40

BH106 12.40 - 15.00

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH107 4.00 - 8.00

BH108 6.50m - 8.80m

PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH108 8.80m - 11.80m

BH108 11.80m - 14.80m

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH108 14.80m - 17.80m

BH108 17.80m - 22.30m

PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH109 5.20m - 12.20m

BH109 12.20m - 16.50m

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH109 16.90m - 19.70m

BH109 19.70m - 20.70m

PHOTOGRAPHS

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH112 5.50m - 7.30m

BH112 7.30m - 10.30m

Project Number : PN153428

Project : STOCKPORT BUS STATION

BH112 10.30m - 14.80m

APPENDIX 4

Trial Pit Records & Sketches

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

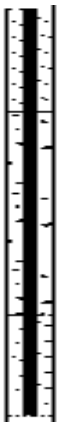
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



Seal

Filter

Seal

Strata

Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

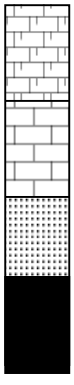
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



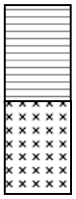
Chalk

Limestone

Sandstone

Coal

Strata, Continued



Mudstone

Siltstone

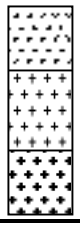
Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

TRIAL PIT RECORD *Inspection Pit*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Trial Pit**	**HP01**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389288.6** E **390260.6** N	Ground Level	**48.58** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		**48.58**
0.20- 0.50	**B**			**MADE GROUND: Black tarmacadam.**	**0.10**		**48.48**
0.20	**ES**			**MADE GROUND: Dark brown gravelly fine to medium sand with ash present. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick and concrete.**			
0.50- 1.00	**B**						
0.50	**ES**						
1.00	**ES**						
					1.20		**47.38**
				End of Excavation			

Excavation

Plant	**Hand Tools**	Width (B)	**0.40**
Date	**09/12/2015**	Length (C)	**0.40**
Shoring	**None.**	Date Backfilled	**09/12/2015**
Stability	**Stable during excavation.**		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **HP02** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** National Grid Coordinates **389310.6** E **390281.3** N Ground Level **52.84** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		52.84
0.20	ES			MADE GROUND: Black tarmacadam.	0.10		52.74
0.20- 0.30	ES			MADE GROUND: Brown gravelly fine to medium sand with ash present. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete.	0.30		52.54
0.30- 0.60	B				0.60		52.24
0.50	ES			MADE GROUND: Light brown gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of sandstone, concrete and brick.			
0.60- 1.00	B				1.20		51.64
1.00	ES			MADE GROUND: Dark brown to grey clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete.			
				End of Excavation			

Excavation

Plant **Hand Tools**
Date **09/12/2015**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.40**
Length (C) **0.40**
Date Backfilled **09/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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TRIAL PIT RECORD *Inspection Pit*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Trial Pit**	**TP1**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389129.8** E **390307.0** N	Ground Level	**42.25** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		**42.25**
0.20	**ES**			**MADE GROUND: Dark brown gravelly clayey fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies, brick, timber, plastic and ceramic.**			
0.50	**ES**				**0.65**		**41.60**
				End of Excavation			

Excavation

Plant	**Hand Tools**	Width (B)	**0.50**
Date	**14/12/2015**	Length (C)	**1.00**
Shoring	**None.**	Date Backfilled	**14/12/2015**
Stability	**Stable during excavation.**		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks

ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A drawing of the excavation is presented separately.
The inspection pit was terminated at 0.65m upon encountering concrete.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **NM**

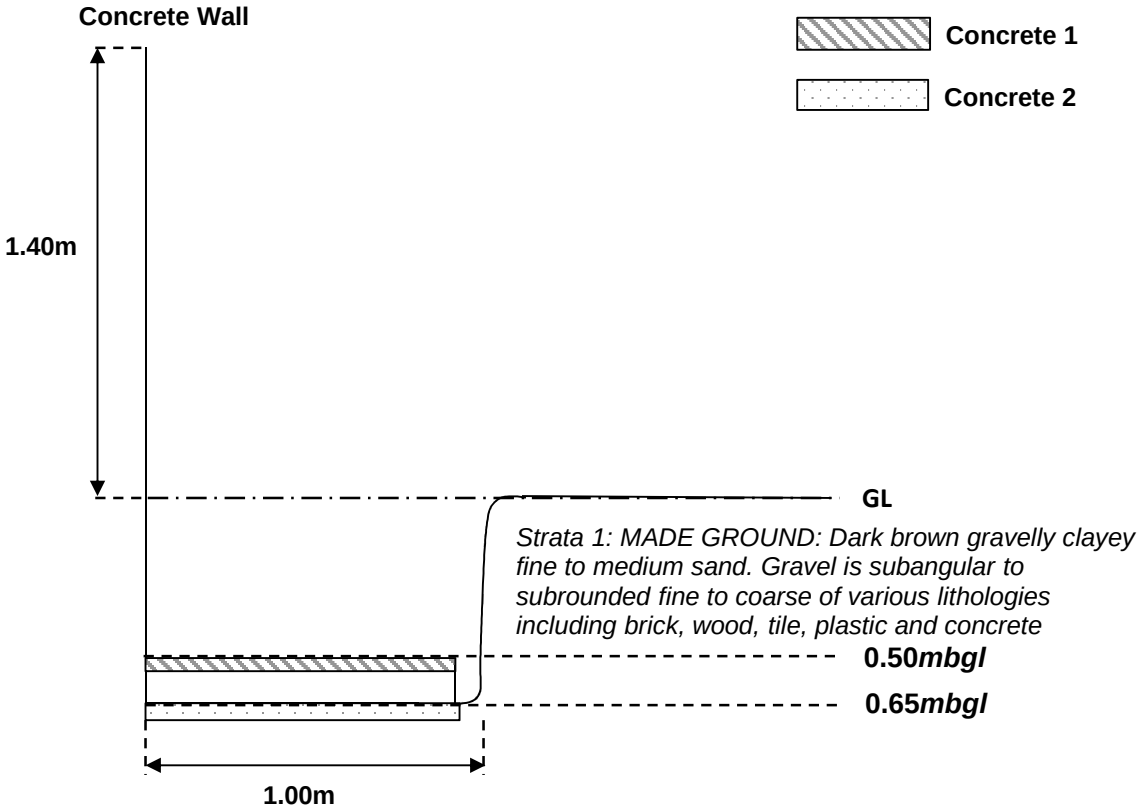
Figure **1 of 1**
11/03/2016

geotechnics

KEY:

Concrete 1

Concrete 2



All dimensions in metres, unless othewise stated

TP1

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-section

Excavated: 14.12.2015

Drawn by: NM

Date: 14.12.2015

Contact: NMisyris@geotechnics.co.uk

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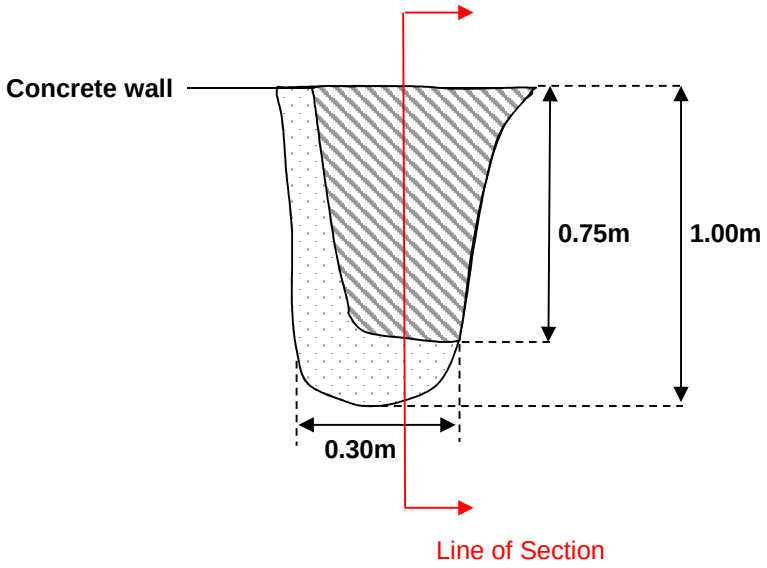
Tel. 01244 671117

Fax. 01244 671122

N° TP1(2)



KEY:

Concrete 2

Concrete 1

All dimensions in metres, unless othewise stated

TP1

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 14.12.2015

Drawn by: NM

Date: 14.12.2015

Contact: NMisyris@geotechnics.co.uk

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Tel. 01244 671117

Fax. 01244 671122

N° TP1(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP2** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** National Grid Coordinates **389138.2** E **390302.5** N Ground Level **42.09** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		42.09
0.20	ES			MADE GROUND: Dark brown gravelly clayey fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.			
0.50	ES						
1.00	ES						
				End of Excavation	1.10		40.99

Excavation

Plant **Hand Tools**
Date **14/12/2015**
Shoring **None.**
Stability **Stable during excavation.**
Width (B) **0.65**
Length (C) **0.45**
Date Backfilled **14/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.

Logged by **NM**
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

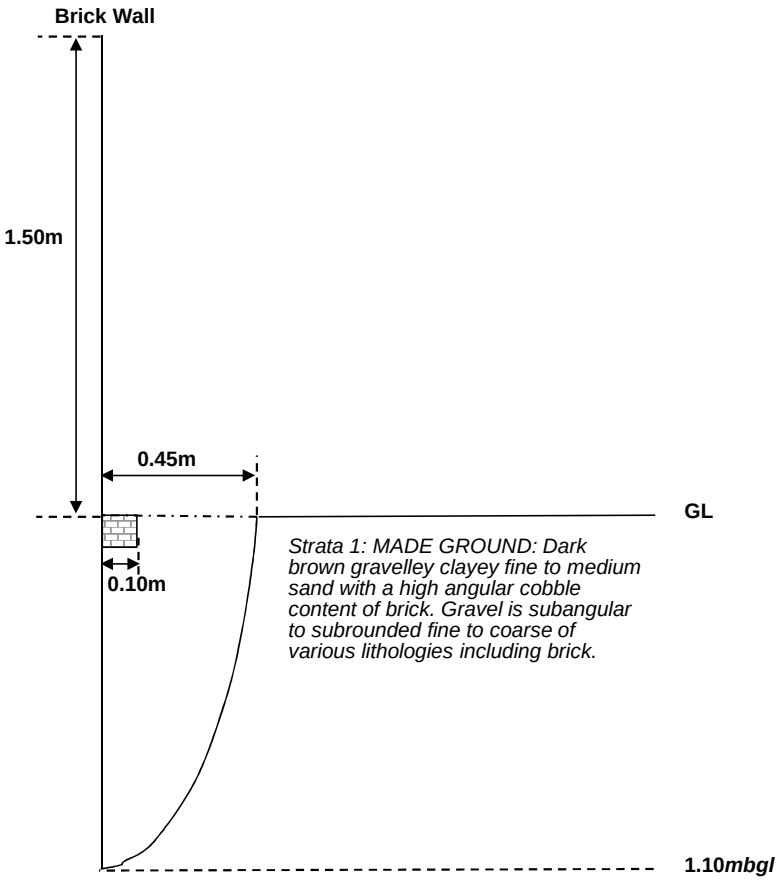
All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

KEY:

Brickwork



All dimensions in metres, unless othewise stated

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 14.12.2015

Drawn by: NM

Date: 14.12.2015

Contact: NMisyris@geotechnics.co.uk

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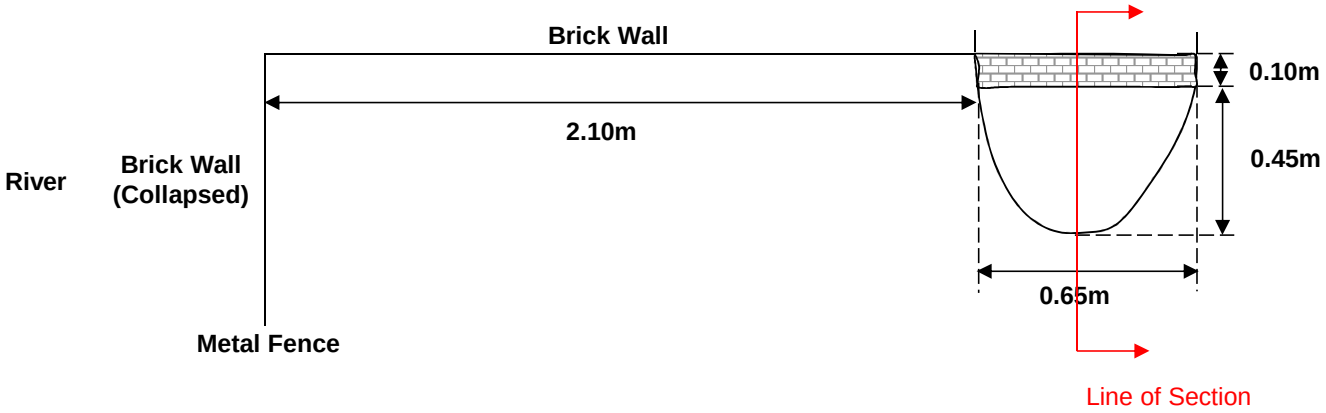
N° TP2(2)

KEY:

Brick Wall



All dimensions in metres, unless othewise stated

TP2

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client:	TFGM
Project:	Stockport Bus Station
Project No:	PN153428
Title:	Foundation Pit Record
View:	Plan
Excavated:	14.12.2015
Drawn by:	NM
Date:	14.12.2015
Contact:	NMisyris@geotechnics.co.uk

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N°	TP2(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP3** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** National Grid Coordinates **389145.5** E **390305.3** N Ground Level **42.07** m OD

Samples and Tests | Strata | Scale 1:50

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		42.07
				MADE GROUND: Black tarmacadam.			
0.20	ES				0.30		41.77
0.50	ES			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies.	0.50		41.57
0.85	ES			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies, fragments of granite, concrete, timber and plastic.	0.85		41.22
				End of Excavation			

Excavation

Plant **Hand Tools**
Date **11/12/2015**
Shoring **None.**
Stability **Stable during excavation.**
Width (B) **0.50**
Length (C) **0.50**
Date Backfilled **11/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.

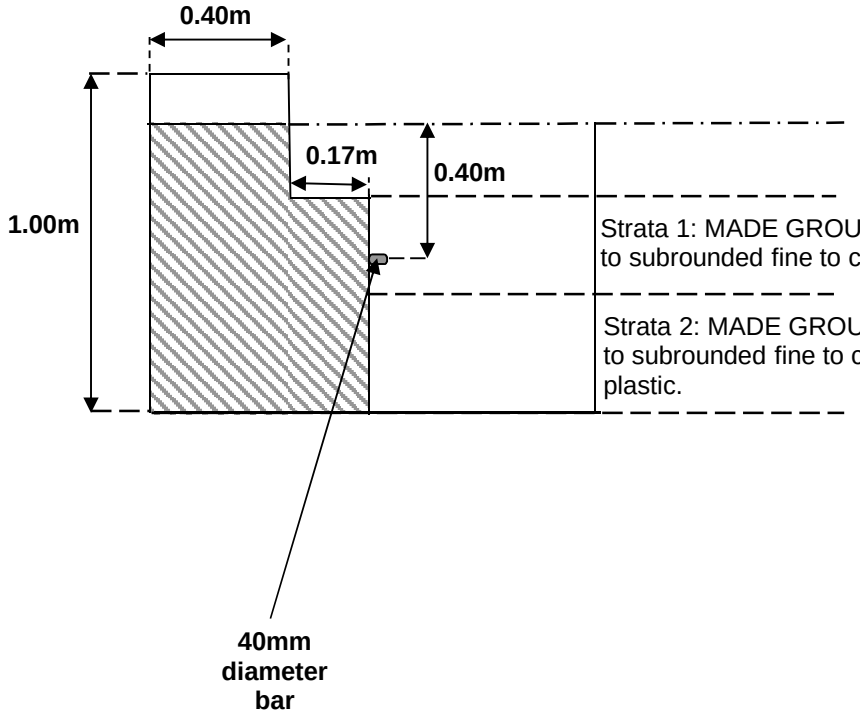
Logged by **NM**
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics



KEY:

Concrete

Strata 1: MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies.

Strata 2: MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies including granite, concrete, wood and plastic.

All dimensions in metres, unless othewise stated

TP3

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 11.12.2015

Drawn by: NM

Date: 11.12.2015

Contact: NMisyris@geotechnics.co.uk

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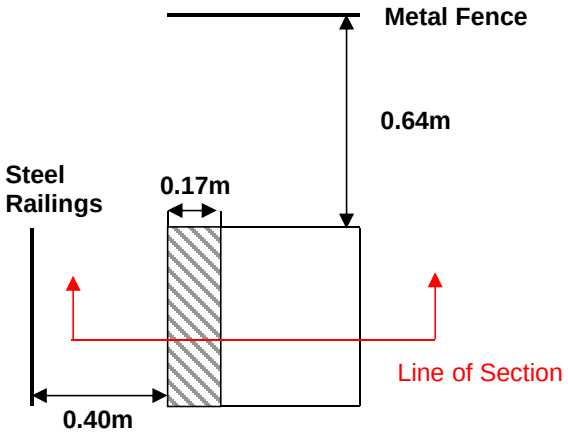
N° TP3(2)



KEY:

Concrete

All dimensions in metres, unless othewise stated

TP3

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 11.12.2015

Drawn by: NM

Date: 11.12.2015

Contact: NMisyris@geotechnics.co.uk

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N° TP3(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP4** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** National Grid Coordinates **389151.2** E **390306.7** N Ground Level **42.12** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		42.12
0.20	ES			MADE GROUND: Black tarmacadam.	0.10		42.02
0.50	ES			MADE GROUND: Black sandy angular to subangular fine to coarse gravel of brick and concrete. Ash present.			
				End of Excavation	0.80		41.32

Excavation

Plant **Hand Tools**
Date **09/12/2015**
Shoring **None.**
Stability **Stable during excavation.**
Width (B) **0.46**
Length (C) **0.40**
Date Backfilled **09/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **The inspection pit was terminated at 0.80m upon encountering concrete.**
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A drawing of the excavation is presented separately.

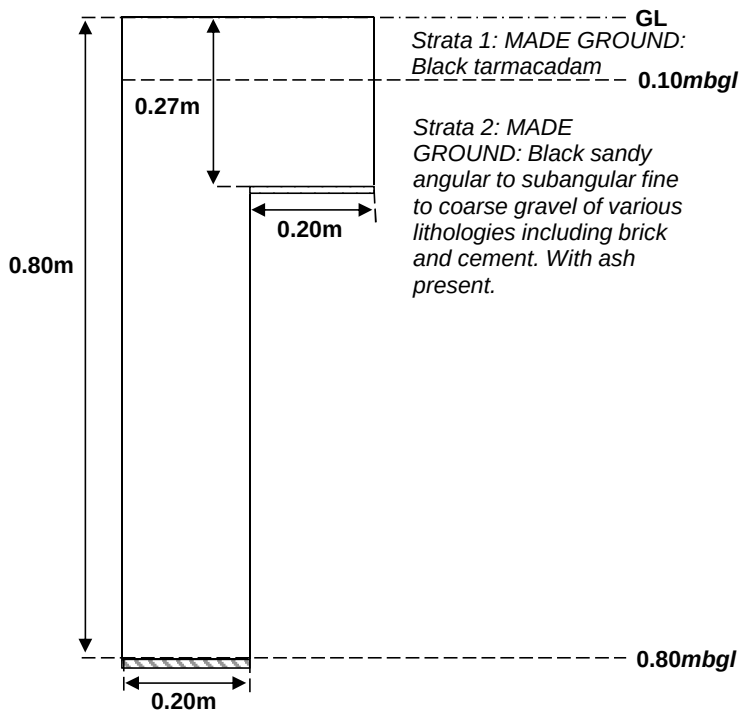
Logged by **GT**
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics



KEY:

Concrete 1

Concrete 2

All dimensions in metres, unless othewise stated

TP4

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client:	TFGM
Project:	Stockport Bus Station
Project No:	PN153428
Title:	Foundation Pit Record
View:	Cross-Section
Excavated:	09.12.2015
Drawn by:	GT
Date:	09.12.2015
Contact:	GTeasdale@geotechnics.co.uk

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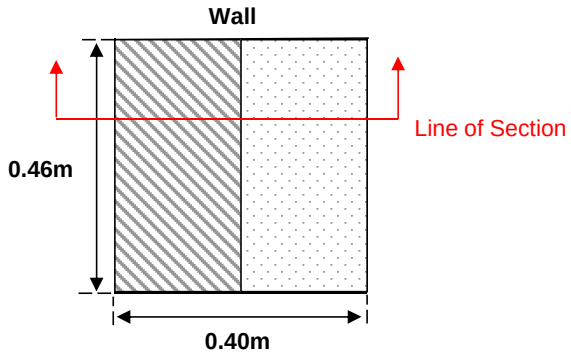
Fax. 01244 671122

N°	TP4(2)



KEY:

Concrete 1

Concrete 2

All dimensions in metres, unless othewise stated

TP4

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 09.12.2015

Drawn by: GT

Date: 09.12.2015

Contact: GTeasdale@geotechnics.co.uk

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N° TP4(1)

TRIAL PIT RECORD *Inspection Pit*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Trial Pit**	**TP5**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	Grid Coordinates	**389148.6** E, **390317.5** N	Ground Level	**42.16** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		**42.16**
				MADE GROUND: Black tarmacadam.	**0.08**		**42.08**
0.20	**ES**			**MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of dolerite.**	**0.14**		**42.02**
0.50	**ES**						
				MADE GROUND: Black gravelly fine to coarse sand. Gravel is angular and fine to coarse of brick.	**0.90**		**41.26**
1.00	**ES**						
				MADE GROUND: Firm brown slightly sandy slightly gravelly clay. Gravel is angular and fine to coarse of brick fragments.	**1.20**		**40.96**
				End of Excavation			

Excavation

Plant	**Hand Tools**	Width (B)	**0.40**
Date	**09/12/2015**	Length (C)	**0.35**
Shoring	**None.**	Date Backfilled	**09/12/2015**
Stability	**Stable during excavation.**		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.

Logged by **GT**

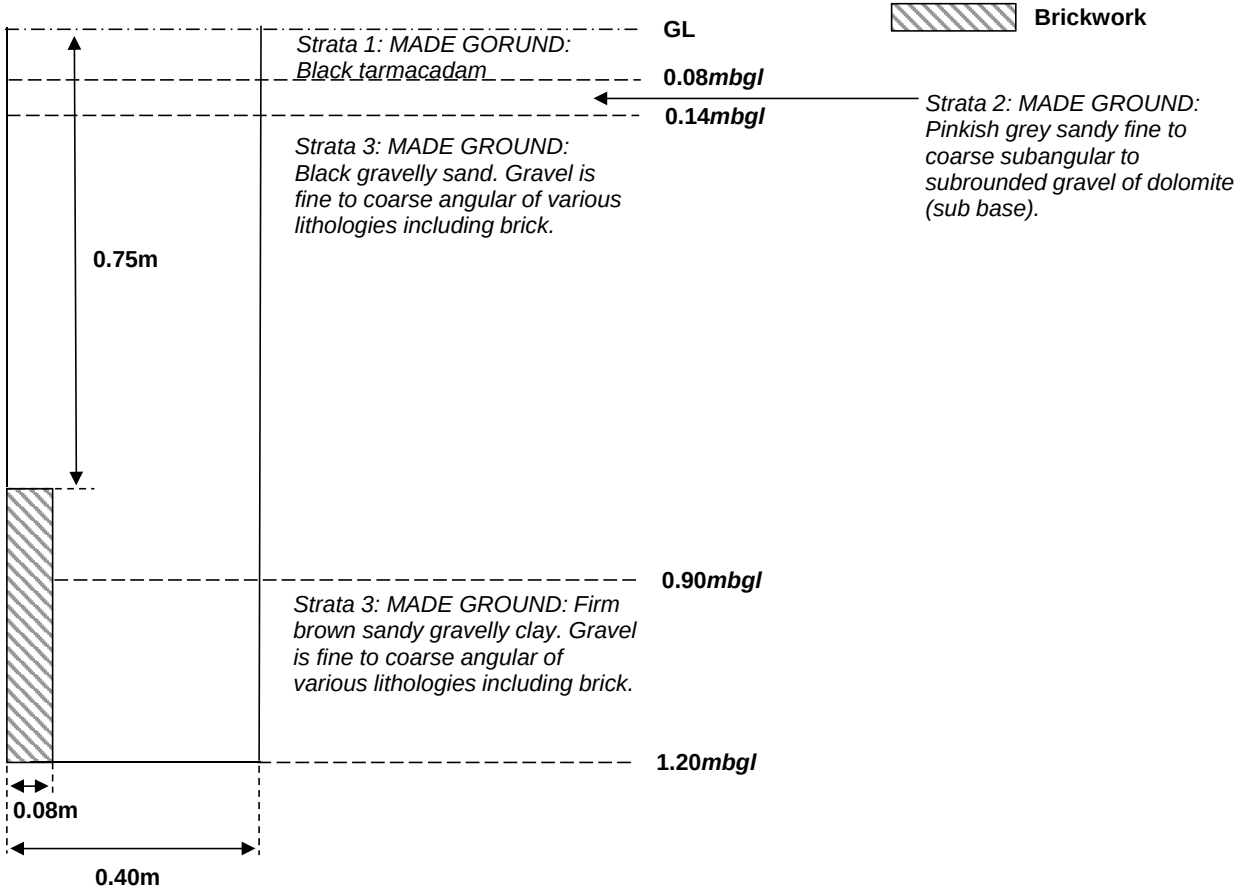
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics



All dimensions in metres, unless othewise stated

TP5

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Sectional

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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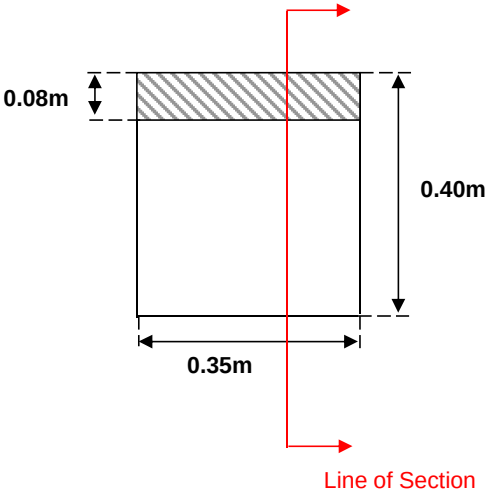
N° TP5(2)



KEY:

Brickwork

All dimensions in metres, unless othewise stated

TP5

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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N° TP5(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP6A** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Samples and Tests				Strata		
Depth	Type	Stratum No	Results	Description	Depth	Legend
					G.L.	
				MADE GROUND: Black tarmacadam.	0.20	
				MADE GROUND: Intact brickwork.	0.30	
0.50	ES			**MADE GROUND: Light brown gravelly clayey fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.**	0.60	
1.00	ES			**MADE GROUND: Dark brown gravelly clayey fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.**	1.25	
				End of Excavation		

Excavation

Plant **Hand Tools**
Date **15/12/2015**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.30**
Length (C) **0.35**
Date Backfilled **15/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars.**
The excavation was subsequently extended and presented as TP6B.

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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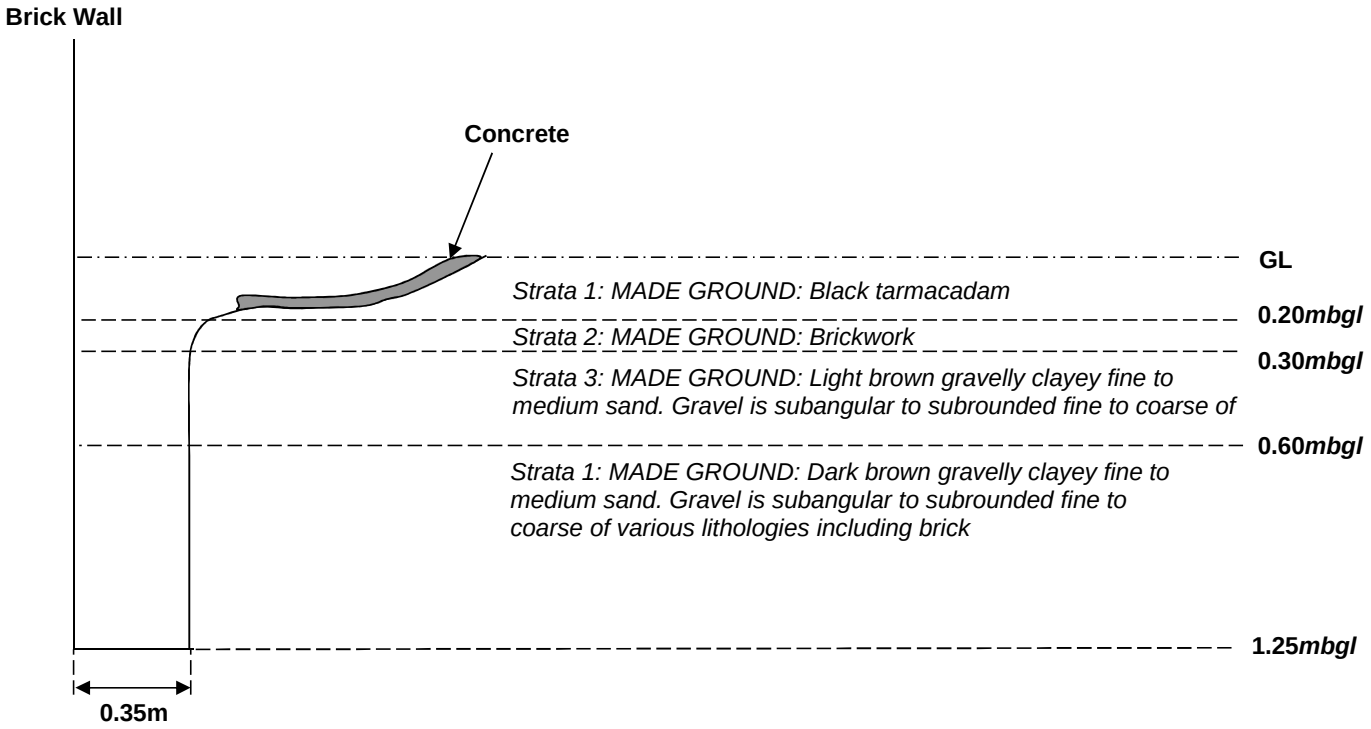

All dimensions in metres, unless othewise stated

TP6a

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 15.12.2015

Drawn by: NM

Date: 15.12.2015

Contact: NMisyris@geotechnics.co.uk

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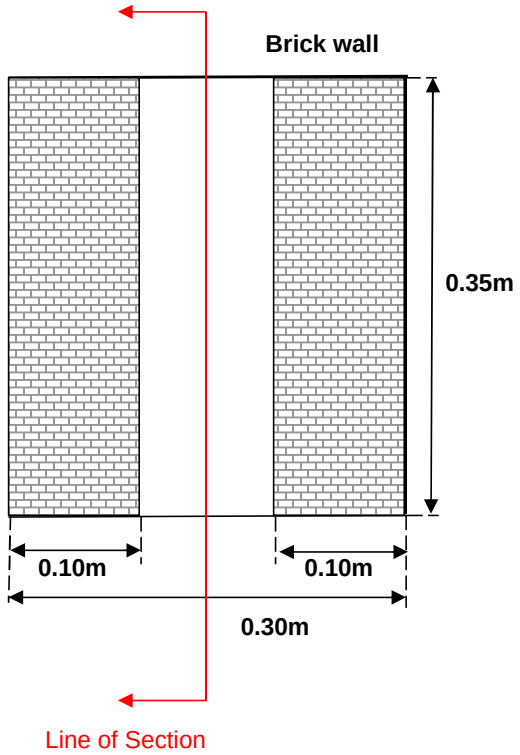
N° TP6a(2)



All dimensions in metres, unless othewise stated

TP6a

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 15.12.2015

Drawn by: NM

Date: 15.12.2015

Contact: NMisyris@geotechnics.co.uk

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N° TP6a(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP6B** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Samples and Tests				Strata		
Depth	Type	Stratum No	Results	Description	Depth	Legend
0.10	ES			MADE GROUND: Black tarmacadam.	G.L.	
				MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of dolerite.	0.10	
				MADE GROUND: Black tarmacadam.	0.24	
				MADE GROUND: Grey sandstone paving slab.	0.35	
				End of Excavation	0.40	

Excavation

Plant **Hand Tools**
Date **15/12/2015**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.70**
Length (C) **5.65**
Date Backfilled **15/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.
The excavation is an extension to TP6A.

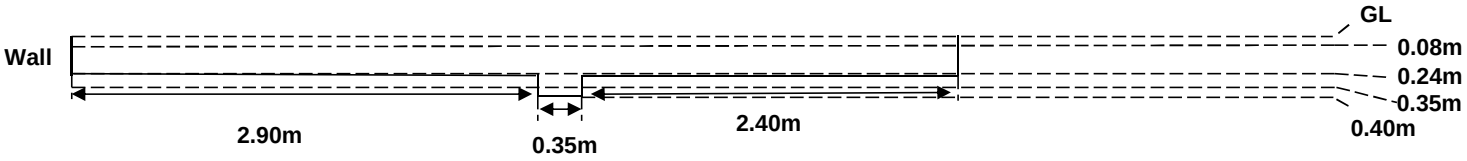
Logged by **GT**
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics



KEY:

GL

Strata 1: MADE GROUND: Black tarmacadam

0.08m

Strata 2: MADE GROUND: Pinkish grey sandy subangular to subrounded fine to coarse gravel of dolomite (sub base).

0.24m

Strata 3: MADE GROUND: Black tarmacadam

0.35m

Strata 4: MADE GROUND: Grey sandstone paving slab.

0.40m

All dimensions in metres, unless othewise stated

TP6b

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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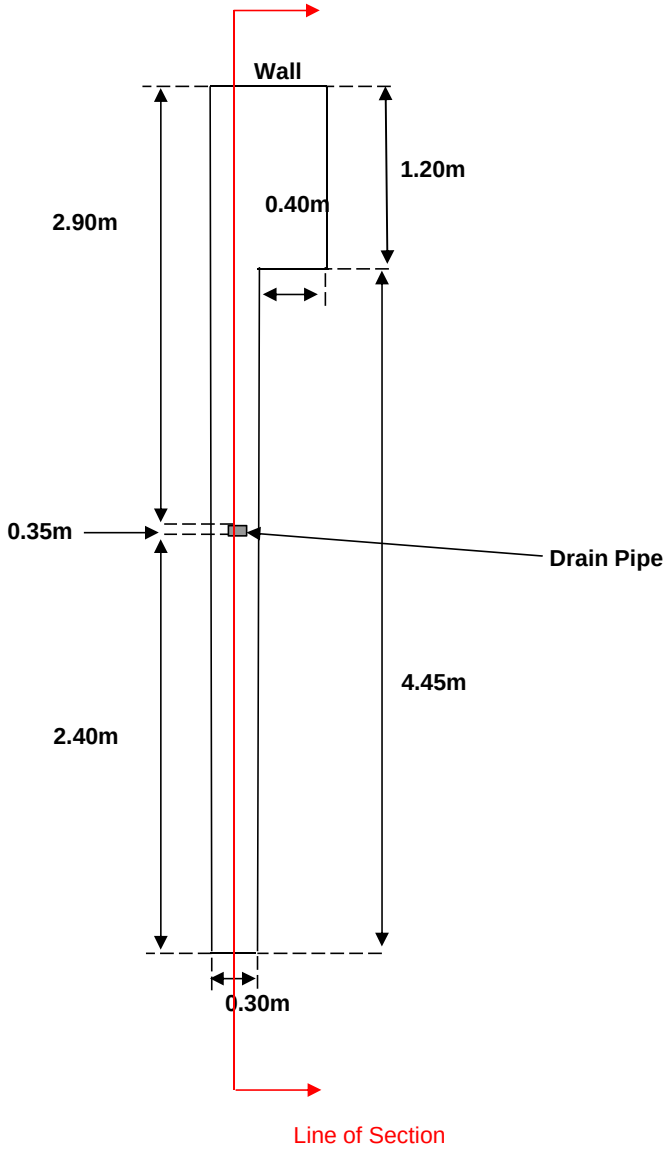
N° TP6b(2)



All dimensions in metres, unless othewise stated

TP6b

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client:	TFGM
Project:	Stockport Bus Station
Project No:	PN153428
Title:	Foundation Pit Record
View:	Cross-Section
Excavated:	15.12.2015
Drawn by:	GT
Date:	15.12.2015
Contact:	GTeasdale@geotechnics.co.uk

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N°	TP6b(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP7A** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Samples and Tests				Strata		
Depth	Type	Stratum No	Results	Description	Depth	Legend
				MADE GROUND: Black tarmacadam.	**G.L.**	
				MADE GROUND: Grey concrete.	**0.20**	
0.50	**ES**			**MADE GROUND: Dark brown gravelly clayey fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick and concrete.**	**0.35**	
1.00	**ES**					
				End of Excavation	**1.30**	

Excavation

Plant **Hand Tools**
Date **15/12/2015**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.50**
Length (C) **0.30**
Date Backfilled **15/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.
The excavation was subsequently extended and presented as TP7B.

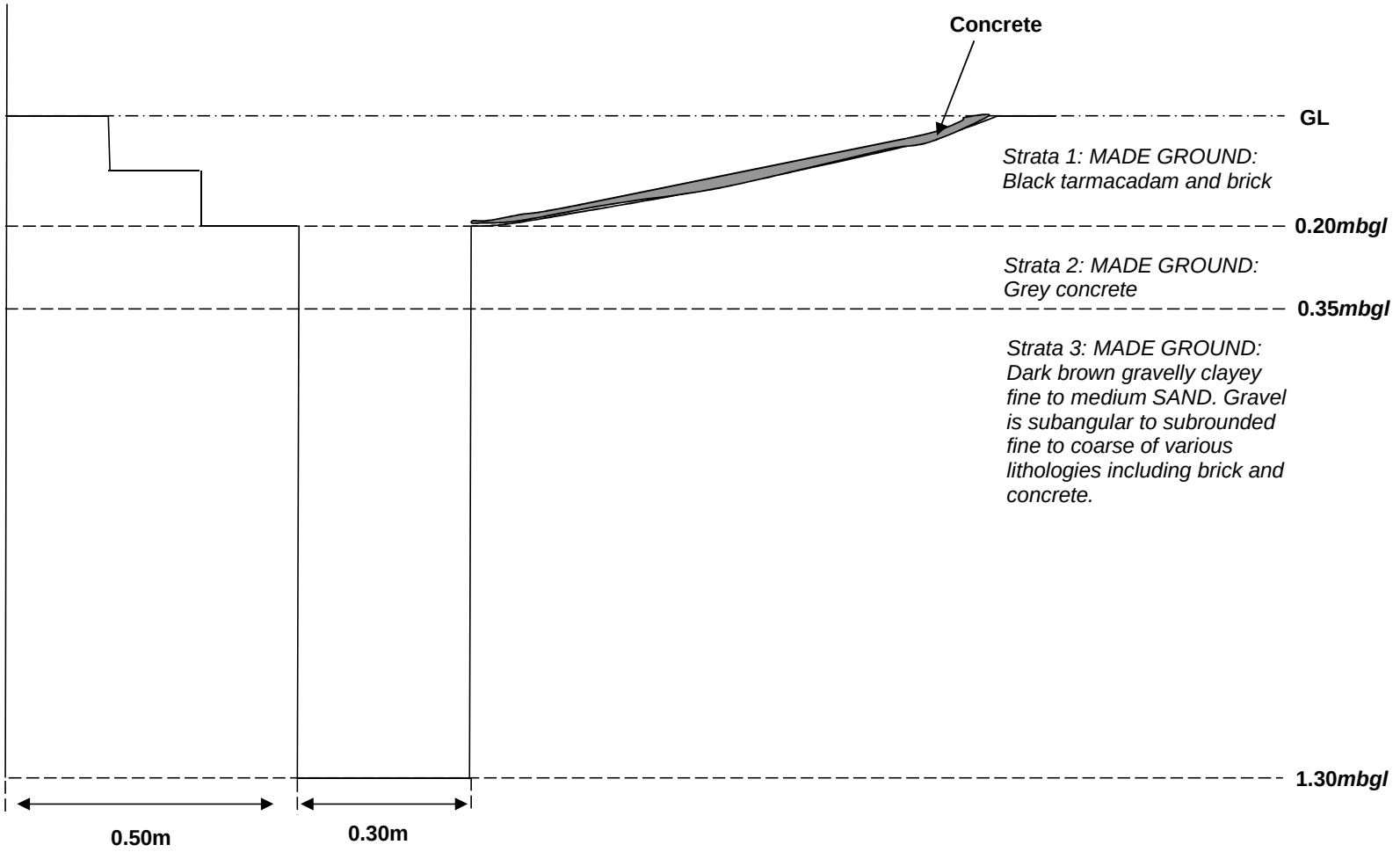
Logged by **NM**
Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics



All dimensions in metres, unless othewise stated

TP7a

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 15.12.2015

Drawn by: NM

Date: 15.12.2015

Contact: NMisyris@geotechnics.co.uk

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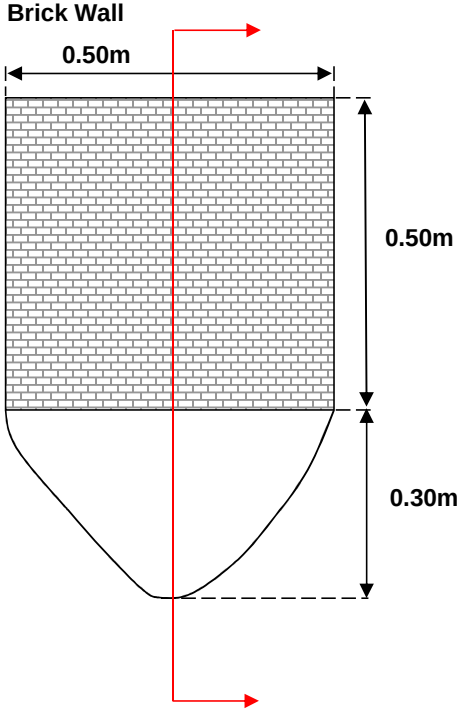
N° TP7a(2)

Brick Wall



KEY:

Brickwork

All dimensions in metres, unless othewise stated

TP7a

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan View

Excavated: 15.12.2015

Drawn by: NM

Date: 15.12.2015

Contact: NMisyris@geotechnics.co.uk

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N° TP7a(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP7B** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Samples and Tests				Strata		
Depth	Type	Stratum No	Results	Description	Depth	Legend
					G.L.	
0.10	ES			MADE GROUND: Black tarmacadam.	0.08	
				MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of dolerite.	0.33	
				At 0.24, refusal on black tarmacadam.		
				End of Excavation		

Excavation

Plant **Hand Tools**
Date **15/12/2015**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.70**
Length (C) **3.00**
Date Backfilled **15/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.
The excavation is an extension to TP7A.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

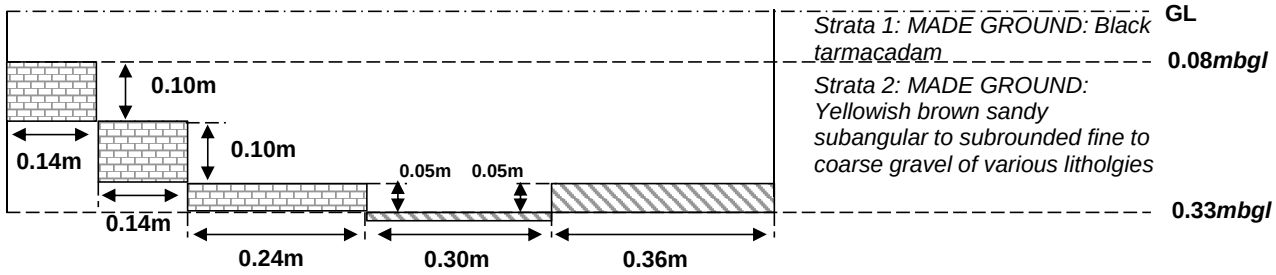
Logged in accordance with BS5930:1999 + A2:2010

Logged by **GT**

Figure **1 of 1**
11/03/2016

geotechnics

Brick Wall



KEY:

Brickwork

Concrete

All dimensions in metres, unless othewise stated

TP7b

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Cross-Section

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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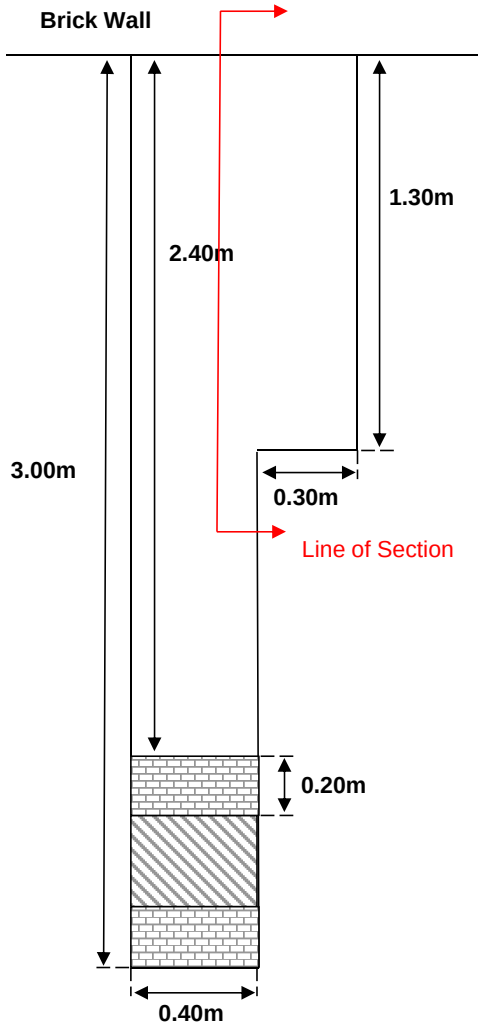
N° TP7b(2)



KEY:

Brickwork

Concrete base

All dimensions in metres, unless othewise stated

TP7b

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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N° TP7b(1)

TRIAL PIT RECORD *Inspection Pit*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Trial Pit**	**TP8**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389165.3** E **390276.6** N	Ground Level	**42.80** m OD

Scale 1:50

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		**42.80**
0.20	**ES**			**MADE GROUND: Black organic gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of brick. Ash present.**			
0.50	**ES**			**MADE GROUND: Blackish brown sandy angular to subangular fine to coarse gravel of clinker. Ash present.**	**0.50**		**42.30**
					0.80		**42.00**
				End of Excavation			

Excavation

Plant	**Hand Tools**	Width (B)	**0.35**
Date	**15/12/2015**	Length (C)	**1.25**
Shoring	**None.**	Date Backfilled	**15/12/2015**
Stability	**Stable during excavation.**		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**
A drawing of the excavation is presented separately.

Logged by **GT**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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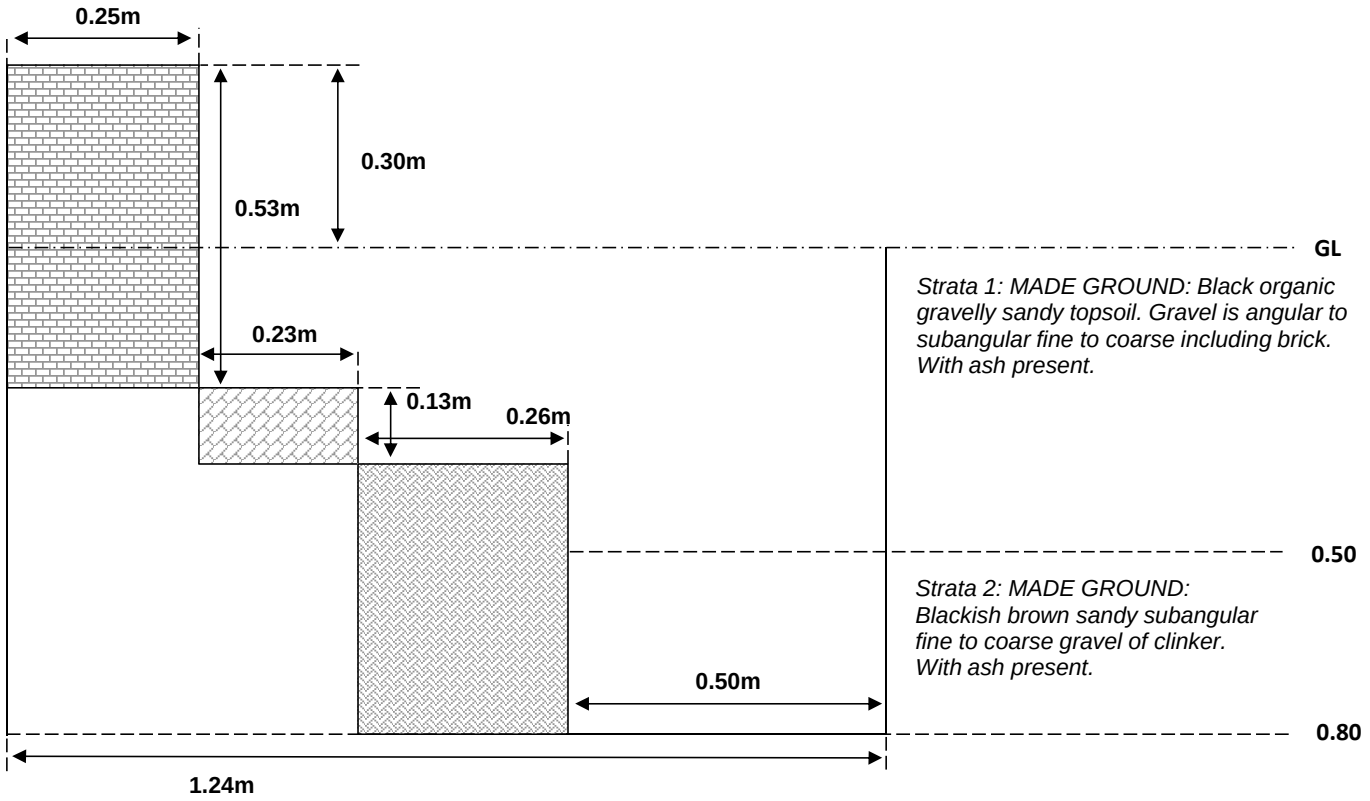

Strata 1: MADE GROUND: Black organic gravelly sandy topsoil. Gravel is angular to subangular fine to coarse including brick. With ash present.

Strata 2: MADE GROUND: Blackish brown sandy subangular fine to coarse gravel of clinker. With ash present.

KEY:

Brickwork 1

Brickwork 2

Brickwork 3

All dimensions in metres, unless othewise stated

TP8

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client:	TFGM
Project:	Stock port Bus Station
Project No:	PN153428
Title:	Foundation Pit Record
View:	Cross-Section
Excavated:	15.12.2015
Drawn by:	GT
Date:	15.12.2015
Contact:	GTeasdale@geotechnics.co.uk

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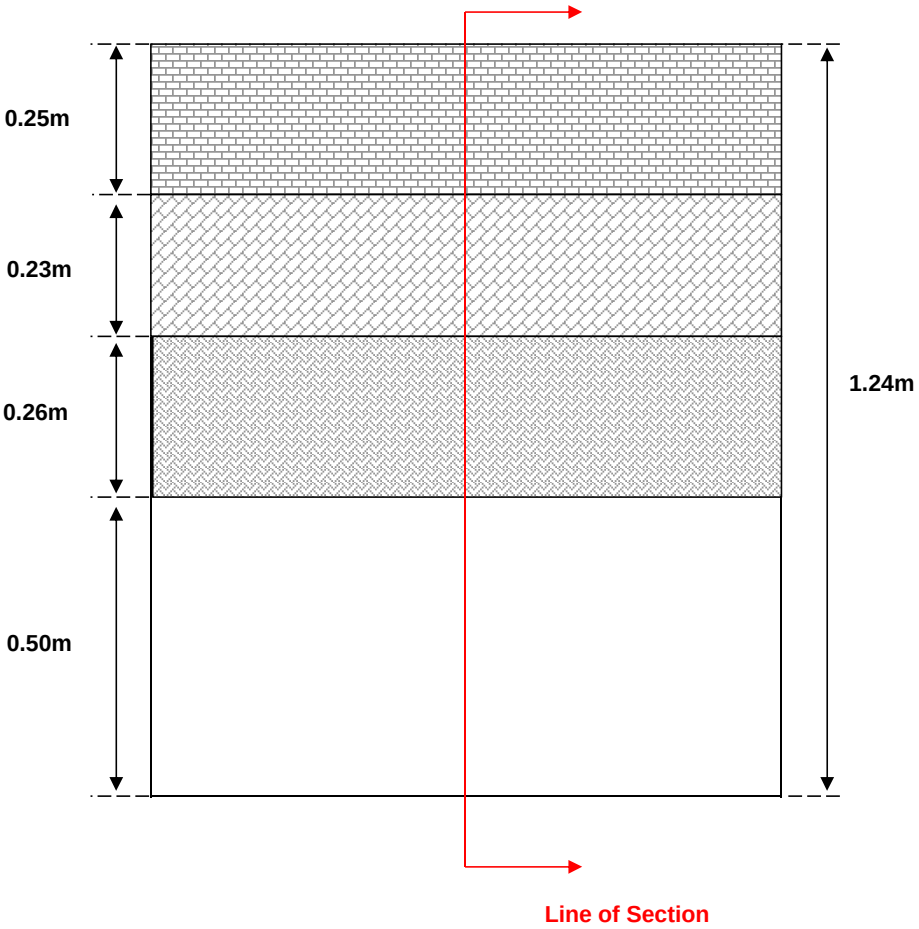
N°	TP8(2)



KEY:

Brickwork 1

Brickwork 2

Brickwork 3

All dimensions in metres, unless othewise stated

TP8

NOT TO SCALE

All Measurements in Metres

All references to the origin and/or ownership of existing underground plant/services are based on the correlation of service drawings provided by the Client and visual inspection of underground plant/services during excavation. Actual origin and/or ownership remains unconfirmed.

Client: TFGM

Project: Stockport Bus Station

Project No: PN153428

Title: Foundation Pit Record

View: Plan

Excavated: 15.12.2015

Drawn by: GT

Date: 15.12.2015

Contact: GTeasdale@geotechnics.co.uk

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N° TP8(1)

TRIAL PIT RECORD *Inspection Pit*

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Trial Pit** **TP9** Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** National Grid Coordinates **389152.1** E **390264.4** N Ground Level **42.79** m OD

Samples and Tests | Strata | Scale 1:50

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		42.79
				MADE GROUND: Black tarmacadam.	0.08		42.71
0.20	ES			MADE GROUND: Yellowish brown sandy angular fine to coarse gravel of dolerite (sub base).	0.24		42.55
				End of Excavation			

Excavation

Plant **Hand Tools**
Date **15/12/2015**
Shoring **None.**
Stability **Stable during excavation.**
Width (B) **0.35**
Length (C) **3.50**
Date Backfilled **15/12/2015**

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered.

Remarks **ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars**

Logged by **GT**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

APPENDIX 5

Trial Pit Photographs

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP1 - Photo A

TP1 - Photo B

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP2 - Photo A

TP2 - Photo B

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP3 - Photo A

TP3 - Photo B

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP4 - Photo A

TP4 - Photo B

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP5 - Photo A

TP5 - Photo B

Project Number : PN153428

Project : Stockport Bus Station

TP6 - Photo A

TP6 - Photo B

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP6 - Photo C

TP7 - Photo A

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP7 - Photo B

TP8 - Photo A

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP8 - Photo B

TP9 - Photo A

PHOTOGRAPHS

Project Number : PN153428

Project : Stockport Bus Station

TP9 - Photo B

APPENDIX 6

Dynamic Probe Test Results

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

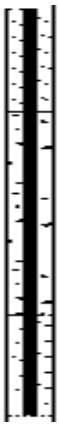
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



Seal

Filter

Seal

Strata

Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

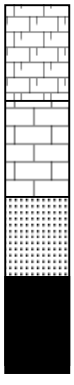
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



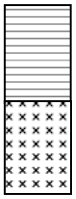
Chalk

Limestone

Sandstone

Coal

Strata, Continued



Mudstone

Siltstone

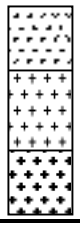
Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

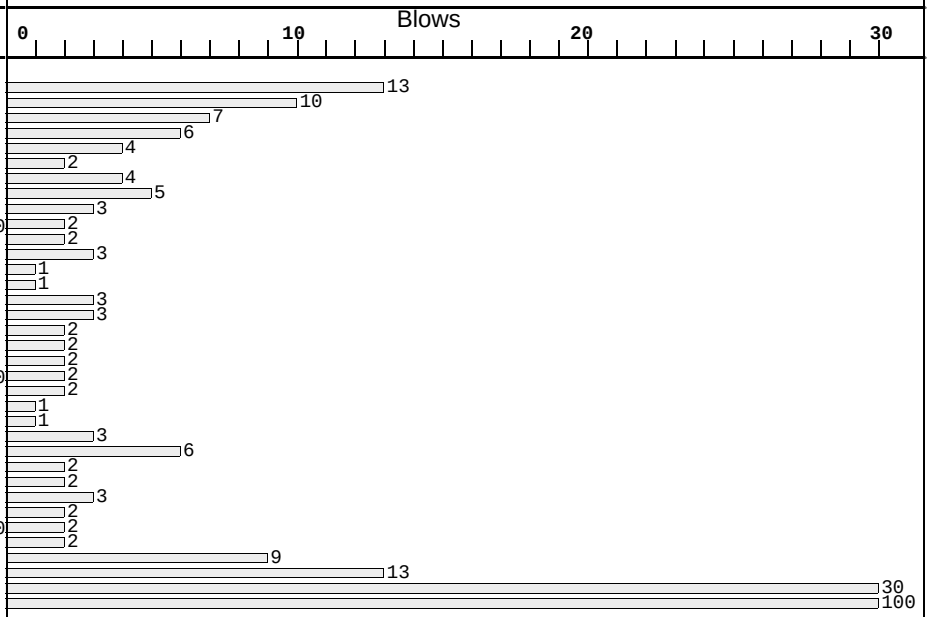
(where core recovery is unknown it is assumed to be at the base of the run)

DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP1**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389135.6** E **390312.5** N	Ground Level	**42.30** m OD

Testing — Scale 1:50

Remarks	Torque N/m	Blows	Level	Depth
		13		
		10		
		7		
		6		
		4		
		2		
		4		
		5		
		3		
		2	41.3	1.00
		2		
		3		
		1		
		1		
		3		
		3		
		2		
		2		
		2		
		2		
		2	40.3	2.00
		2		
		1		
		1		
		3		
		6		
		2		
		2		
		3		
		2		
		2	39.3	3.00
		2		
		9		
		13		
		30		
		100		
			38.3	4.00
			37.3	5.00
			36.3	6.00
			35.3	7.00
			34.3	8.00
			33.3	9.00
			32.3	10.00



Probing

Depth	Dia	Technique	Crew
3.45	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
3.45		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Figure **1 of 1**
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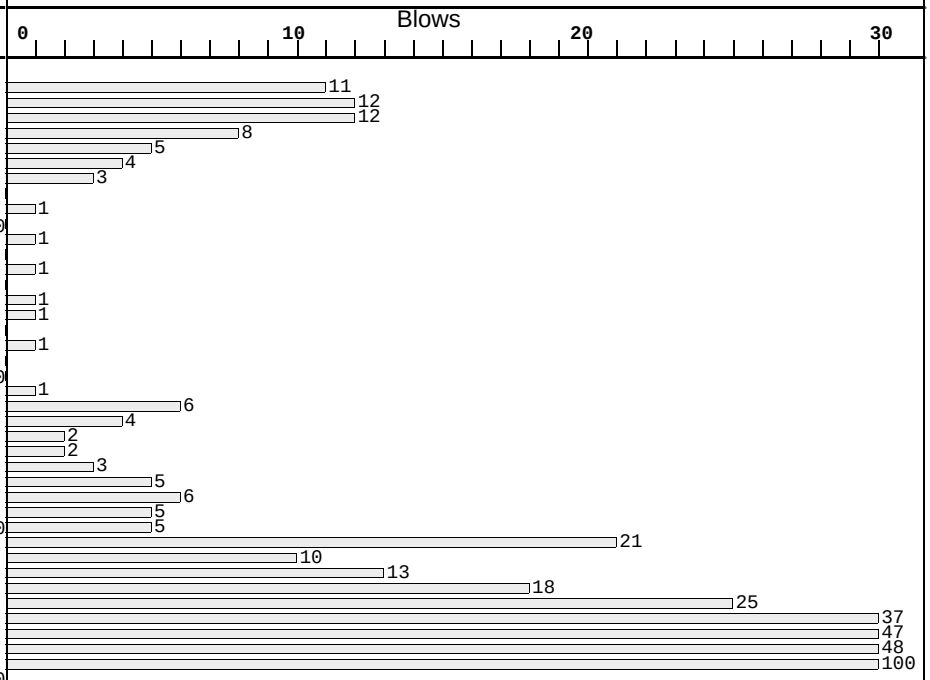
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP2**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389141.1** E **390310.4** N	Ground Level	**42.13** m OD

Testing — Scale 1:50

Remarks	Torque N/m	Blows	Level	Depth
		11		
		12		
		12		
		8		
		5		
		4		
		3		
		0		
		1		
		0	41.1	1.00
		1		
		0		
		1		
		0		
		1		
		1		
		0		
		1		
		0		
		0	40.1	2.00
		1		
		6		
		4		
		2		
		2		
		3		
		5		
		6		
		5		
		5	39.1	3.00
		21		
		10		
		13		
		18		
		25		
		37		
		47		
		48		
		100	38.1	4.00
			37.1	5.00
			36.1	6.00
			35.1	7.00
			34.1	8.00
			33.1	9.00
			32.1	10.00



Probing

Depth	Dia	Technique	Crew
3.87	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
3.87		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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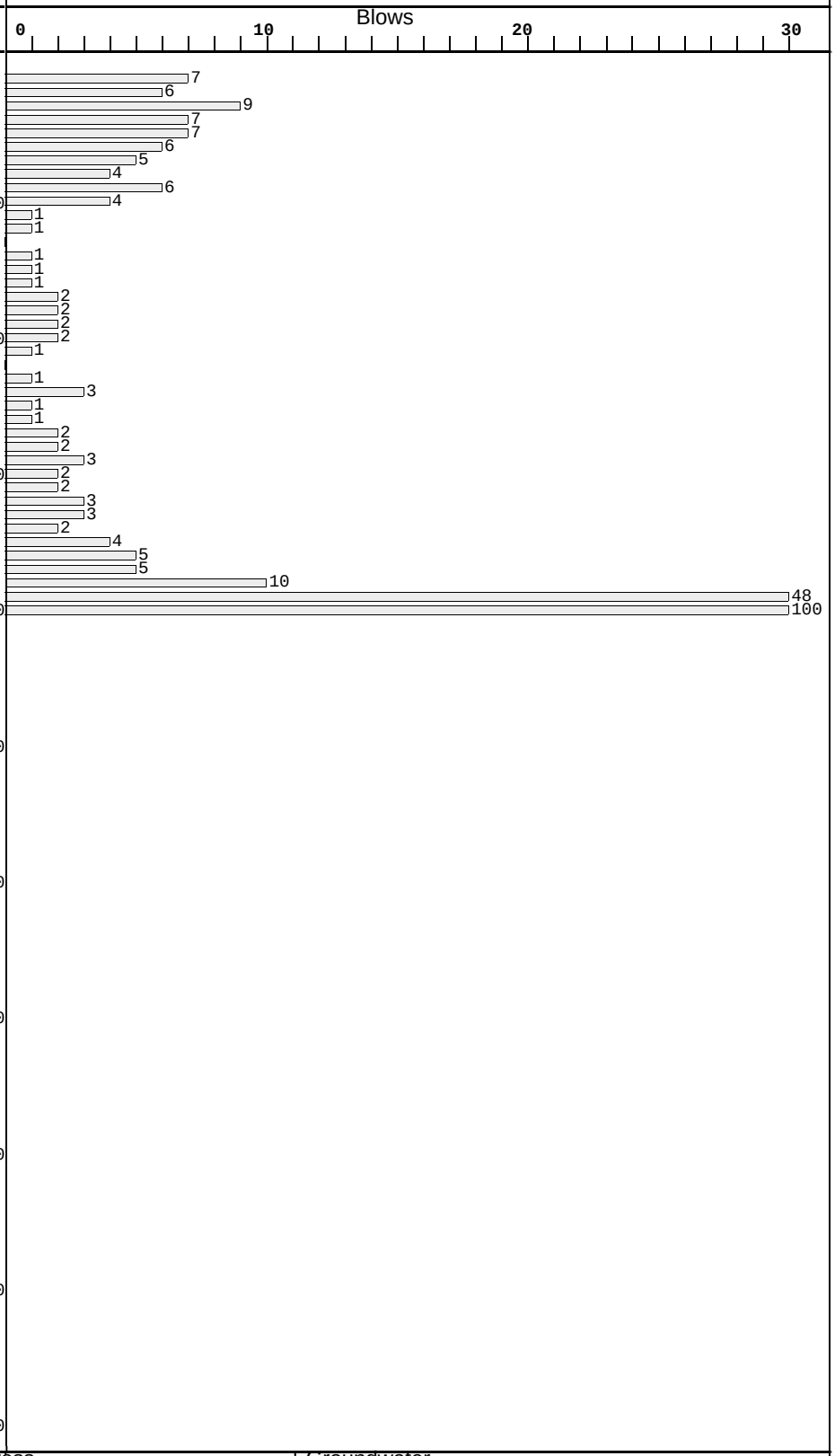
DYNAMIC PROBE RECORD - Super Heavy

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP3**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389138.1** E **390305.6** N	Ground Level	**42.13** m OD

Testing — Scale 1:50



Remarks	Torque N/m	Blows	Level	Depth
		7 6 9 7 7 6 5 4 6 4	41.1	1.00
		1 1 0 1 1 1 2 2 2 2 2	40.1	2.00
		1 1 3 1 1 2 2 3 2 2	39.1	3.00
		3 3 3 2 4 5 5 10 48 100	38.1	4.00
			37.1	5.00
			36.1	6.00
			35.1	7.00
			34.1	8.00
			33.1	9.00
			32.1	10.00

Probing

Depth	Dia	Technique	Crew
3.95	0.05	Inspection Pit	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
3.95		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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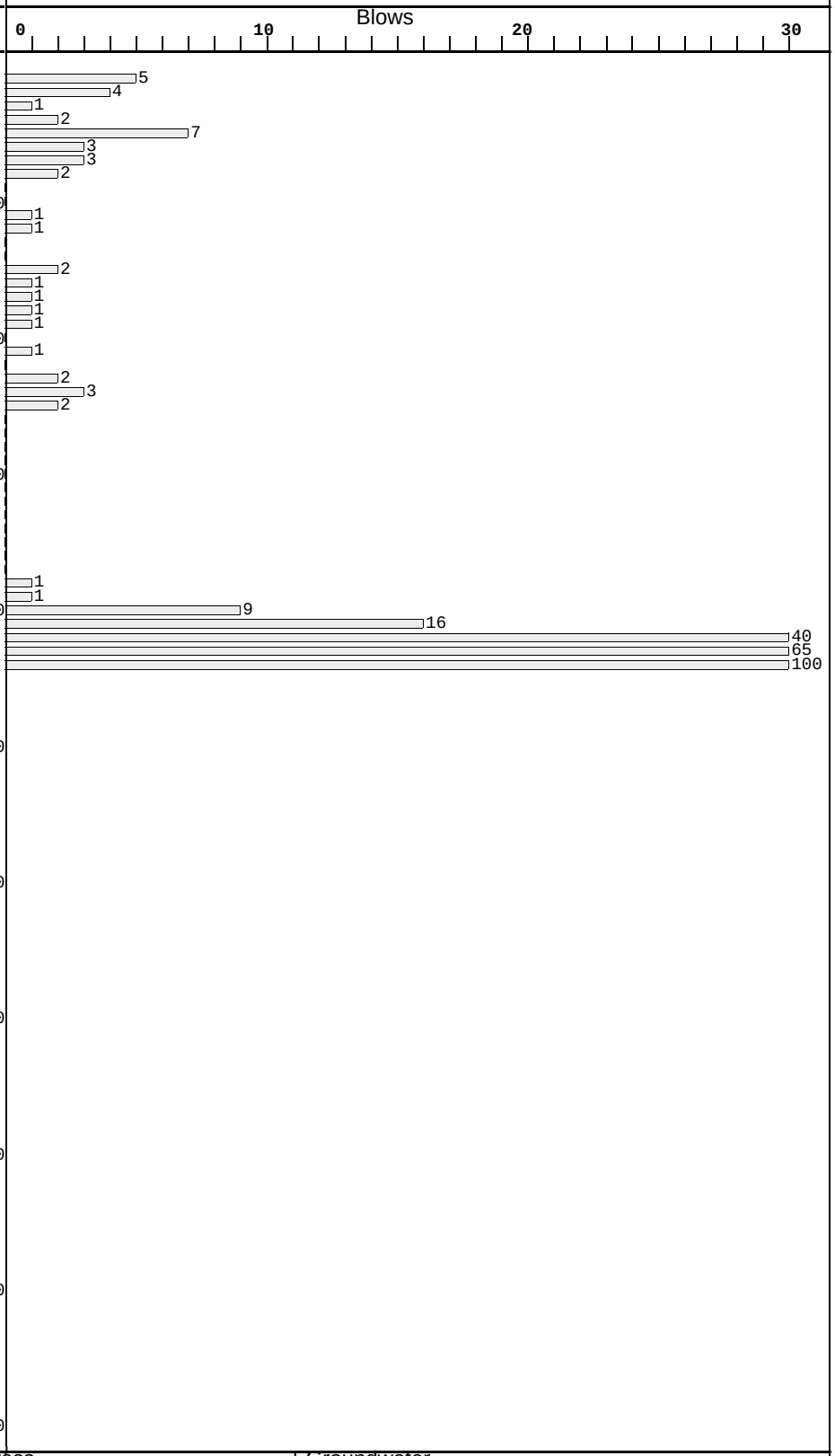
DYNAMIC PROBE RECORD - Super Heavy

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP4**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389142.6** E **390304.6** N	Ground Level	**42.07** m OD

Testing — Scale 1:50



Remarks	Torque N/m	Blows	Level	Depth
		5 4 1 2 7 3 3 2		
		0 1 1 0 0 2 1 1 1 1 0	41.0	1.00
		1 1 0 2 3 2 0 0 0 0 0	40.0	2.00
		0 0 0 0 0 0 0 0 1 1	39.0	3.00
		9 16 40 65 100	38.0	4.00
			37.0	5.00
			36.0	6.00
			35.0	7.00
			34.0	8.00
			33.0	9.00
			32.0	10.00

Probing

Depth	Dia	Technique	Crew
4.34	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
4.34		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks AGS Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP5**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389149.5** E **390269.8** N	Ground Level	**42.73** m OD

Testing — Scale 1:50

Remarks	Torque N/m	Blows	Level	Depth
		2	41.7	1.00
		2 1 1 1 1 1 1 1		
		2 2 2 1 2 1 2 4 5 4 3 2 4	40.7	2.00
		3 2 3 2 3 6 9 9 30 100	39.7	3.00
			38.7	4.00
			37.7	5.00
			36.7	6.00
			35.7	7.00
			34.7	8.00
			33.7	9.00
			32.7	10.00

Blows: 0 10 20 30

Probing

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
3.95	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			16/12/15	08:00
3.95		DRY	16/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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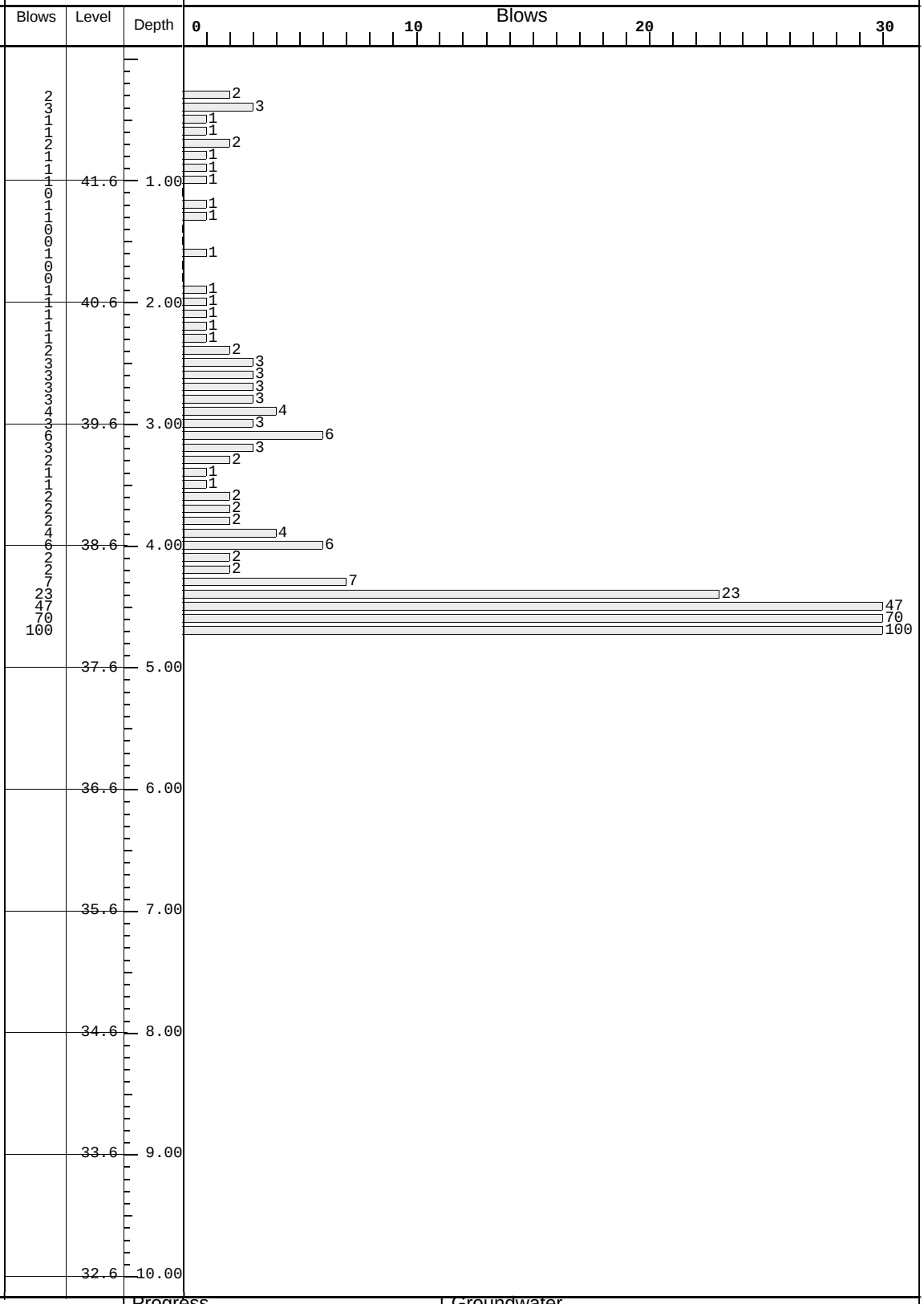
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP6**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389156.8** E **390270.8** N	Ground Level	**42.62** m OD

Testing — Scale 1:50



Probing

Depth	Dia	Technique	Crew
0.30	0.40	Inspection Pit	AT
4.75	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
4.75		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks AGS Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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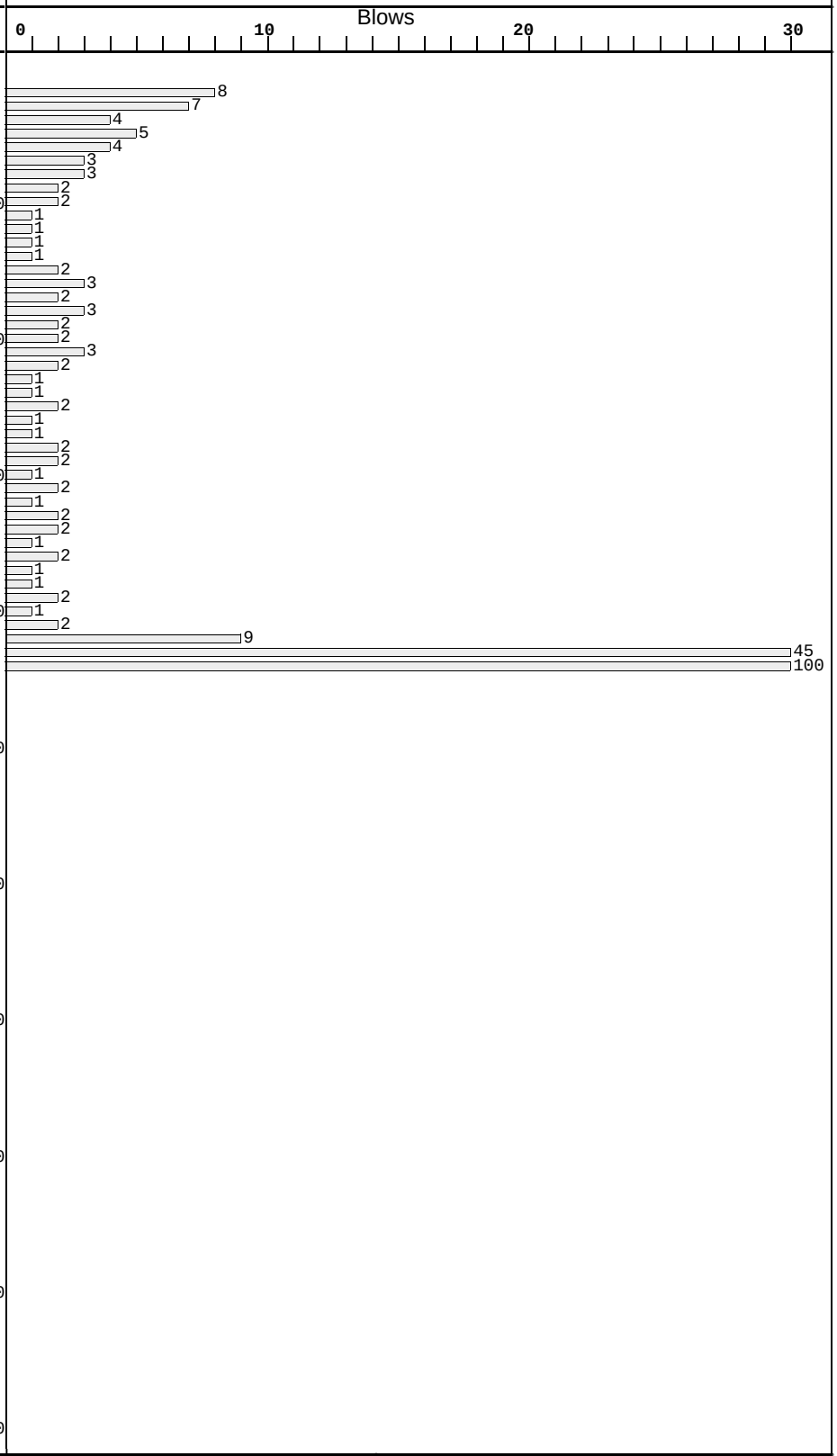
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP7**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389161.7** E **390271.3** N	Ground Level	**42.59** m OD

Testing — Scale 1:50

Remarks	Torque N/m	Blows	Level	Depth
		8 7 4 5 4 3 3 2 2		
		2 1 1 1 1 1 2 3 2 3 2 2 2	41.5	1.00
		3 2 1 1 2 1 1 2 2 1 2 1 2 2 1 2 1 1 2 1 1 2	40.5	2.00
		1 2 1 1 2 2 1 2 1 1 2	39.5	3.00
		1 2 9 45 100	38.5	4.00
			37.5	5.00
			36.5	6.00
			35.5	7.00
			34.5	8.00
			33.5	9.00
			32.5	10.00



Probing

Depth	Dia	Technique	Crew
0.20	0.40	Inspection Pit	AT
4.46	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			16/12/15	08:00
4.46		DRY	16/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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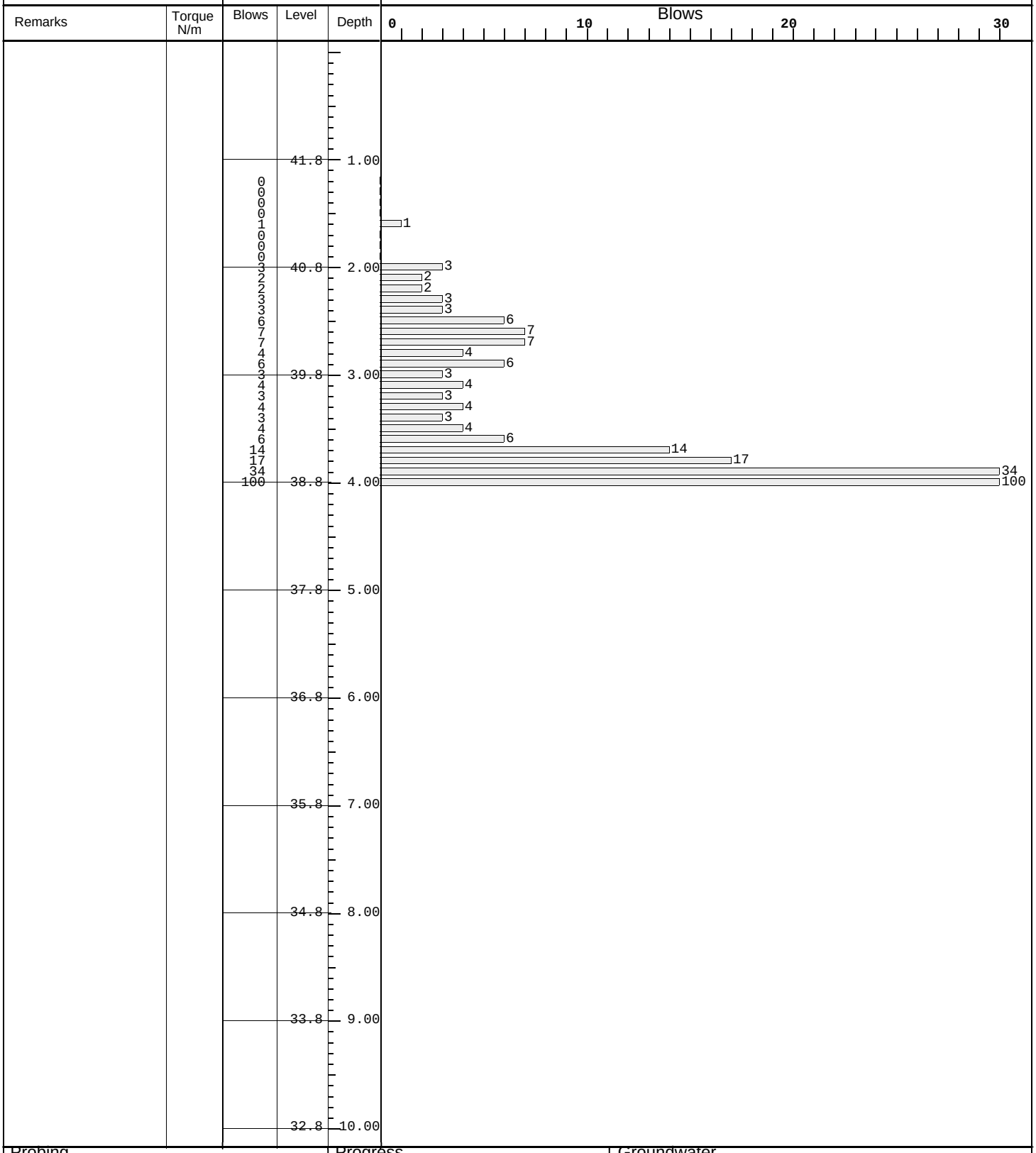
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP8**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389152.9** E **390260.0** N	Ground Level	**42.85** m OD

Testing — Scale 1:50



Probing

Depth	Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
4.07	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			16/12/15	08:00
4.07		DRY	16/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Figure **1 of 1**
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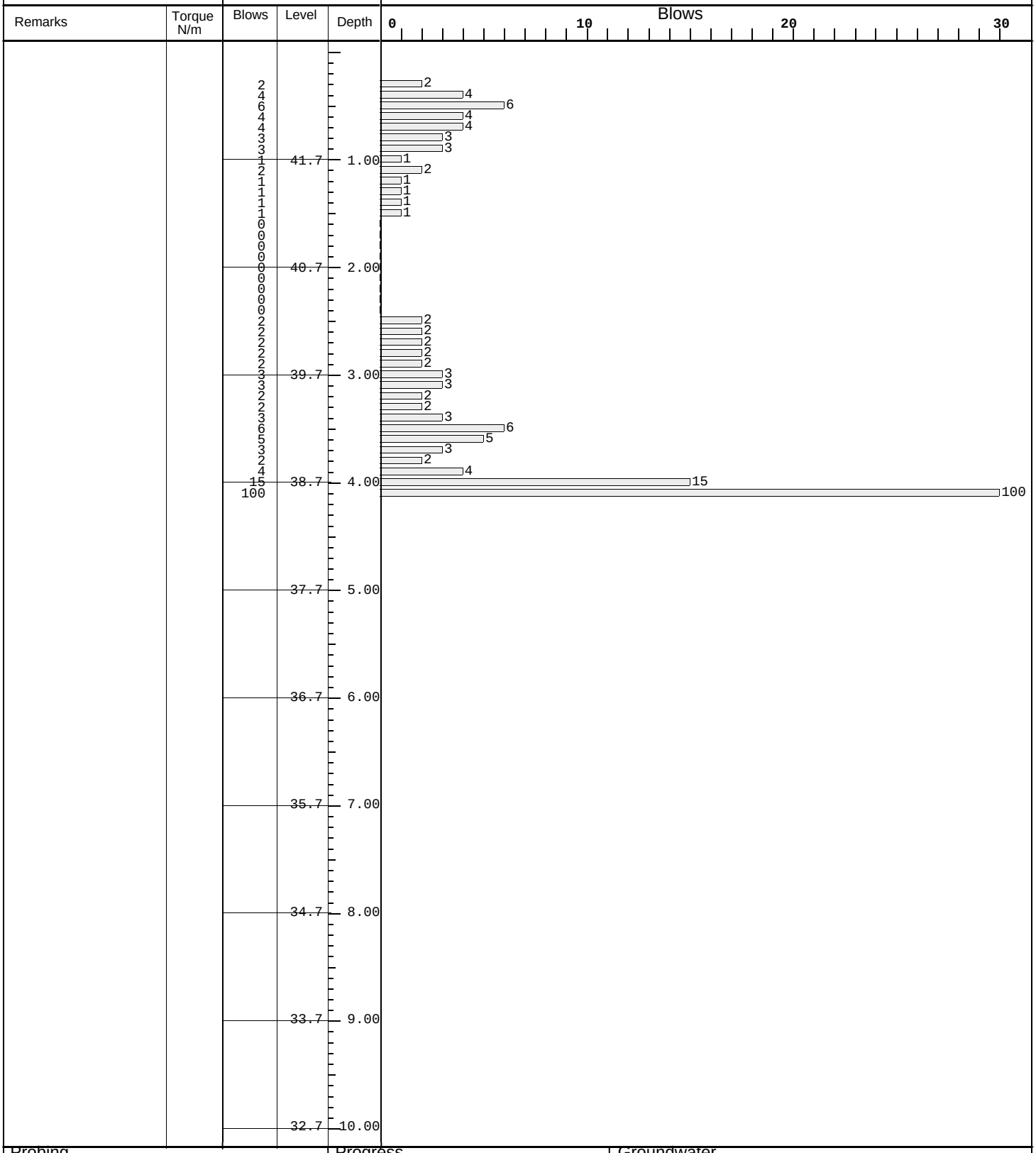
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP9**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389159.2** E **390263.8** N	Ground Level	**42.71** m OD

Testing — Scale 1:50



Probing

Depth	Dia	Technique	Crew
0.30	0.40	Inspection Pit	AT
4.08	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			17/12/15	08:00
7.08		DRY	17/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Figure **1 of 1**
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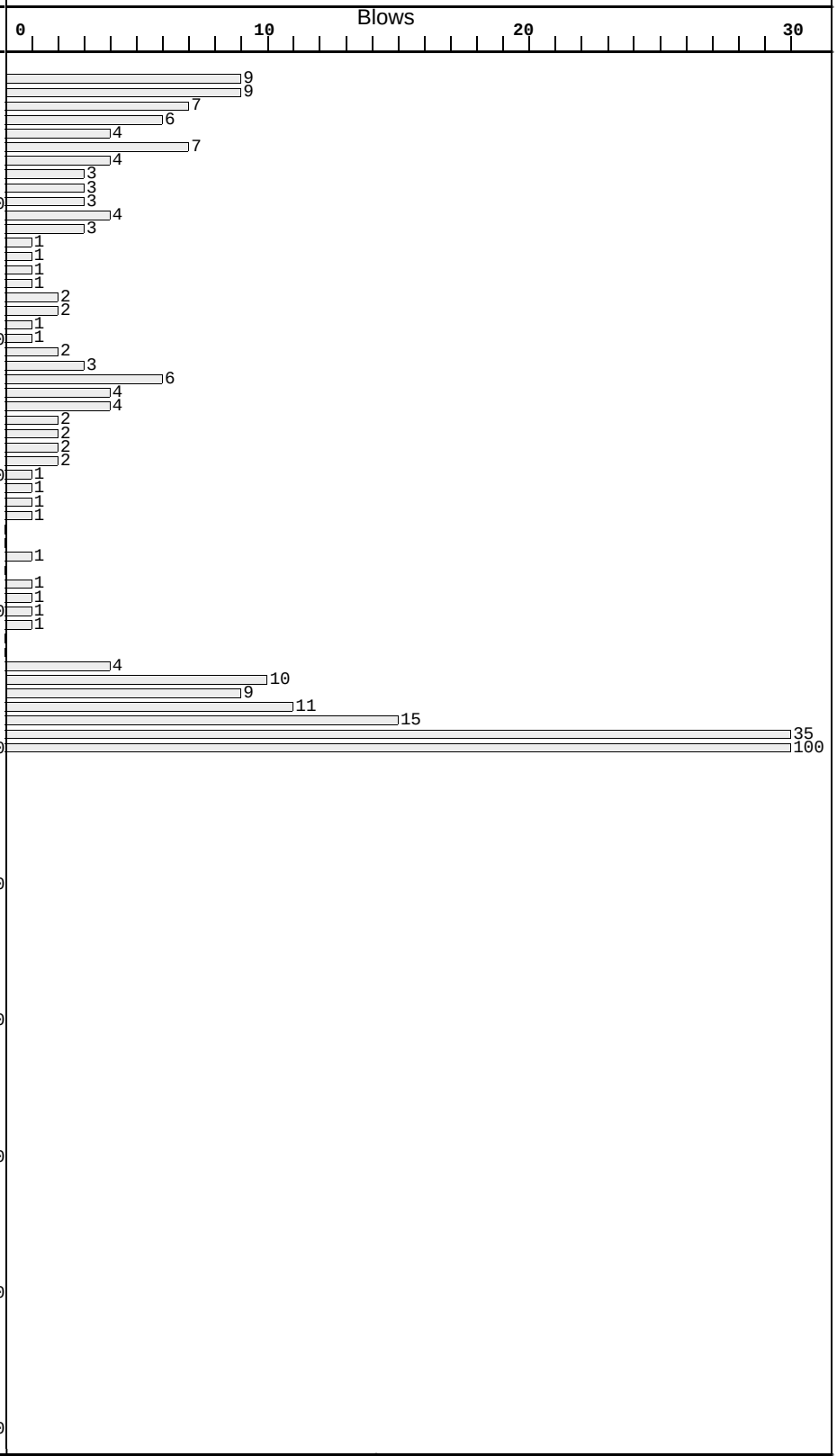
DYNAMIC PROBE RECORD - *Super Heavy*

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**DP10**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389164.1** E **390266.9** N	Ground Level	**42.65** m OD

Testing — Scale 1:50

Remarks	Torque N/m	Blows	Level	Depth
		9 9 7 6 4 7 4 3 3 3 3 4 3 1 1 1 1 1 2 2 1 1 1 2 3 6 4 4 2 2 2 2 2 1 1 1 1 1 0 0 1 0 1 1 1 1 0 0 4 10 9 11 15 35 100	41.6 40.6 39.6 38.6 37.6 36.6 35.6 34.6 33.6 32.6	1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00



Probing

Depth	Dia	Technique	Crew
4.98	0.05	Dynamic Probe	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			16/12/15	08:00
5.98		DRY	16/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks: Probe equipment checked and test carried out in accordance with BS EN ISO 22476-2:2005.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Figure **1 of 1**
11/03/2016

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APPENDIX 7

Dynamic Sample Borehole Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

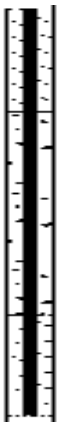
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



Seal

Filter

Seal

Strata

Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

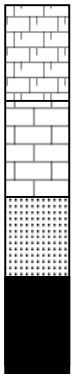
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



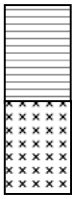
Chalk

Limestone

Sandstone

Coal

Strata, Continued



Mudstone

Siltstone

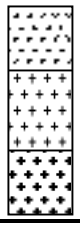
Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS201** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389210.7** E **390145.9** N | Ground Level **45.61** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		45.61
0.20	ES					MADE GROUND: Brownish orange gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.			
0.50	ES								
							0.80		44.81
1.00- 1.20	D					MADE GROUND: Soft brown sandy gravelly clay, locally silt. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments. Below 1.20m, stiff.			
1.00	ES								
1.20- 2.00	B								
1.20- 1.65	D	(DRY)		18	S28				
2.00- 2.45	D	(DRY)			S11		2.00		43.61
2.00- 2.40	D					Firm greyish brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies.			
2.40- 3.00	B			23					
3.00- 3.45	D	(DRY)			S10		3.00		42.61
3.00- 3.20	D					Firm brown CLAY.			
3.20- 3.50	B								
3.50- 3.60	D						3.50		42.11
3.60- 4.00	B					Very dense reddish brown fine to medium SAND.			
4.00- 4.27	D	(DRY)			S50/ 115				
							4.27		41.34
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
4.27	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			30/11/15	08:00
4.27		DRY	30/11/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 4.00m with a slotted section from 3.50m to 4.00m with flush lockable protective cover. Backfill details from base of hole: fine gravel filter up to 3.50m, bentonite seal up to 1.50m, arisings up to 0.20m, concrete up to ground level.

Logged by **NM**

Figure **1 of 1**

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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS203
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389159.1 E 390201.0 N	Ground Level	43.01 m OD

Scale 1:50

Sampling: Depth	Sample Type	Depth Cased & (to Water)	Properties: Strength kPa	w %	SPT N	Strata: Description	Depth	Legend	Level m OD
							G.L.		43.01
						MADE GROUND: Tarmacadam.	0.10		42.91
0.20- 0.50	B					MADE GROUND: Dark brown sandy angular to subangular fine to medium gravel of various lithologies, fragments of brick and concrete. Occasional rootlets.	0.20		42.81
0.20	ES								
0.50- 1.00	B								
0.50	ES								
1.00	ES					MADE GROUND: Very loose dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick.			
1.20- 2.00	B								
1.20- 1.65	D	(DRY)			S0		1.50		41.51
						Very loose reddish brown gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse of sandstone. Low cobble content of sandstone.			
2.00- 3.00	B						2.00		41.01
2.00- 2.45	D	(DRY)			S34				
						Dense brown gravelly fine to medium SAND with black organic matter. Gravel is subangular to subrounded fine to coarse of sandstone.	2.30		40.71
						Dense orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone. Low cobble content of sandstone. At 3.00m, very dense.			
3.00- 3.34	D	(DRY)			S50/ 185				
						End of Borehole	3.34		39.67

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
3.34	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			04/12/15	08:00
3.34		DRY	04/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 3.00m with a geowrapped slotted section from 2.00m to 3.00m with flush lockable protective cover. Backfill details from base of hole: fine gravel filter up to 2.00m, bentonite seal up to 0.20m, concrete up to 0.05m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by NM

Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS204** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389161.8** E **390232.6** N | Ground Level **42.85** m OD

Scale 1:50

Sampling: Depth	Sample Type	Depth Cased & (to Water)	Properties: Strength kPa	w %	SPT N	Strata: Description	Depth	Legend	Level m OD
							G.L.		42.85
						MADE GROUND: Tarmacadam.	0.10		42.75
0.20- 0.50	B					MADE GROUND: Dark brown gravelly fine to medium sand of ash. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick.	0.50		42.35
0.20	ES								
0.50- 1.00	B								
0.50	ES								
1.00	ES					MADE GROUND: Brown gravelly fine to medium sand. Gravel is angular to subangular fine to medium of various lithologies and fragments of brick. Many rootlets.	1.20		41.65
1.20- 2.00	B								
1.20- 1.65	D	(DRY)			S10				
						MADE GROUND: Loose orangish brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick. Between 1.40m and 1.50m, band of sandy clay. Between 1.50m and 1.55m, cobbles of sandstone.	1.55		41.30
2.00- 2.50	B								
2.00- 2.45	D	(DRY)			S18				
2.50- 2.86	D	(DRY)			S50/ 205	Medium dense orangish grey fine to coarse SAND.	2.45		40.40
						Very dense orange gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone.	2.86		39.99
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
2.86	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			03/12/15	08:00
2.86		DRY	03/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 2.45m with a geowrapped slotted section from 1.50m to 2.45m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 2.45m, fine gravel filter up to 1.50m, bentonite seal up to 0.20m, concrete up to 0.05m, tarmacadam up to ground level.

Logged by **NM**

Figure **1 of 1**

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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	**STOCKPORT BUS STATION**	Engineer	**AECOM**	**Borehole**	**WS205**
				Project No	**PN153428**
Client	**TRANSPORT FOR GREATER MANCHESTER**	National Grid Coordinates	**389192.1** E **390221.8** N	Ground Level	**42.39** m OD

Sampling / Properties / Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		42.39
						MADE GROUND: Grey granite cobble setts.	0.10		42.29
0.20	ES					**MADE GROUND: Light brown gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of concrete.**			
0.50	ES								
1.00	ES								
1.20- 2.00	B						1.20		41.19
1.20- 1.65	D	(DRY)			S38	**Dense orangish brown gravelly fine to coarse SAND with a medium subangular cobble content of sandstone. Gravel is subangular to subrounded fine to coarse including sandstone and mudstone.**			
2.00- 2.38	D	(DRY)			S50/ 230	**At 2.00m, very dense.**			
						End of Borehole	2.38		40.01

Boring / Progress / Groundwater

Boring Depth	Hole Dia	Technique	Crew	Progress Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	AT	G.L.			11/12/15	08:00						None encountered.
2.38	0.10	Dynamic Sampler	AT	2.38		DRY	11/12/15	18:00						

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars.
A 50mm standpipe was installed to 2.00m with a geowrapped slotted section from 1.50m to 2.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 1.50m, gravel filter up to 1.00m, bentonite seal up to 0.30m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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Figure **1 of 1**

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS206
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389278.8 E 390194.8 N	Ground Level	48.13 m OD

Scale 1:50

Sampling			Properties			Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		48.13
						MADE GROUND: Tarmacadam.			
0.20	ES						0.20		47.93
0.50- 1.00	B					MADE GROUND: Dark greyish brown gravelly sand of ash. Gravel is subangular to subrounded fine to medium of various lithologies.			
0.50	ES								
1.00	ES						1.00		47.13
1.20- 1.65	D	(DRY)			S50	MADE GROUND: Dense to very dense brown slightly gravelly fine to medium sand of ash. Gravel is angular to subangular fine to medium of various lithologies. Low cobble content of broken brick and concrete.			
1.20- 1.50	D								
1.50- 2.00	B								
2.00- 2.34	D	(DRY)			S50/ 190				
							2.34		45.79
						End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.50	Inspection Pit	AT	G.L.			02/12/15	08:00						None encountered.
2.34	0.10	Dynamic Sampler	AT	2.34		DRY	02/12/15	18:00						

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 2.00m with a geowrapped slotted section from 1.00m to 2.00m with flush lockable protective cover. Backfill details from base of hole: fine gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to 0.10m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS208
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389241.3 E 390273.4 N	Ground Level	42.35 m OD

Sampling / Properties / Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
						MADE GROUND: Concrete.	G.L.		42.35
0.50- 1.00	B								
0.50	ES					MADE GROUND: Dark brownish grey gravelly sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick.	0.50		41.85
1.00	ES								
1.20- 1.65	D	(DRY)		12	S14				
1.20- 1.30	D								
1.30- 1.70	B					Firm brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to medium of various lithologies.	1.30		41.05
1.70- 1.80	D						1.70		40.65
1.80- 2.00	D								
2.00- 2.45	D	(DRY)			S7	Loose light brown to reddish brown gravelly SAND. Gravel is subrounded fine to medium of sandstone.			
2.00- 2.40	D								
2.40- 2.80	B					Between 2.40m and 2.80m, grading to silty sand and gravel.			
2.40- 2.80	B								
2.80- 3.00	D								
3.00- 3.50	B					At 3.00m, very dense.			
3.00- 3.20	D	(DRY)			S50/50				
						End of Borehole	3.20		39.15

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
3.20	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			01/12/15	08:00
3.20		DRY	01/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 2.80m with a geowrapped slotted section from 1.70m to 2.80m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 2.80m, fine gravel filter up to 1.70m, bentonite seal up to 0.70m, sub base up to 0.20m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS209
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389242.3 E 390284.3 N	Ground Level	42.67 m OD

Scale 1:50

Sampling: Depth	Sample Type	Depth Cased & (to Water)	Properties: Strength kPa	w %	SPT N	Strata: Description	Depth	Legend	Level m OD
							G.L.		42.67
						MADE GROUND: Tarmacadam.			
0.20	ES						0.20		42.47
0.50	ES					MADE GROUND: Dark brown gravelly fine to medium sand of ash. Gravel is subangular to subrounded fine to medium of various lithologies and fragments of concrete and brick.			
0.60- 1.00	B								
1.00	ES						0.80		41.87
1.20- 1.65	D	(DRY)			S16	Medium dense reddish brown gravelly fine to coarse SAND with a low cobble content of sandstone. Gravel is subangular to subrounded fine to coarse including sandstone and quartzite.			
1.20- 1.30	D								
1.30- 1.60	B								
1.60- 2.00	B						1.60		41.07
2.00- 2.45	D	(DRY)			S9	Loose reddish brown very gravelly clayey SAND with a low cobble content of sandstone. Gravel is subangular to subrounded fine to coarse including sandstone and mudstone.			
2.00- 2.40	D								
2.40- 3.00	B								
3.00- 3.26	D	(DRY)			S50/ 105	At 3.00m, very dense.			
						End of Borehole	3.26		39.41

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
3.26	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			02/12/15	08:00
3.26		DRY	02/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 3.00m with a geowrapped slotted section from 1.00m to 3.00m with flush lockable protective cover. Backfill details from base of hole: fine gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to 0.10m, tarmacadam up to ground level.

Logged by NM

Figure 1 of 1
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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS210
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389316.0 E, 390273.8 N	Ground Level	44.43 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		44.43
0.20- 0.50	B					MADE GROUND: Grey and red angular cobbles of brick and concrete.	0.10		44.33
0.20	ES								
0.50- 1.00	B					MADE GROUND: Loose to medium dense dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick.			
0.50	ES								
1.00	ES								
1.20- 2.00	B								
1.20- 1.65	D	(DRY)			S28				
2.00- 3.00	B					At 2.00m, loose, grading to slightly silty very sandy gravel.			
2.00- 3.00	B								
2.00- 2.45	D	(DRY)			S5				
							2.60		41.83
3.00- 4.00	B					Medium dense greyish orange very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse including sandstone.			
3.00- 3.45	D	(DRY)			S18				
4.00- 5.00	B					At 4.00m, silty.			
4.00- 4.45	D	(DRY)			S23				
5.00- 5.09	D	(DRY)			S50/40	At 5.00m, very dense.			
						End of Borehole	5.09		39.34

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
5.09	0.15	Cable Percussion	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			09/12/15	08:00
5.09		DRY	09/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 5.00m with a geowrapped slotted section from 3.00m to 5.00m with flush lockable protective cover. Backfill details from base of hole: gravel filter up to 3.00m, bentonite seal up to 0.30m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by NM

Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS211
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389333.0 E, 390302.7 N	Ground Level	44.88 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		44.88
0.20- 0.50	B					MADE GROUND: Grey concrete.	0.10		44.78
0.20	ES					MADE GROUND: Dark brown gravelly fine to medium sand with ash present. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete.	0.50		44.38
0.50- 1.00	B								
0.50	ES								
1.00- 1.20	B					MADE GROUND: Soft brown slightly gravelly sandy clay. Gravel is subangular to subrounded fine to coarse of various lithologies, brick and concrete.	1.00		43.88
1.00	ES						1.20		43.68
1.20- 1.50	B								
1.20- 1.65	D	(DRY)			S19				
1.50- 1.60	D					MADE GROUND: Light brown gravelly clayey fine to coarse sand. Gravel is subangular to subrounded fine to coarse to various lithologies and brick fragments.			
1.60- 1.80	B								
1.80- 2.00	B						1.80		43.08
2.00- 2.60	B								
2.00- 2.45	D	(DRY)			S6	MADE GROUND: Medium dense dark brown mottled black clayey gravelly fine to medium sand with a strong hydrocarbon odour and organic remains. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.			
2.60- 2.80	B						2.60		42.28
2.80- 3.00	B					MADE GROUND: Loose orangish brown clayey gravelly fine to medium sand. Gravel is angular to subrounded fine to coarse of various lithologies, brick and glass.			
3.00- 3.50	B						3.00		41.88
3.00- 3.45	D	(DRY)			S4				
3.50- 3.80	B					MADE GROUND: Dark grey clayey gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and brick fragments.	3.50		41.38
3.80- 4.00	D			43			3.80		41.08
4.00- 4.45	D	(DRY)			S12		4.00		40.88
4.00- 4.50	D					Very loose/loose grey clayey fine to coarse SAND.			
						Orangish grey fine to coarse SAND.			
4.60- 4.67		(DRY)			S50/40	Soft dark grey sandy CLAY, locally silt.	4.67		40.21
						Medium dense greyish orange fine to coarse SAND. At 4.60m, very dense.			
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
4.67	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			08/12/15	08:00
4.67		DRY	08/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 2.00m with a geowrapped slotted section from 1.00m to 2.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 2.00m, fine gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS212** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389284.7** E **390377.1** N | Ground Level **45.74** m OD

Scale 1:50

Sampling Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		45.74
						MADE GROUND: Concrete slab.	0.08		45.66
0.50	ES					**MADE GROUND: Loose dark brown gravelly fine to medium sand of ash. Gravel is angular to subangular fine to coarse of various lithologies and concrete.**			
1.00	ES								
1.20- 1.50	B								
1.20- 1.65	D	(DRY)			S9				
1.50- 1.70	D						1.50		44.24
1.70- 2.00	B					**MADE GROUND: Loose dark brown gravelly fine to medium sand with black organic matter. Gravel is angular to subangular fine to coarse of various lithologies.**	1.70		44.04
2.00- 2.40	B								
2.00- 2.45	D	(DRY)			S4	**Very loose/loose brown slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse predominantly of sandstone.**	2.40		43.34
2.40- 2.60	D								
2.60- 3.00	B					**Soft brown slightly gravelly sandy CLAY, locally silt. Gravel is subangular to subrounded fine to coarse of various lithologies.**			
3.00- 3.45	D	(DRY)		22	S25	**At 3.00m, stiff.**			
3.00- 3.40	D								
3.00- 3.40	D								
							3.40		42.34
3.40- 3.70	B					**Stiff brown slightly sandy CLAY.**			
3.70- 4.00	B						3.70		42.04
4.00- 4.43	D	(DRY)			S50/ 275	**Very dense reddish brown fine to coarse SAND.**			
							4.43		41.31
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
4.43	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			07/12/15	08:00
4.43		DRY	07/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

AGS

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 3.50m with a geowrapped slotted section from 2.50m to 3.50m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 3.50m, fine gravel filter up to 2.50m, bentonite seal up to 1.00m, sub base up to 0.20m, concrete up to ground level.

Logged by **NM**

Figure **1 of 1**

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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS214** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389280.9** E **390357.9** N | Ground Level **46.35** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		46.35
						MADE GROUND: Grey concrete.	0.07		46.28
0.20- 0.50	B					MADE GROUND: Orange fine to coarse sand.	0.15		46.20
0.20	ES								
0.50- 1.00	B					MADE GROUND: Dark brown gravelly fine to coarse sand with ash. Gravel is subangular to subrounded fine to coarse of various lithologies, ceramic, brick fragments and concrete.			
0.50	ES								
1.00- 1.20	B						1.00		45.35
1.00	ES								
1.20- 1.65	D	(DRY)			S14	Medium dense reddish brown fine to coarse SAND with a low cobble content.			
1.20- 1.40	D								
1.40- 1.50	D						1.50		44.85
1.50- 1.80	B					Medium dense reddish brown gravelly fine to medium SAND with black organic remains. Gravel is subangular to subrounded fine to coarse of various lithologies.			
1.80- 2.00	D						1.80		44.55
2.00- 2.45	D	(DRY)			S5				
2.00- 2.40	D					Loose reddish brown gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse including sandstone and mudstone. At 2.40m, very gravelly.			
2.40- 3.00	B								
3.00- 3.45	D	(DRY)			S4				
3.00- 3.50	D								
3.50- 3.70	B								
3.70- 4.00	B						3.70		42.65
4.00- 4.45	D	(DRY)			S2	Dark brown mottled black fine to coarse gravelly SAND with black organic remains. Gravel is subangular to subrounded fine to coarse including mudstone.	4.00		42.35
4.50- 4.70	D					Very loose brown clayey fine to coarse SAND.			
							4.70		41.65
5.00- 5.45	D	(DRY)			S9	Loose brown fine to coarse SAND.			
							5.45		40.90
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
5.45	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			08/12/15	08:00
5.45		DRY	08/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
Clay pipe noted in side of inspection pit.
A 50mm standpipe was installed to 1.00m with a geowrapped slotted section from 0.50m to 1.00m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 1.00m, fine gravel filter up to 0.50m, bentonite seal up to 0.20m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **NM**

Figure **1 of 1**

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS217** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389229.8** E **390255.0** N | Ground Level **42.30** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		42.30
						MADE GROUND: Grey subangular granite cobble setts.	0.10		42.20
0.20	ES					**MADE GROUND: Light brown gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of concrete (Sub base).**			
0.50	ES								
1.00	ES								
1.20- 1.30	D						1.20		41.10
1.20- 1.65		(DRY)			S26	**Dark brown clayey gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse including limestone and sandstone.**	1.30		41.00
1.30- 2.00	B								
1.30	ES								
2.00- 2.60	B					**Medium dense greyish orange gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse including limestone, sandstone and quartzite.**			
2.00- 2.45	D	(DRY)			S28				
2.60- 2.68	D	(DRY)			S50/25	**At 2.60m, very dense.**			
							2.68		39.62
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
2.68	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			14/12/15	08:00
2.68		DRY	14/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A 50mm standpipe was installed to 2.50m with a geowrapped slotted section from 1.50m to 2.50m with flush lockable protective cover. Backfill details from base of hole: gravel filter up to 1.50m, bentonite seal up to 0.50m, sub base up to 0.30m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by **JBSI**

Figure **1 of 1**

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS218
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389254.7 E 390238.1 N	Ground Level	42.75 m OD

Scale 1:50

Sampling			Properties			Strata			
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
						MADE GROUND: Grey concrete.	G.L.		42.75
0.50	ES					MADE GROUND: Light grey gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of concrete, granite and sandstone. At 0.60m, with a medium angular cobble content of sandstone, granite and concrete.	0.40		42.35
0.95- 1.00	D					Medium dense greyish brown clayey sandy angular to subangular fine to coarse GRAVEL including sandstone and limestone. At 0.95m, with clay bands.	0.95		41.80
1.00	ES								
1.20- 1.65	D	(0.90)			S27				
						End of Borehole	1.70		41.05

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	AT	G.L.			15/12/15	08:00	0.90		0.80	20		Slow inflow.
1.65	0.10	Dynamic Sampler	AT	1.70		0.90	15/12/15	18:00						

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
The borehole was terminated at a depth of 1.70m having met refusal on an obstruction.
Backfill details from base of hole: arisings up to 0.40m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS218A
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389253.9 E 390239.0 N	Ground Level	42.71 m OD

Sampling / Properties / Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		42.71
						MADE GROUND: Grey concrete.			
							0.40		42.31
0.50	ES					MADE GROUND: Light grey gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of concrete, granite and sandstone.			
1.00	ES								
1.20- 2.00	B						1.20		41.51
1.20- 1.65	D	(DAMP)			S11	Loose greenish brown clayey fine to medium SAND.			
1.20	ES						1.50		41.21
						Medium dense orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse including sandstone.			
2.00- 3.00	B								
2.00- 2.45	D	(DRY)			S14				
							2.50		40.21
						Very dense orange gravelly fine to coarse SAND with a low subangular cobble content of sandstone. Gravel is subangular to subrounded fine to coarse			
3.00- 3.17	D	(DRY)			S50/50	of sandstone.			
							3.17		39.54
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
3.17	0.15	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			16/12/15	08:00
3.17		DRY	16/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.90					Damp - no rise.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A 50mm standpipe was installed to 2.50m with a geowrapped slotted section from 1.00m to 2.50m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 2.50m, gravel filter up to 1.00m, bentonite seal up to 0.40m, sub base up to 0.20m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Figure 1 of 1
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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project **STOCKPORT BUS STATION** | Engineer **AECOM** | **Borehole** **WS219** | Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER** | National Grid Coordinates **389259.7** E **390175.3** N | Ground Level **45.13** m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		45.13
						MADE GROUND: Concrete.	0.20		44.93
0.50- 0.90	B					MADE GROUND: Greyish brown gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of various lithologies.	0.50		44.63
0.50	ES								
1.00	ES					Reddish brown sandy angular to subangular fine to coarse GRAVEL of limestone. Medium angular to subangular cobble content.			
1.20- 2.00	B						1.20		43.93
1.20- 1.65	D	(DRY)			S26	Medium dense brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of limestone.			
2.00- 2.45	D	(DRY)			S44	At 2.00m, dense.			
						End of Borehole	2.45		42.68

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
2.45	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			01/12/15	08:00
2.45		DRY	01/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
Backfill details from base of hole: bentonite seal up to ground level.

Logged by **NM**

Figure **1 of 1**
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Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS220
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389143.2 E 390224.6 N	Ground Level	44.69 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		44.69
						MADE GROUND: Tarmacadam.	0.10		44.59
0.20- 0.50	B					MADE GROUND: Light brown gravelly fine to medium sand of ash. Gravel is subangular to subrounded fine to coarse of sandstone and fragments of brick.	0.20		44.49
0.20	ES								
0.50- 1.00	B								
0.50	ES								
						MADE GROUND: Very loose/loose dark brown gravelly fine to medium sand of ash. Gravel is subangular to subrounded fine to coarse of various lithologies, fragments of brick and concrete. Between 1.20m and 1.70m, black organic matter.			
1.00	ES								
1.20- 1.65	D	(DRY)			S4				
1.20- 1.30	D								
1.30- 1.70	B								
1.30- 1.70	D			33					
1.70- 2.00	B						1.70		42.99
						Medium dense light grey fine to coarse SAND. Between 2.00m and 2.60m, gravelly. Gravel is subangular to subrounded fine to coarse of sandstone.			
2.00- 2.45	D	(DRY)			S27				
2.00- 2.40	D								
2.40- 2.60	D								
2.60- 3.00	B						2.60		42.09
						Dense orangish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of sandstone.			
3.00- 4.00	B								
3.00- 3.45	D	(DRY)			S34				
						Below 3.60m, cobbles of sandstone.			
4.00- 4.07	D	(DRY)			S50/50	At 4.00m, very dense.			
						End of Borehole	4.07		40.62

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.50	Inspection Pit	AT
4.07	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			03/12/15	08:00
4.07		DRY	03/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
A 50mm standpipe was installed to 1.70m with a geowrapped slotted section from 1.20m to 1.70m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 1.70m, gravel filter up to 1.20m, bentonite seal up to 0.20m, concrete up to 0.05m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by NM

Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS221
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389275.0 E 390086.2 N	Ground Level	51.03 m OD

Sampling / Properties / Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	Description	Depth	Legend	Level m OD
						G.L.		51.03
0.10- 0.30	ES				**MADE GROUND: Topsoil with broken concrete. At 0.30m, sandstone.	0.30		50.73
					End of Borehole			

Boring / Progress / Groundwater

Boring Depth	Hole Dia	Technique	Crew	Progress Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.30	0.50	Inspection Pit	AT	G.L. 0.30			03/12/15 03/12/15	08:00 18:00						None encountered.

Remarks

Inspection pit hand excavated to 0.30m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
The Trial Pit was terminated at a depth of 0.30m due to the presence of an obstruction.
** Driller's description.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by NM

Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS223
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389237.7 E, 390204.9 N	Ground Level	43.39 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		43.39
						MADE GROUND: Grey concrete.	0.40		42.99
0.50- 1.00	B					MADE GROUND: Loose brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of sandstone and fragments of brick.			
0.50	ES								
1.00	ES								
1.20	D			20					
1.20- 1.65	D	(1.00)			S5		1.40		41.99
1.30- 1.90	B					Firm grey mottled dark brown slightly gravelly slightly sandy CLAY with organic traces. Gravel is subangular to subrounded fine to coarse of various lithologies.			
2.00- 2.50	B						2.00		41.39
2.00- 2.45	D	(1.30)			S10	Loose/medium dense greyish brown fine to medium clayey SAND.			
2.00	ES								
2.50- 3.00	B						2.50		40.89
						Medium dense greyish orange silty slightly gravelly fine to coarse SAND.			
3.00- 3.65	B								
3.00- 3.45	D	(2.50)			S20				
							3.20		40.19
						Medium dense greyish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse including quartzite and some igneous lithologies. At 3.65m, very dense.			
3.65- 3.72		(3.00)			S50/40		3.72		39.67
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	AT
3.72	0.10	Dynamic Sampler	AT

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			10/12/15	08:00
3.72		3.00	10/12/15	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20					Slow inflow.

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 2 x 60ml VOC vials, 1 x 1kg plastic tub and 2 x 258ml amber jars
A 50mm standpipe was installed to 1.40m with a geowrapped slotted section from 0.50m to 1.40m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 1.40m, gravel filter up to 0.50m, bentonite seal up to 0.30m, tarmacadam up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

Logged by NM

Figure 1 of 1

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geotechnics

BOREHOLE RECORD – Dynamic Sample

Project	STOCKPORT BUS STATION	Engineer	AECOM	Borehole	WS224
				Project No	PN153428
Client	TRANSPORT FOR GREATER MANCHESTER	National Grid Coordinates	389229.7 E 390086.4 N	Ground Level	53.31 m OD

Sampling / Properties / Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	Description	Depth	Legend	Level m OD
						G.L.		53.31
0.20- 0.50	B				MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is subangular to subrounded fine to coarse of various lithologies and fragments of brick. Some wood.			
0.20	ES							
0.50- 1.00	B							
0.50	ES							
1.00	ES							
1.20- 1.40	D					1.20		52.11
					Dark brown gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse including mudstone and quartzite.	1.40		51.91
1.40- 1.70	B							
					Brown gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse of various lithologies.	1.70		51.61
					End of Borehole			

Boring / Progress / Groundwater

Boring Depth	Hole Dia	Technique	Crew	Progress Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.50	Inspection Pit	AT	G.L.			04/12/15	08:00						None encountered.
1.70	0.10	Dynamic Sampler	AT	1.20		DRY	04/12/15	18:00						
				1.20		DRY	10/12/15	08:00						
				1.70		DRY	05/12/15	18:00						

Remarks

Inspection pit hand excavated to 1.20m depth.
ES Sample = 1 x 60ml VOC vial, 1 x 1kg plastic tub and 1 x 258ml amber jar.
The Dynamic Sample was undertaken using hand held equipment.
Backfill details from base of hole: arisings up to ground level.

Logged by NM

Figure 1 of 1
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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APPENDIX 8

Concrete Core Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

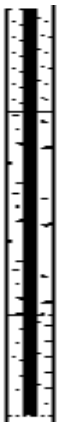
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



Seal

Filter

Seal

Strata

Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

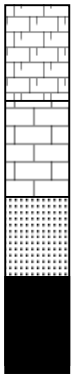
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



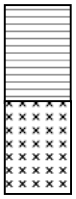
Chalk

Limestone

Sandstone

Coal

Strata, Continued



Mudstone

Siltstone

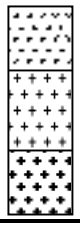
Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC1**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	Description General	Description Detail	Depth	Legend
							G.L.	
0.00- 0.14		C			MADE GROUND: Strong light grey fine grained micaceous sandstone with well bonded light grey mottled white mortar up to 5mm thick.		0.14	
					End of Borehole			

Drilling

Depth	Hole Dia	Technique	Crew
0.14		Concrete core	UU

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC2**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.24		C			MADE GROUND: Strong light grey fine grained micaceous sandstone with well bonded light grey mottled white mortar up to 5mm thick.		0.24	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.24		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC3**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.37		C			MADE GROUND: Strong light grey fine grained micaceous sandstone with well bonded light grey concrete, 70-80% aggregate of angular to subangular fine to coarse gravel of various lithologies. 5% voids in concrete.		0.37	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.37		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC4**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	Description General	Description Detail	Depth	Legend
							G.L.	
0.00- 0.25		C			MADE GROUND: Strong light grey fine grained micaceous sandstone with occasional orangish brown staining.		0.25	
					End of Borehole			

Drilling

Depth	Hole Dia	Technique	Crew
0.25		Concrete core	UU

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC5**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.40		C			MADE GROUND: Medium strong orangish brown bricks (216 x 102 x 64mm) with voids up to 5mm in size. Well bonded dark brown mortar up to 10mm thick.		0.40	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.40		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC5A**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.52		C			MADE GROUND: Medium strong orangish brown bricks (216 x 102 x 64) with voids up to 30mm in size. Well bonded, occasionally poorly bonded, dark brown mortar up to 15mm thick.		0.52	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.52		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC6**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Core Run/Depth (Core Dia)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	Description General	Description Detail	Depth	Legend
							G.L.	
0.00- 0.27		C			MADE GROUND: Strong light grey coarse grained sandstone.		0.27	
					End of Borehole			

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.27		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC8**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Depth	Legend
							G.L.	
0.00- 0.67		C			MADE GROUND: Strong to very strong grey coarse grained sandstone.	Between 0.10-0.17m, 70mm diameter void (probably previous core hole).	0.32	
					MADE GROUND: Orangish brown/reddish brown bricks (216 x 102 x 64mm) with voids up to 30mm in size. Well bonded grey mortar up to 10mm thick.		0.67	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.67		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC9**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.48		C			Brownish orange/red mottled yellow bricks (216 x 102 x 64mm) with voids up to 10mm. Well bonded grey mortar, up to 25mm thick.		0.48	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.48		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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BOREHOLE RECORD – Concrete core

Project **STOCKPORT BUS STATION** Engineer **AECOM** **Borehole** **CC10**
Project No **PN153428**

Client **TRANSPORT FOR GREATER MANCHESTER**

Scale 1:50

Drilling: Core Run/Depth (Core Dia)	Drilling: Depth Cased & (to Water)	Properties/Sampling: Type TCR/SCR%	Properties/Sampling: Length Max/Min	Properties/Sampling: RQD %	Strata: Description General	Strata: Description Detail	Strata: Depth	Strata: Legend
							G.L.	
0.00- 0.71		C			MADE GROUND: Reddish brown locally mottled yellowish brown bricks (216 x 102 x 64mm) with voids up to 50mm. Well bonded light grey sharp sand mortar up to 10mm thick.		0.71	
					End of Borehole			

Drilling: Depth	Hole Dia	Technique	Crew	Progress: Depth of Hole	Depth Cased	Depth to Water	Date	Time	Groundwater: Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
0.71		Concrete core	UU											

Remarks **Angle of Inclination: 0 degrees from horizontal.**

Logged by **NM**

Figure **1 of 1**
11/03/2016

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:1999 + A2:2010

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APPENDIX 9

Concrete Core Photographs

Project Number : PN153428

Project : STOCKPORT BUS STATION

Concrete core 1

Concrete core 2

Project Number : PN153428

Project : STOCKPORT BUS STATION

Concrete core 3

Concrete core 4

Project Number : PN153428

Project : STOCKPORT BUS STATION

Concrete core 5

Concrete core 5A

Project Number : PN153428

Project : STOCKPORT BUS STATION

Concrete core 6

Concrete core 8

Project Number : PN153428

Project : STOCKPORT BUS STATION

Concrete core 9

Concrete core 10

APPENDIX 10

Monitoring Results

FIELDWORK - *Water Level Monitoring*

Project STOCKPORT BUS STATION

Project No PN153428

Client TRANSPORT FOR GREATER MANCHESTER

Sheet No 1

Borehole		BH101		BH102		BH103		BH104		BH105		BH106	
Instrument (dia. mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)	
Depth to Base (m)		7.00		10.00		14.70		3.50		12.00		7.00	
Filter Zone (m)		5.00-7.00		8.00-10.00		11.00-14.00		1.00-3.50		9.50-12.00		5.00-7.00	
Level		45.22 m OD		43.35 m OD		42.42 m OD		42.47 m OD		42.62 m OD		42.45 m OD	
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
11 Jan 2016		6.17	*39.05*	5.42	*37.93*	6.60	*35.82*	3.56	*38.91*	6.41	*36.21*	5.41	*37.04*
25 Jan 2016		5.83	*39.39*	5.46	*37.89*	6.20	*36.22*	DRY		6.49	*36.13*	5.46	*36.99*
9 Feb 2016		5.79	*39.43*	5.35	*38.00*	6.50	*35.92*	3.57	*38.90*	6.40	*36.22*	5.20	*37.25*
22 Feb 2016		5.54	*39.68*	5.45	*37.90*	6.66	*35.76*	DRY		6.48	*36.14*	5.45	*37.00*
8 Mar 2016		6.03	*39.19*	5.47	*37.88*	6.67	*35.75*	DRY		6.50	*36.12*	5.50	*36.95*

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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FIELDWORK - *Water Level Monitoring*

Project STOCKPORT BUS STATION

Project No PN153428

Client TRANSPORT FOR GREATER MANCHESTER

Sheet No 2

Borehole		BH108		BH109		BH112		WS201		WS203		WS204	
Instrument (dia. mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)	
Depth to Base (m)		21.00		20.00		14.80		4.00		3.00		2.45	
Filter Zone (m)		18.00-21.00		18.00-20.00		12.80-14.80		3.50-4.00		2.00-3.00		1.50-2.45	
Level		42.72 m OD		42.36 m OD		43.70 m OD		45.61 m OD		43.01 m OD		42.85 m OD	
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
11 Jan 2016		6.68	*36.04*	5.18	*37.18*	5.02	*38.68*	3.85	*41.76*	CAR		2.45	*40.40*
25 Jan 2016		6.86	*35.86*	5.29	*37.07*	5.05	*38.65*	DRY		DRY		DRY	
9 Feb 2016		6.35	*36.37*	4.83	*37.53*	4.96	*38.74*	DRY		CAR		DRY	
22 Feb 2016		6.72	*36.00*	5.16	*37.20*	5.07	*38.63*	DRY		2.66	*40.35*	DRY	
8 Mar 2016		6.84	*35.88*	5.24	*37.12*	5.06	*38.64*	DRY		2.67	*40.34*	CAR	

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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FIELDWORK - *Water Level Monitoring*

Project STOCKPORT BUS STATION

Project No PN153428

Client TRANSPORT FOR GREATER MANCHESTER

Sheet No 3

Borehole		WS205		WS206		WS208		WS209		WS210		WS211	
Instrument (dia. mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)	
Depth to Base (m)		2.00		2.00		2.80		3.00		5.00		2.00	
Filter Zone (m)		1.50-2.00		1.00-2.00		1.70-2.80		1.00-3.00		3.00-5.00		1.00-2.00	
Level		42.39 m OD		48.13 m OD		42.35 m OD		42.67 m OD		44.43 m OD		44.88 m OD	
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
11 Jan 2016		1.94	*40.45*	1.82	*46.31*	2.72	*39.63*	2.91	*39.76*	5.00	*39.43*	1.87	*43.01*
25 Jan 2016		DRY		DRY		DRY		DRY		DRY		1.92	*42.96*
9 Feb 2016		DRY		DRY		DRY		DRY		DRY		1.90	*42.98*
22 Feb 2016		DRY		DRY		DRY		DRY		DRY		1.87	*43.01*
8 Mar 2016		DRY		DRY		DRY		DRY		DRY		1.87	*43.01*

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

geotechnics

FIELDWORK - *Water Level Monitoring*

Project STOCKPORT BUS STATION

Project No PN153428

Client TRANSPORT FOR GREATER MANCHESTER

Sheet No 4

Borehole		WS212		WS214		WS217		WS218A		WS220		WS223	
Instrument (dia. mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)	
Depth to Base (m)		3.50		1.00		2.50		2.50		1.70		1.40	
Filter Zone (m)		2.50-3.50		0.50-1.00		1.50-2.50		1.00-2.50		1.20-1.70		0.50-1.40	
Level		45.74 m OD		46.35 m OD		42.30 m OD		42.71 m OD		44.69 m OD		43.39 m OD	
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
11 Jan 2016		3.16	*42.58*	0.93	*45.42*	2.50	*39.80*	2.50	*40.21*	1.60	*43.09*	1.60	*41.79*
25 Jan 2016		3.20	*42.54*	DRY		DRY		DRY		1.65	*43.04*	1.60	*41.79*
9 Feb 2016		3.20	*42.54*	DRY		DRY		DRY		1.60	*43.09*	1.50	*41.89*
22 Feb 2016		3.18	*42.56*	DRY		DRY		DRY		1.65	*43.04*	1.53	*41.86*
8 Mar 2016		3.18	*42.56*	DRY		DRY		DRY		1.67	*43.02*	DRY	

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **11/01/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (1 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	x	Light	☐	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Current Hole Depth (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Remarks
BH101	7.00	6.17	7.00	0.0	0.0	0.0	21.0	78.9	
BH102	10.00	5.42	9.85	0.0	0.0	0.1	20.8	79.0	
BH103	14.70	6.60	13.06	0.0	0.0	0.0	20.9	79.0	
BH104	3.50	3.56	3.64	0.0	0.0	2.2	18.9	78.8	
BH105	12.00	6.41	11.90	0.0	0.0	0.0	21.0	78.9	
BH106	7.00	5.41	7.00	0.0	0.0	0.0	20.9	79.0	
BH108	21.00	6.68	20.94	0.0	0.0	0.5	20.5	78.9	
BH109	20.00	5.18	20.12	0.0	0.0	1.3	20.5	78.1	
BH112	14.80	5.02	14.52	0.0	0.0	0.0	21.1	78.8	
WS201	4.00	3.85	3.85	0.0	0.0	0.0	21.0	78.9	
WS203	3.00	CAR		-	-	-	-	-	Car over
WS204	2.45	2.45	2.45	0.0	0.0	7.1	11.8	81.0	
WS205	2.00	1.94	1.94	0.0	0.0	0.0	21.0	78.9	
WS206	2.00	1.82	1.82	0.0	0.0	0.4	20.5	79.0	
WS208	2.80	2.72	2.72	0.0	0.0	2.5	18.6	78.8	
WS209	3.00	2.91	2.91	0.0	0.0	2.6	19.6	77.7	
WS210	5.00	5.00	4.40	0.0	0.0	1.0	20.4	78.5	
WS211	2.00	1.87	1.98	0.0	0.0	0.3	20.3	79.3	
WS212	3.50	3.16	3.46	0.0	0.0	4.0	7.2	88.7	
WS214	1.00	0.93	0.94	0.0	0.0	0.3	20.6	79.0	
WS217	2.50	2.50	2.23	0.0	0.0	3.2	18.6	78.1	
WS218A	2.50	2.50	2.46	0.0	0.0	0.4	20.4	79.1	
WS220	1.70	1.60	1.72	0.0	0.0	0.6	19.4	79.9	
WS223	1.40	1.60	1.64	0.0	0.0	0.0	18.9	81.0	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION** Project No **PN153428**

Date **11/01/2016**

Client **TRANSPORT FOR GREATER MANCHESTER** Sheet No. **1 (2 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	x	Light	☐	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH101	7.00	0.0	0.0	996	-2.0	-1.9	
BH102	10.00	0.0	0.0	969	0.0	0.0	
BH103	14.70	0.0	0.0	969	-0.1	0.0	
BH104	3.50	0.0	0.0	969	0.0	0.0	
BH105	12.00	0.0	0.0	969	0.4	0.0	
BH106	7.00	0.0	0.0	969	-0.9	-0.7	
BH108	21.00	0.0	0.0	969	0.0	0.0	
BH109	20.00	0.0	0.0	969	-0.1	0.0	
BH112	14.80	0.0	0.0	969	-0.1	0.0	
WS201	4.00	0.0	0.0	969	-0.3	-0.1	
WS203	3.00	-	-	969	-	-	Car over
WS204	2.45	0.0	0.0	969	0.0	0.0	
WS205	2.00	0.0	0.0	969	0.0	0.0	
WS206	2.00	0.0	0.0	969	-0.3	-0.1	
WS208	2.80	0.0	0.0	969	0.0	0.0	
WS209	3.00	0.0	0.0	969	0.0	0.0	
WS210	5.00	0.0	0.0	969	0.0	0.0	
WS211	2.00	0.0	0.0	969	-0.1	0.0	
WS212	3.50	0.0	0.0	969	0.0	0.0	
WS214	1.00	0.0	0.0	969	0.0	0.0	
WS217	2.50	0.0	0.0	969	0.0	0.0	
WS218A	2.50	0.0	0.0	969	0.0	0.0	
WS220	1.70	0.0	0.0	969	0.0	0.0	
WS223	1.40	0.0	0.0	969	0.0	0.0	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **25/01/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (1 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	x	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Current Hole Depth (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Remarks
BH101	7.00	5.83	7.00	0.0	0.0	4.0	16.7	79.2	
BH102	10.00	5.46	9.85	0.0	0.0	0.0	20.9	79.0	
BH103	14.70	6.20	13.06	0.0	0.0	0.0	20.8	79.1	
BH104	3.50	DRY	3.64	0.0	0.0	1.5	19.5	78.9	
BH105	12.00	6.49	11.90	0.0	0.0	0.0	20.7	74.2	
BH106	7.00	5.46	7.00	0.0	0.0	0.0	20.6	79.3	
BH108	21.00	6.86	20.94	0.0	0.0	0.3	20.7	78.9	
BH109	20.00	5.29	20.12	0.0	0.0	0.4	20.5	79.0	
BH112	14.80	5.05	14.52	0.0	0.0	0.0	21.1	78.8	
WS201	4.00	DRY	3.85	0.0	0.0	3.6	18.2	78.1	
WS203	3.00	DRY	2.76	0.0	0.0	2.0	14.4	78.5	
WS204	2.45	DRY	2.45	0.0	0.0	0.0	20.9	79.0	
WS205	2.00	DRY	1.94	0.0	0.0	0.0	20.9	79.0	
WS206	2.00	DRY	1.82	0.0	0.0	0.0	20.8	79.1	
WS208	2.80	DRY	2.72	0.0	0.0	0.0	20.7	79.2	
WS209	3.00	DRY	2.91	0.0	0.0	2.3	19.8	77.9	
WS210	5.00	DRY	4.40	0.0	0.0	0.2	20.7	79.0	
WS211	2.00	1.92	1.98	0.0	0.0	0.6	20.0	79.3	
WS212	3.50	3.20	3.46	0.0	0.0	1.4	15.1	85.4	
WS214	1.00	DRY	0.94	0.0	0.0	0.0	20.9	79.0	
WS217	2.50	DRY	2.23	0.0	0.0	0.6	19.4	79.9	
WS218A	2.50	DRY	2.46	0.0	0.0	0.1	20.7	79.1	
WS220	1.70	1.65	1.72	0.0	0.0	0.0	20.8	79.1	
WS223	1.40	1.60	1.64	0.0	0.0	0.0	18.3	81.6	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **25/01/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (2 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	x	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH101	7.00	0.0	0.0	1001	-0.5	0.0	
BH102	10.00	0.0	0.0	1001	0.0	0.0	
BH103	14.70	0.0	0.0	1001	1.0	0.5	
BH104	3.50	0.0	0.0	1001	1.2	0.4	
BH105	12.00	0.0	0.0	1001	0.3	0.0	
BH106	7.00	0.0	0.0	1001	-0.5	0.0	
BH108	21.00	0.0	0.0	1001	0.0	0.0	
BH109	20.00	0.0	0.0	1001	0.0	0.0	
BH112	14.80	0.0	0.0	1001	0.0	0.0	
WS201	4.00	0.0	0.0	1001	0.0	0.0	
WS203	3.00	0.0	0.0	1001	0.0	-0.5	
WS204	2.45	0.0	0.0	1001	0.0	0.0	
WS205	2.00	0.0	0.0	1001	0.0	0.0	
WS206	2.00	0.0	0.0	1001	0.0	0.4	
WS208	2.80	0.0	0.0	1001	0.0	0.0	
WS209	3.00	0.0	0.0	1001	0.0	0.0	
WS210	5.00	0.0	0.0	1001	1.4	0.4	
WS211	2.00	0.0	0.0	1001	-0.2	0.0	
WS212	3.50	0.0	0.0	1001	1.4	0.1	
WS214	1.00	0.0	0.0	1001	0.0	0.0	
WS217	2.50	0.0	0.0	1001	0.0	0.0	
WS218A	2.50	0.0	0.0	1001	-0.5	0.0	
WS220	1.70	0.0	0.0	1001	0.0	0.0	
WS223	1.40	0.0	0.0	1001	0.0	0.0	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION** Project No **PN153428**

Date **09/02/2016**

Client **TRANSPORT FOR GREATER MANCHESTER** Sheet No. **1 (1 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	x	Light	☐	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	x	Cloudy	☐	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Current Hole Depth (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Remarks
BH101	7.00	5.79	7.00	0.0	0.0	3.8	17.6	78.5	
BH102	10.00	5.35	9.85	0.0	0.0	0.1	21.1	78.7	
BH103	14.70	6.50	13.06	0.0	0.0	0.0	20.6	79.3	
BH104	3.50	3.57	3.64	0.0	0.0	2.4	19.1	78.4	
BH105	12.00	6.40	11.90	0.0	0.0	0.0	20.8	79.1	
BH106	7.00	5.20	7.00	0.0	0.0	0.7	18.8	80.4	
BH108	21.00	6.35	20.94	0.0	0.0	1.9	19.9	78.1	
BH109	20.00	4.83	20.12	0.0	0.0	2.4	19.7	77.8	
BH112	14.80	4.96	14.52	0.0	0.0	0.1	21.2	78.6	
WS201	4.00	DRY	3.85	0.0	0.0	6.1	16.5	77.3	
WS203	3.00	CAR	2.76	-	-	-	-	-	Car over
WS204	2.45	DRY	2.45	0.0	0.0	1.8	19.9	78.2	
WS205	2.00	DRY	1.94	0.0	0.0	2.3	18.4	79.2	
WS206	2.00	DRY	1.82	0.0	0.0	0.2	21.1	78.6	
WS208	2.80	DRY	2.72	0.0	0.0	3.6	18.5	77.8	
WS209	3.00	DRY	2.91	0.0	0.0	1.8	20.3	77.8	
WS210	5.00	DRY	4.40	0.0	0.0	0.4	20.8	78.7	
WS211	2.00	1.90	1.98	0.0	0.0	0.7	19.8	79.4	
WS212	3.50	3.20	3.46	0.0	0.0	3.5	8.5	87.9	
WS214	1.00	DRY	0.94	0.0	0.0	3.0	18.1	78.8	
WS217	2.50	DRY	2.23	0.0	0.0	3.0	18.9	78.0	
WS218A	2.50	DRY	2.46	0.0	0.0	0.0	20.8	79.1	
WS220	1.70	1.60	1.72	0.0	0.0	2.5	17.2	80.2	
WS223	1.40	1.50	1.64	0.0	0.0	0.1	20.2	79.6	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION** Project No **PN153428**

Date **09/02/2016**

Client **TRANSPORT FOR GREATER MANCHESTER** Sheet No. **1 (2 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	x	Light	☐	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	x	Cloudy	☐	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH101	7.00	0.0	0.0	969	-4.6	-2.1	
BH102	10.00	0.0	0.0	969	0.1	0.0	
BH103	14.70	0.0	0.0	969	7.4	6.4	
BH104	3.50	0.0	1.6	969	0.0	0.0	
BH105	12.00	0.0	1.3	969	0.0	0.0	
BH106	7.00	0.0	0.0	969	-0.6	-0.2	
BH108	21.00	0.0	0.0	969	0.0	0.0	
BH109	20.00	0.0	2.0	969	0.0	0.0	
BH112	14.80	0.0	0.0	969	0.0	0.0	
WS201	4.00	0.0	0.0	969	0.0	0.0	
WS203	3.00	-	-	969	-	-	Car over
WS204	2.45	0.0	0.0	969	0.0	0.0	
WS205	2.00	0.0	3.2	969	0.0	0.0	
WS206	2.00	0.0	0.0	969	0.3	0.1	
WS208	2.80	0.0	0.0	969	0.0	0.0	
WS209	3.00	0.0	0.0	969	0.2	0.1	
WS210	5.00	0.0	0.0	969	0.2	0.1	
WS211	2.00	0.0	0.0	969	0.0	0.0	
WS212	3.50	0.0	0.0	969	0.0	0.0	
WS214	1.00	0.0	0.0	969	0.0	0.0	
WS217	2.50	0.0	0.0	969	0.0	0.0	
WS218A	2.50	0.0	0.0	969	-0.1	0.0	
WS220	1.70	0.0	0.0	969	0.0	0.0	
WS223	1.40	0.0	0.0	969	0.0	0.0	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **22/02/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (1 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	☐	Moderate	x	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Current Hole Depth (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Remarks
BH101	7.00	5.54	7.00	0.0	0.0	0.0	21.2	78.7	
BH102	10.00	5.45	9.85	0.0	0.0	0.0	20.9	79.0	
BH103	14.70	6.66	13.06	0.0	0.0	0.0	20.9	79.0	
BH104	3.50	DRY	3.64	0.0	0.0	0.1	20.9	78.9	
BH105	12.00	6.48	11.90	0.0	0.0	0.0	21.0	78.9	
BH106	7.00	5.45	7.00	0.0	0.0	0.0	20.9	79.0	
BH108	21.00	6.72	20.94	0.0	0.0	1.2	20.4	78.3	
BH109	20.00	5.16	20.12	0.0	0.0	0.5	20.5	78.9	
BH112	14.80	5.07	14.52	0.0	0.0	0.0	21.4	78.5	
WS201	4.00	DRY	3.85	0.0	0.0	1.5	20.3	78.1	
WS203	3.00	2.66	2.76	0.0	0.0	0.6	20.4	78.9	
WS204	2.45	DRY	2.45	0.0	0.0	0.0	20.9	79.0	
WS205	2.00	DRY	1.94	0.0	0.0	1.2	19.6	79.1	
WS206	2.00	DRY	1.82	0.0	0.0	0.0	21.3	78.6	
WS208	2.80	DRY	2.72	0.0	0.0	3.7	18.3	77.9	
WS209	3.00	DRY	2.91	0.0	0.0	2.4	19.9	77.6	
WS210	5.00	DRY	4.40	0.0	0.0	0.1	21.2	78.6	
WS211	2.00	1.87	1.98	0.0	0.0	0.0	21.1	78.8	
WS212	3.50	3.18	3.46	0.0	0.0	0.4	13.0	86.5	
WS214	1.00	DRY	0.94	0.0	0.0	1.0	19.9	79.0	
WS217	2.50	DRY	2.24	0.0	0.0	2.7	19.2	78.0	
WS218A	2.50	DRY	2.46	0.0	0.0	0.0	21.0	78.9	
WS220	1.70	1.65	1.72	0.0	0.0	2.3	19.1	78.5	
WS223	1.40	1.53	1.65	0.0	0.0	0.0	19.8	80.1	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **22/02/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (2 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	☐	Moderate	x	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	x	Overcast ☐
Precipitation	Dry	x	Slight	☐	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH101	7.00	0.0	0.0	996	-2.8	-1.5	
BH102	10.00	0.0	0.0	996	0.0	0.0	
BH103	14.70	0.0	0.0	996	1.5	1.2	
BH104	3.50	0.0	0.0	996	0.0	0.0	
BH105	12.00	0.0	0.0	996	-1.3	0.0	
BH106	7.00	0.0	0.0	996	-0.2	-0.1	
BH108	21.00	0.0	0.0	996	0.0	0.0	
BH109	20.00	0.0	0.0	996	1.7	0.0	
BH112	14.80	0.0	0.0	996	0.0	0.0	
WS201	4.00	0.0	0.0	996	0.0	0.0	
WS203	3.00	0.0	0.0	996	0.2	0.1	
WS204	2.45	0.0	0.0	996	0.2	0.0	
WS205	2.00	0.0	1.3	996	0.0	0.0	
WS206	2.00	0.0	0.0	996	-0.4	0.0	
WS208	2.80	0.0	0.0	996	0.0	0.0	
WS209	3.00	0.0	0.0	996	-0.1	0.0	
WS210	5.00	0.0	0.0	996	-1.4	-0.3	
WS211	2.00	0.0	0.0	996	-0.1	0.0	
WS212	3.50	0.0	1.3	996	0.8	0.2	
WS214	1.00	0.0	0.0	996	-0.6	-0.3	
WS217	2.50	0.0	0.0	996	0.0	0.0	
WS218A	2.50	0.0	0.0	996	0.0	0.0	
WS220	1.70	0.0	0.0	996	-0.2	0.0	
WS223	1.40	0.0	2.6	996	0.0	0.0	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION**

Project No **PN153428**

Date **08/03/2016**

Client **TRANSPORT FOR GREATER MANCHESTER**

Sheet No. **1 (1 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	x	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	☐	Overcast x
Precipitation	Dry	☐	Slight	x	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Current Hole Depth (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Remarks
BH101	7.00	6.03	7.00	0.0	0.0	0.1	21.1	78.7	
BH102	10.00	5.47	9.85	0.0	0.0	0.0	20.8	79.1	
BH103	14.70	6.67	13.06	0.0	0.0	0.0	21.0	78.9	
BH104	3.50	DRY	3.64	0.0	0.0	4.0	18.0	77.9	
BH105	12.00	6.50	11.90	0.0	0.0	0.0	20.9	79.0	
BH106	7.00	5.50	7.00	0.0	0.0	0.0	20.9	79.0	
BH108	21.00	6.84	20.94	0.0	0.0	0.6	21.2	78.1	
BH109	20.00	5.24	20.12	0.0	0.0	0.0	20.9	79.0	
BH112	14.80	5.06	14.52	0.0	0.0	0.0	21.3	78.6	
WS201	4.00	DRY	3.85	0.0	0.0	2.5	19.6	77.8	
WS203	3.00	2.67	2.76	0.0	0.0	3.0	19.0	77.9	
WS204	2.45	CAR	2.45	-	-	-	-	-	
WS205	2.00	DRY	1.94	0.0	0.0	0.1	21.0	78.8	
WS206	2.00	DRY	1.82	0.0	0.0	0.3	20.8	78.8	
WS208	2.80	DRY	2.72	0.0	0.0	3.3	18.9	77.7	
WS209	3.00	DRY	2.91	0.0	0.0	2.1	19.9	77.9	
WS210	5.00	DRY	4.40	0.0	0.0	0.5	20.8	78.6	
WS211	2.00	1.87	1.98	0.0	0.0	0.1	21.0	78.8	
WS212	3.50	3.18	3.46	0.0	0.0	2.8	12.4	84.7	
WS214	1.00	DRY	0.94	0.0	0.0	0.5	20.1	79.3	
WS217	2.50	DRY	2.24	0.0	0.0	3.0	19.1	77.8	
WS218A	2.50	DRY	2.46	0.0	0.0	0.0	21.0	78.9	
WS220	1.70	1.67	1.72	0.0	0.0	1.4	19.9	78.6	
WS223	1.40	DRY	1.65	0.0	0.0	0.0	20.1	79.8	

Remarks

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FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **STOCKPORT BUS STATION** Project No **PN153428**

Date **08/03/2016**

Client **TRANSPORT FOR GREATER MANCHESTER** Sheet No. **1 (2 of 2)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data LMSxi gas analyser;**

Weather / Site Conditions

Wind	Still	☐	Light	x	Moderate	☐	Strong ☐
Cloud Cover	None	☐	Slight	☐	Cloudy	☐	Overcast x
Precipitation	Dry	☐	Slight	x	Moderate	☐	Heavy ☐

Borehole	Depth to Base (m)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH101	7.00	0.0	0.0	999	0.0	0.0	
BH102	10.00	0.0	0.0	999	0.0	0.0	
BH103	14.70	0.0	0.0	999	0.0	0.0	
BH104	3.50	0.0	0.0	999	0.0	0.0	
BH105	12.00	0.0	0.0	999	0.2	0.0	
BH106	7.00	0.0	0.0	999	0.0	0.0	
BH108	21.00	0.0	0.0	999	0.5	0.1	
BH109	20.00	0.0	0.0	999	0.0	0.0	
BH112	14.80	0.0	0.0	999	0.0	0.0	
WS201	4.00	0.0	0.0	999	0.2	0.0	
WS203	3.00	0.0	0.0	999	-0.6	-0.3	
WS204	2.45	-	-	999	-	-	
WS205	2.00	0.0	0.0	999	0.0	0.0	
WS206	2.00	0.0	0.0	999	0.0	0.0	
WS208	2.80	0.0	0.0	999	0.0	0.0	
WS209	3.00	0.0	0.0	999	0.0	0.0	
WS210	5.00	0.0	0.0	999	0.3	0.3	
WS211	2.00	0.0	0.0	999	0.0	0.0	
WS212	3.50	0.0	0.0	999	0.0	0.0	
WS214	1.00	0.0	0.0	999	-0.3	0.0	
WS217	2.50	0.0	0.0	999	0.4	0.2	
WS218A	2.50	0.0	0.0	999	0.0	0.0	
WS220	1.70	0.0	0.0	999	0.0	0.0	
WS223	1.40	0.0	0.0	999	0.1	0.0	

Remarks

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APPENDIX 11

Laboratory Test Results - Geotechnical

DATA SHEET - Laboratory Test Symbols

Classification and Strength

Symbol	**C - Clay**	**M - Silt**
	(0 - containing organic matter)	
	Plasticity	L - Low
		I - Intermediate
		H - High
		V - Very High
		E - Extremely High
Ip	Plasticity Index	
%	% Retained on 425 µm sieve, shown under Ip value	
w_L	Liquid Limit	
w_P	Plastic Limit	
NP	Non-Plastic	
NAT	Sample tested in natural state	
w	Water Content	
P_d	Particle Density	
Test	**Quick undrained triaxial tests**	
	SS	Single stage - 102mm diameter.
	S3	Single stage - set of 3 38mm diameter.
	MS	Multistage - 102mm diameter.
	D	Drained Test
	HV	Hand Vane
	PP	Pocket Penetrometer (kg/cm²)
	NST	Not suitable for test
γ_b	Bulk Density	
σ_3	Triaxial Cell Pressure	
$\sigma_1 - \sigma_3$	Deviator Stress	
##	Excessive Strain	
c_u	Undrained Cohesion	
c	Cohesion Intercept	
ϕ	Angle of Shearing Resistance	
Linear Shrink	Linear Shrinkage	

Consolidation

m_v	Coefficient of Volume Compressibility
c_{v50}	Coefficient of Consolidation - Log t
c_{v90}	Coefficient of Consolidation - $\sqrt{t}$

Rock

UF	Unacceptable Failure

Chemical Analysis

Acid Soluble	Total sulphate in specimen, expressed as SO_3 %, value in brackets expressed as SO_4 %
Water Soluble	Soluble sulphate in 2:1 water : soil extract, expressed as SO_3 g/l, value in brackets expressed as SO_4 g/l
In Water	Sulphate content of groundwater, expressed as SO_3 g/l, value in brackets expressed as SO_4 g/l
pH	pH value
Organic content	Organic content expressed as a percentage of dry weight
Chloride	Chloride Ion content expressed as a percentage of dry weight

MCV, Compaction, CBR

MCV	Moisture Condition Value at natural water content
MCC	Moisture Condition Calibration
CCV	Chalk Crushing Value

Compaction

Type	2.5	=	BS 2.5 kg Rammer
	4.5	=	BS 4.5 kg Rammer
	V	=	BS Vibrating Hammer

γ_b	Bulk Density
γ_d	Dry Density

CBR California Bearing Ratio

Type	2.5	=	Test on Specimen Recompacted using BS 2.5 kg Rammer
	4.5	=	As above but using BS 4.5 kg Rammer
	V	=	As above but using BS Vibrating Hammer
	M	=	Test on open drive mould specimen cut in field
	S	=	Soaked Specimen

Top	CBR at top of mould
Bottom	CBR at bottom of mould
ND	None Detected

Tests performed in accordance with BS 1377: Parts 1-9:1990 incorporating amendments where appropriate and BS EN ISO 17892: Parts 1-2:2014.

LABORATORY RESULTS - *Classification and Strength*

Project STOCKPORT BUS STATION **Project No:** PN153428

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
BH101	2.20-2.65 (2.20)	D	N61653	Grey sandy SILT.		(15%)	26	NP	23.3						
BH106	1.20-1.70 (1.20)	B	N61702	Yellowish brown sandy fine to coarse GRAVEL.					5.0						
BH108	2.00-2.50 (2.00)	B	N61711	MADE GROUND: Reddish grey and black sandy fine to coarse gravel with pockets of clay.		(54%)	34	NP	22.2						
BH108	3.00-3.45 (3.00)	D	N61670	MADE GROUND: Reddish grey and black sandy fine to coarse gravel with pockets of clay.		(65%)	32	NP	16.3						
BH112	1.80 (1.80)	D	N61648	Dark brown/black sandy SILT.		(30%)	77	NP	109						
WS201	1.20-1.65 (1.20)	D	N61671	MADE GROUND: Brown sandy gravelly silt.		(50%)	33	NP	17.6						
WS201	2.40-3.00 (2.40)	B	N61675	Firm greyish brown sandy CLAY.	CL	15 (NAT)	33	18	22.9						
WS208	1.20-1.65 (1.20)	D	N61649	Brown gravelly very clayey SAND.		(51%)	29	NP	12.4						
WS211	3.80-4.00 (3.80)	D	N61652	Dark grey sandy SILT.		(9%)	38	NP	42.5						
WS212	3.00-3.45 (3.00)	D	N61651	Brown slightly gravelly sandy SILT.		(49%)	37	NP	21.9						
WS220	1.30-1.70 (1.30)	D	N61793	MADE GROUND: Dark brown gravelly sand with ash. (See Test Remarks Sheet for further information)		(73%)	69	NP	33.2						
WS223	1.20 (1.20)	D	N61655	MADE GROUND: Brown gravelly fine to medium sand.		(25%)	29	NP	19.9						

Remarks NST - Not suitable for Test
Water Content Test performed in accordance with BS EN ISO 17892 - 1: 2014
All other Tests performed in accordance with BS1377: 1990

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