One Central Park, Harpurhey

Geo-Environmental Ground Investigation

For: Manchester City Council

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1.0 INTRODUCTION

This Geo-Environmental report has been prepared at the request of Manchester City Council. Instructions to proceed with this report were received in May 2017.

A Geo-Environmental ground investigation has been undertaken at One Central Park, Harpurhey, following a Phase 1 Geo-Environmental Investigation Report by Integra Consulting Environmental (May 2017). The information obtained in the Phase 1 Geo-Environmental Investigation Report has been used to scope the geo-environmental investigation.

The site is located within One Central Park, Harpurhey, approximately 4km to the north east of Manchester City Centre at the approximate postcode M40 5BP. The site under investigation is a roughly triangular shaped, 0.1 Ha courtyard in the centre of the One Central Park building, situated to the north and east of Northampton Road. The National Ordnance Survey grid reference for the site is 386657E, 400701N. The site comprises a paved courtyard area entirely bound by the One Central Park building. Access to the site is through the One Central Park building from Northampton Road.

The existing site is shown on the site location plan in Appendix 1.

This Geo-Environmental Investigation report is to be used for submission to the Local Authority as it is the Client's intention to enclose the open air central courtyard with a roof supported by support columns located within the courtyard. No proposed development plan has been provided, consequently, upon receipt of the finalised development plan, a re-assessment / re-appraisal of this report may be required.

2.0 BRIEF

The brief was to carry out a preliminary intrusive geo-environmental ground investigation for the site at One Central Park, Harpurhey, based upon the proposed development outlined in Section 1.0 and following the findings and recommendations of the Phase 1 Geo-Environmental Investigation report.

The investigation was to include the following tasks:

a) Undertake / install appropriate exploratory holes and collect representative samples from exploratory holes and arrange appropriate chemical testing, where appropriate, in accordance with the latest legal framework, record olfactory and / or visual evidence of contamination during intrusive works and undertake on site in-situ and laboratory geotechnical testing;

b) Formulate conceptual models to accommodate the findings of the site investigation works in terms of the risk to human health, ground gas, controlled waters and the wider environment;

c) Carry out ground gas and groundwater level monitoring visits for a minimum of 2 months to establish the presence or otherwise of a groundwater table and ground gas concentrations in 3 No. wells.

d) Identify the risks and evaluate whether a Phase 3 numerical risk assessment and / or a Remedial Strategy, is required.

e) Undertake an assessment of the ground conditions findings to provide outline recommendations for the proposed station foundations.

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

3.0 LIMITATIONS OF INVESTIGATION WORK AND REPORT

Exploratory Holes

The locations of the exploratory holes for the ground investigation have been derived to provide a reasonable indication of the ground conditions and any contaminants, if present but has ultimately been limited by commercial constraints. The findings from the exploratory holes relate specifically to the exploratory hole locations and there is no absolute guarantee of the ground conditions and extent of contamination between the locations.

Extent of Contamination Testing

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

When investigating or developing potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and temporally. The absence of certain ground, ground gas, contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing structures, access could not be obtained to all areas. Additional contamination may be identified following the removal of the hardstanding. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities. The conclusions and recommendations sections of the

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

Extent of Contamination Studies

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

4.0 THIRD PARTIES

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5.0 SCOPE OF INVESTIGATION WORK

This preliminary geo-environmental ground investigation has been designed following the findings and recommendations of the Integra Consulting Environmental Phase 1 Geo-Environmental Investigation Report and the proposed development outlined in Section 1.0.

The ground investigation works were undertaken between the 18th and 20th May 2017 and comprised 4 No. window sample holes with associated in-situ geotechnical and chemical laboratory testing.

Drilling of window sample holes and associated installation of ground gas and groundwater monitoring wells was carried out by Geo Site Surveys Ltd. Testing of soil samples for environmental purposes was carried out by Chemtest Ltd. in accordance with the Environment Agency's MCERTS (Monitoring Certification) quality assurance accreditation scheme. These organisations were appointed directly by Integra Consulting Environmental to carry out these contracting works.

The ground investigation was undertaken in general accordance with:

- BS 5930 (2015) Code of Practice for Ground Investigation;
- BS 1377 (1990) Methods of test for Soils for Civil Engineering Purposes;
- BS 10175 (2011) Investigation of Potentially Contaminated Sites – Code of Practice; and
- BS EN 1997-2 (2007) Eurocode 7 – Geotechnical Design – Ground Investigation and Testing.

The sampling strategy for the site has been completed in accordance with CLR4 and the design of the investigation was carried out in accordance with R&D Technical Report P 5-TR066, CLR 11 and BS:8485 (2015).

Further details pertaining to the site investigation works are outlined in the following sections.

5.1 Window Sample Holes

In total 4 No. window sample holes were constructed on a spatial basis across the site to depths of between 4.00m and 4.50m bgl (between 71.76m and 71.26m AOD) to achieve the following:

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

Window sample hole construction was undertaken between 18th and 20th May 2017 utilising an Competitor 130 sampling rig.

The following window sample holes were installed with standpipes to allow for monitoring, if present, of the underlying groundwater depth together with ground gas concentrations:

Exploratory Hole	Response Zone Strata	Response Zone Depth m bgl (m AOD)	
		Top of Response Zone	Base of Response Zone
WS01	Made Ground and Glacial Till	1.00 (74.76)	2.00 (73.76)
WS03	Glacial Sand	2.00 (73.76)	3.00 (73.76)
WS04	Made Ground	0.00 (75.76)	2.00 (73.76)

The locations of the window sample holes are shown on the exploratory hole location plan in Appendix 3 and the window sample logs and photographs are contained in Appendix 4.

5.2 Site Testing & Sampling

The following site tests and sampling was carried out:

a) Sleeves were retrieved from the window sample holes from ground level to a depth of 4.50m bgl (between 75.76m and 71.26m AOD) for the purposes of laboratory testing and classification.

b) Hand shear vane strength tests were undertaken using a hand shear vane in accordance with BS1377-9, at depths of between 0.75m and 4.40m bgl (between 75.01m and 71.36m AOD) within cohesive material (clay) recovered within the window sample sleeves.

c) Standard Penetration Tests (SPT's) were undertaken at every meter at depths between 1.00m and 5.45m bgl (between 74.76m and 70.31m AOD) within the window sample holes.

d) WS01, WS02 and WS04 were installed with standpipes to allow for monitoring, if present, of the underlying groundwater depth together with ground gas concentrations. Where possible the monitoring wells comprised of a minimum 1.00m upper section of 50mm diameter HDPE plain pipe and lower sections of 50mm diameter HDPE slotted pipe with bentonite seals top and bottom. The monitoring wells were topped with flush lockable covers. The standpipe details are summarised in Section 5.2.

5.3 Laboratory Testing

6 No. chemical soil samples were sub-sampled from the samples obtained during exploratory hole construction. These samples were placed into sterile sealed containers to facilitate MCERTS chemical laboratory testing of potential contaminants as shown in Section 6.7. Chemical testing suites were based upon the possible contaminative sources identified within the Integra Consulting Environmental Phase 1 Geo-Environmental Investigation report.

The results of the chemical laboratory tests are contained in Appendix 5.

6.0 FINDINGS

6.1 Visual and Olfactory Contamination Findings

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

6.2 Ground Conditions

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

- PAVING STONE to a depth of between 0.08m and 0.10m bgl, underlain by:
- MADE GROUND (sub-base) comprising damp, yellowish brown, slightly gravelly, coarse sand to a depth of between 0.20m and 0.30m bgl (75.56m and 75.46m AOD), underlain by:
- MADE GROUND (sub-base) comprising damp, yellowish brown, sandy gravel to a depth of between 0.40m and 0.60m bgl (75.36m and 75.16m AOD), underlain by:
- MADE GROUND comprising dark brown to black, sandy, slightly clayey, slightly silty in places gravel to a depth of between 0.55m and 0.70m bgl (75.21m and 75.06m AOD), underlain by:
- MADE GROUND comprising firm to stiff, reddish brown, dark brown in places, slightly gravelly, slightly sandy clay to a depth of between 0.90m to 1.80m bgl (74.86m and 72.96m AOD), underlain by:
- Glacial till comprising firm to very stiff, reddish brown, slightly gravelly, slightly sandy CLAY to a depth of between 1.85m and 2.00m bgl (73.91m and 75.76m AOD), underlain by:
- Glacial sand comprising damp, reddish brown, becoming dark brown with depth, silty, fine to medium SAND with gravel sized pockets of coarse, black sand of suspected crushed coal, to a depth of between at least 4.00m and 4.30m bgl, underlain by:

- GLACIAL TILL comprising firm, damp, reddish brown, slightly gravelly, silty clay to at least a depth of 4.50m bgl.

Cobbles and suspected bricks were encountered within the made ground in 2 No. of the exploratory holes.

For detailed, specific descriptions of the underlying strata, please refer to the window sample hole logs contained within Appendix 4.

6.3 Water Strikes

Water strikes were not recorded in the exploratory holes during the site investigation, however, it should be noted that in all exploratory holes the samples recovered from the glacial sand were damp.

For details of the strata that were recovered as 'damp' please refer to sample logs contained within Appendix 4.

6.4 Geotechnical Site Testing

The results of the in-situ site tests undertaken during the site investigation are summarised below.

6.4.1 Standard Penetration Tests

SPT tests were undertaken during the construction of the window sample holes. The following table outlines the uncorrected N-Values derived from the SPT tests undertaken for the various deposits encountered during the site investigation works:

Deposit Type	Depth Range of Tests m bgl (m AOD)	Number of Tests	Uncorrected N-Value Range	Uncorrected N-Value Average
Made Ground	1.00 – 1.45 (74.76 – 74.31)	3	10 – 20	15
Glacial Till	1.00 – 4.95 (74.76 – 70.81)	6	7 – 34	20
Glacial Sand	2.00 – 4.45 (73.76 – 71.31)	9	18 – 50+	30

For detailed, specific information pertaining to the SPT tests undertaken, please refer to the window sample logs contained within Appendix 4.

6.4.2 Hand Shear Vane (19mm) Tests

Where possible ex-situ shear strength testing was undertaken on disturbed samples of cohesive material (clay) recovered from sleeves during construction of the window sample holes using a hand shear vane (19mm vane) in accordance with BS1377-9.

The following table outlines the undrained shear strength values obtained for the cohesive materials encountered during the site investigation works:

Deposit Type	Depth Range of Tests m bgl (m AOD)	Number of Tests	Undrained Shear Strength kN/m^2 Range	Undrained Shear Strength kN/m^2 Average
Cohesive Made Ground	0.75 – 0.85 (75.01 – 74.91)	2*	79 – 117	98
Glacial Till	0.75 – 4.40 (75.01 – 71.36)	10	48 – 230	137

* Hand shear vain testing unable to be undertaken in the majority of the cohesive made ground due to the high percentage of secondary granular constituents.

For detailed, specific information pertaining to the hand shear vane tests, please refer to window sample hole logs contained within Appendix 4.

6.5 Environmental Laboratory Tests Results

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

- Human health receptors (e.g. end-users, construction workers and the general public) via measured solid concentrations, and;

Additional receptors may be relevant dependant on the site e.g. flora/fauna, water, buried concrete.

The GAC adopted for assessment of soils in relation to Human Health are based on published LQM/CIEH S4ULs (2015) for those compounds for which published criteria are available for varying scenarios (residential, commercial, allotment, public open space). In the absence of LQM/CIEH S4ULs (2015) the following GAC defining documents are adopted - CL:AIRE Soil GAC for Human Health Assessment (2010) and Category 4 Screening Levels (C4SL's) (2014).

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

GACs / Tier 1s for waters must be selected to assess potential risks to the identified environmental receptors. There are numerous UK and European guidelines for waters based on the site situation and different receptors. GACs utilised include -

The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 (Part 7:Groundwater Threshold Values), UK Drinking Water Standards (2000), Environmental Quality Standards, World Health Organisation concentrations, Environment Agency guidance concentrations and United States Environmental Protection Agency – Region 9 GACs.

Summary tables indicating the results, assessed against their relevant GACs (residential with plant uptake), are noted below:

Solid Contamination Results					
Determinand	**No. of Samples**	**Range of Results**	**Mean**	**GAC**	**Exceeded Allowable**
Inorganics, Carbon and Asbestos					
Asbestos Quantification (%)	6	No asbestos detected	-	-	-
Water Soluble Sulphate as SO4 2:1 Extract (g/l)	4	0.02 – 0.36	0.13	-	-
Soil Organic Matter (%)	4	2.20 – 4.70	3.68	-	-
pH	4	7.60 – 9.00	8.10	-	-
Cyanide, Total	4	0.50 – 2.60	1.08	60	0
Cyanide, Free	4	0.50	0.50	60	0
Nitrate as NO_3 2:1 water soluble (g/l)	4	0.01	0.01	-	-
Metals and Semi-Metals					
Arsenic	4	9.70 – 21	14.43	640	0
Barium	4	98 – 220	164.5	22000[(2)]	0
Beryllium	4	1.0 – 1.2	1.1	12	0
Cadmium	4	0.2 – 0.38	0.33	190	0
Chromium	4	23 – 32	25.5	8600	0
Copper	4	35 – 66	52.75	68000	0
Mercury	4	0.13 – 0.25	0.19	58	0
Nickel	4	27 – 37	31	980	0
Lead	4	61 – 99	81.75	2330[(1)]	0
Selenium	4	0.20	0.20	12000	0
Vanadium	4	23 – 30	27.25	9000	0
Zinc	4	80 – 150	108.5	730000	0
Chromium (Hexavalent)	4	0.5	0.5	33	0
Total Petroleum Hydrocarbons Screen					
TPH >C6-C10	4	1	1	-	-
TPH >C10-C21	4	22 – 110	66.25	-	-

Determinand	No. of Samples	Range of Results	Mean	GAC	Exceeded Allowable
TPH >C21-C40	4	18 – 210	113.25	-	-
Total TPH >C6-C40	4	41 – 330	184.5	-	-
Polynuclear Aromatic Hydrocarbons (PAHs)					
Naphthalene	4	0.59 – 1	0.77	460	0
Acenaphthylene	4	0.13 – 0.31	0.19	97000	0
Acenaphthene	4	0.36 – 1.5	0.75	97000	0
Fluorene	4	0.44 – 1.2	0.81	68000	0
Phenanthrene	4	3.7 – 14	7.50	22000	0
Anthracene	4	0.72 – 3.20	1.63	540000	0
Fluoranthene	4	5.5 – 19	10.78	23000	0
Pyrene	4	5.1 – 17	9.78	54000	0
Benz(a)anthracene	4	2.4 – 7.8	4.53	170	0
Chrysene	4	2.6 – 8.4	5.03	350	0
Benzo(b)fluoranthene	4	3.2 – 9.3	5.6	44	0
Benzo(k)fluoranthene	4	1.1 – 3.6	2.15	1200	0
Benzo(a)pyrene	4	2.6 – 7.4	4.53	35	0
Indeno(1,2,3-cd)pyrene	4	1.7 – 4.9	3.05	510	0
Dibenzo(a,h)anthracene	4	0.28 – 0.90	0.55	3.6	0
Benzo(g,h,i)perylene	4	1.6 – 4. 7	2.88	4000	0
Total Polyaromatic Hydrocarbons	4	32 – 100	59.5	-	-

Generic Assessment Criteria Used: LQM/CIEH S4ULs for Human Health Risk Assessment (3rd edition, 2015), unless stated:

1) *Category 4 Screening Levels (March 2014)*
2) *CL:AIRE Soil GAC for Human Health Assessment (January 2010)*

Note 1 – Units are in mg/kg unless stated.
Note 2 – Assumed 2.5% SOM (mean Organic Matter % used)
Note 3 – Detection limit values used to calculate arithmetic mean
Note 4 – All exceedances noted relate to the commercial land use scenario

6.6 Ground Gas Monitoring

Following the findings of the Integra Consulting Environmental Phase 1 Geo-Environmental Investigation report gas monitoring wells were located in specific positions in order to allow monitoring and subsequent ground gas risk assessment to be undertaken. The response zones for each of the monitoring wells are detailed in Section 5.2.

At the time of writing 3 No. gas monitoring visits have been undertaken. The following results were recorded:

Gas Monitoring Well	Steady O_2 Concentration Range (%)	Peak CO_2 Concentration Range (%)	Peak CH_4 Concentration Range (%)	Peak H_2S Concentration Range (ppm)	Atmospheric Pressure Range (mbar)	Steady Gas Flow Range (l/hr)
WS01	14.1 – 18.9	1.6 – 2.9	0	0	991 – 1022	0 - 0.7
WS03	16.5 – 16.5	2.2 – 3.0	0	0	991 – 1022	0 - 0.7
WS04	17.4 – 18.2	0 – 0.1	0	0	992 – 1022	0

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

The ground gas monitoring results and ground gas monitoring instrument calibration certificate are included in Appendix 6.

6.7 Groundwater Depth Monitoring

Following construction of the window sample holes 3 No. groundwater monitoring wells were installed for the purposes of groundwater monitoring.

At the time of writing 3 No. groundwater monitoring visits have been undertaken. The following results were recorded:

Groundwater Monitoring Well	Response Zone m bgl (m AOD)	Water Level m bgl (m AOD)	Remarks
WS01	1.00 – 2.00 (74.76 – 73.76)	Dry	-
WS03	2.00 – 3.00 (73.76 – 72.76)	Dry	-
WS04	0.00 – 2.00 (75.76 – 73.76)	0.76 – 1.17 (75.00 – 74.59)	-

The groundwater monitoring results are included in Appendix 6.

7.0 ENVIRONMENTAL CONCLUSIONS

7.1 Assessment of Environmental Results

Soil sample analyses have assessed the presence of contaminants at window sample hole locations, and the concentrations at which they occur on a spatial basis as well as targeted samples exhibiting olfactory / visual contaminative evidence.

No GAC exceedances for the commercial land use scenario were recorded within the 4 No. made ground samples sent for chemical laboratory testing.

No asbestos was detected within the 6 No. samples sent for laboratory testing.

7.2 Revised Conceptual Models

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

7.2.1 Revised Conceptual Model for Human Health Risk Assessment

Following the findings of the preliminary site investigation including the conceptual model for human health has been updated as follows.

Human Heath Receptors

The human health receptors identified from the Phase 1 Geo-Environmental Investigation report include:

- End-users
- Construction workers
- General public and adjacent site users

For the site in its current state, during development and following the development the commercial land use scenario will apply with the critical site user as an adult.

Human Health Pathways

The human health pathways identified from the Phase 1 Geo-Environmental Investigation report include:

a) Ingestion of soil directly and indoor dust *
b) Inhalation of soil dust (indoor and outdoor).
c) Dermal contact with soil (indoor and outdoor).
d) Inhalation of soil vapours (indoor and outdoor).
e) Oral background.
f) Inhalation background.

** Treated as one pathway*

Made ground and residual contamination associated with historic on-site developments and historic storage tanks and diesel pump were identified in the Phase 1 Geo-environmental report as sources of contamination on-site. No visual or olfactory evidence of contamination was encountered during the site investigation and based on the chemical laboratory test results, no elevated concentrations of the tested determinants have been recorded above their respective GACs. Furthermore, no pathways exist as hardstanding is present across the site and will be replaced by a concrete slab following development.

Consequently, the site is considered to pose a very low risk to human health of site occupants, construction workers and the general public, nevertheless, the presence of possible unrecorded sources cannot be discounted. Any risk to construction workers can be mitigated with the use of appropriate PPE.

7.2.2 Revised Conceptual Model for Ground Gas Risk Assessment

Following the findings of the preliminary site investigation including the conceptual model for ground gas has been updated as follows.

Ground Gas Sources

Potential ground gas sources identified from the Phase 1 Geo-Environmental report include:

- On-site made ground
- Off-site residual hydrocarbon contamination
- Off-site landfill

Based on the findings of the preliminary site investigation works and those additional ground gas sources identified above, the conceptual model has been updated as follows:

Based on chemical laboratory test results of the 4 No. samples tested, the made ground can be discounted as a ground gas source due to the relatively low recorded organic matter content (maximum 4.7%), the results of the 3 No. monitoring visits concur with this.

No visual or olfactory evidence of residual hydrocarbon contamination was noted during the site investigation works or during the 3 No. monitoring visits (No hydrocarbon odour was noted in the well, no VOCs were detected by the photoionization detector (PID) and no sheen was noted on the groundwater). The presence of off-site hydrocarbon contamination cannot be discounted, however, following the monitoring visits off-site hydrocarbon contamination can be discounted as a ground gas source.

Based on the ground gas monitoring visits, no evidence of migrating landfill gases was recorded in any of the 3 No. monitoring wells as no methane above detection limit (0.1% v/v) and a maximum carbon dioxide concentration of 3.0% v/v was recorded, consequently migration of landfill gases on-site is considered unlikely and the source can be discounted.

Based on the preliminary site investigation works and preliminary monitoring the risk to the proposed development from ground gas is considered to be very low.

The ground gas conceptual model and subsequent monitoring results have been assessed in accordance with BS 8485 (2015).

The characteristic Gas Screening Value (GSV) is calculated by dividing the maximum gas concentration (peak methane or peak carbon dioxide) by 100 and multiplying by the maximum steady flow rate in litres per hour (minimum 0.1 l/hr utilised when below instrument detection limit flow rates are recorded).

For the 3 No. gas monitoring visits undertaken across the 3 No. ground gas monitoring boreholes, a maximum steady flow rate of 0.7 l/h and a peak carbon dioxide concentration of 3.0% v/v was recorded. No methane concentrations above detection limit was recorded (0.1% v/v).

Consequently, the characteristic GSV for the site = (3.0/100) x 0.7 = 0.02 l/hr.

Based on the 3 No. monitoring visits, the gas regime is regarded to represent Characteristic Situation 1 (CS1) as detailed in BS:8485 (2015) guidance, consequently no ground gas protection measures are deemed necessary within the proposed courtyard roof development.

Radon

The site lies within a lower probability radon area where less than 1% of homes are above the action level. Consequently, utilising BR211 (2015) no radon protective measures are required.

7.2.3 Revised Conceptual Model for Waters Risk Assessment

Following the findings of the preliminary site investigation including the conceptual model for controlled waters has been updated as follows.

Controlled Waters Receptors

The controlled waters receptors identified from the Phase 1 Geo-Environments Investigation report include:

- Groundwater contained within the Principal Aquifer within the bedrock
- Groundwater contained within the Secondary Undifferentiated Aquifer within the superficial deposits

Surface water features have been excluded from the conceptual model on the basis that there are no surface water features in close proximity to the site and that surface water run-off pathways are not considered viable over the distance (700m from the site) within which the nearest surface water feature is located.

Pathways to Controlled Waters

The pathways to controlled waters identified from the Phase 1 Geo-Environmental Investigation report include;

- Vertical migration along current and future foundations and pooling at base / beneath foundations.
- Vertical migration through granular made ground and / or granular natural deposits / lenses in natural cohesive deposits.
- Negligible infiltration through low permeability natural deposits.
- Lateral migration along low permeability natural deposits and pooling at relative low points.
- Vertical migration along off-site fault.
- Migration through porous bedrock.
- Migration along groundwater flow.

The site investigation works highlighted that most of the site is underlain by granular and cohesive soils. Consequently, vertical pathways are significantly reduced to the underlying Secondary Undifferentiated Aquifer and Principal Aquifer. Furthermore

due to the presence of hardstanding across the site, the infiltration of water into the made ground below is significantly reduced. If piled foundations are utilised for the proposed development, possible pathways may be created for the vertical migration of contaminants into the granular soils below, however, no contamination was recorded within the made ground during the site investigation works or within the samples of made ground sent for chemical laboratory testing. There are no recorded surface water receptors within 700m of the site.

Based on the preliminary site investigation works and subsequent solid chemical laboratory test results, the site is regarded to pose a very low risk to controlled waters.

7.2.4 Conceptual Model for Building Materials & Services

Potential for aggressive ground conditions caused by potential PAH contamination was identified within the Integra Consulting Phase 1 Geo-Environmental Investigations Report. Based on chemical laboratory test results aggressive contaminants with the ability to attack building materials and services (e.g. sulphates and PAHs) were not detected in notable concentrations during the preliminary site investigation works.

In accordance with BRE Special Digest 1: Concrete in Aggressive Ground (2005), soluble sulphates were recorded within design sulphate levels DS-1 and subsequently within the Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1. Please refer to the chemical laboratory testing results contained within Appendix 7 for details.

Consequently, the overall risk envisaged for building materials and services across the site are low.

8.0 GEOTECHNICAL CONCLUSIONS

8.1 Geotechnical Assessment of Ground Conditions

The preliminary site investigation works have revealed that the ground conditions at the site are variable with a mixture of both granular and cohesive Made Ground deposits, typically being underlain by natural superficial cohesive and granular deposits.

The principal strata identified are outlined in further detail below.

8.1.1 Made Ground

Made Ground deposits encountered across the site were found to be relatively variable in regards to the composition (sand, gravel and stiff clay) and thickness (between 0.90m and 1.80m thick). Uncorrected N values of between 10 and 20 were recorded in 3 No. SPT tests within the made ground. Cobbles and suspected brickz were encountered in 2 No. of the exploratory holes indicating the presence of coarse constituents. A cobble sized timber fragment was also encountered in WS02 indicating the possible presence of degradable constituents, however, based on chemical laboratory test results, the made ground has a low organic matter content (maximum 4.7%).

8.1.2 Natural Granular Deposits

The natural granular deposits encountered were found in all 4 No. exploratory holes at a depth of between 1.85m and 2.00m bgl. The natural granular deposits were relatively uniform in terms of their composition (damp, reddish brown, silty, fine to medium sand), thickness (between 2m and 2.35m), however the uncorrected N values ranged between 18 and 42, with a with a single refusal in WS04 at 2m bgl.

8.1.3 Glacial Till

The upper glacial till strata was encountered in all 4 No. exploratory holes at a depth of between 0.90m and 1.80m bgl, however was not uniform in regards to the thickness of the stratum (between 0.15m and 1.10m). Only 1 No. SPT test was

undertaken fully within the upper glacial till stratum (WS03) due to the thickness of the deposit, the uncorrected N value was recorded as 12. Hand shear vane tests were within the stratum and recorded shear strengths of between 100 kN/m^2 and 230 kN/m^2.

The lower glacial till was encountered in 3 No. of the 4 No. exploratory holes at a depth between 4.00m and 4.30m bgl. The glacial till was found to be relatively uniform with regards to its composition (firm, damp, reddish brown, slightly gravelly, silty clay). Uncorrected N values of between 11 and 34 were recorded between 4.00m and 4.50m bgl, increasing with depth.

8.2 Groundwater Assessment

At the time of writing 3 No. groundwater monitoring visits and observations made during exploratory hole construction the following has been ascertained:

- No groundwater was encountered within the shallow granular natural deposits in WS03 between 2.00m – 3.00m bgl (73.76 – 72.76m AOD).
- Pockets of perched waters are anticipated to be present within the Made Ground deposits.

Consequently, it should be noted that there may be a requirement for localised temporary works in the form of dewatering, during excavation of the service trenches and mass foundations – subject to finalised groundwater depth monitoring. Groundwater monitoring should continue at regular intervals until commencement of works on site.

8.3 Mining / Geological Assessment

Given the depth of the solid geology beneath the site (40m + bgl), site investigation works to assess the solid geology was beyond the scope of the works.

8.4 Foundations

Following the completion of the site investigation works, it is concluded that for the proposed roof support columns it would be acceptable to utilise traditional mass or reinforced concrete strip or pad foundations with an allowable bearing pressure of 100kN/m^2. Based on existing site levels, it was anticipated that foundations can bear onto the medium dense – dense sand deposits, provided that the underside of the foundations penetrate through any loose initial interface of that layer (approximately 0.30m thick). As an alternative, the client / contractor may also wish to consider a piled solution if the on-site constraints limit the potential for safe excavations subject to detailed inspection / advice from specialist piling contractors due to vibration / disturbance.

To minimise issues with potential differential settlement of the foundation structure, it is recommended that foundations are not constructed upon more than one stratum type, as delineated within the exploratory hole logs contained within Appendix 4.

Due to the presence of frequent cobbles and boulders identified within the shallow deposits, if a piling option is chosen then provisions should be taken to remove these obstructions within the made ground deposits.

It is recommended that any localised 'soft spot' areas encountered during excavation works should be removed and foundations extended down to suitable formation strata.

8.5 Floor Slab

On the basis of the site works undertaken, it is deemed feasible to utilise a ground bearing floor slab, cast directly onto the made ground deposits following ground improvement activities i.e. rolling, to achieve the necessary uniformity to provide a ground bearing solution and the localised removal of any remaining 'hard-spots' / obstructions within the bearing strata. In line with Section 7.2.2 no ground gas protection measures are deemed necessary.

APPENDIX 1
SITE LOCATION PLAN

Historic Monsall Hospital Site

Historic Ambulance Station Site

Historic Moston High School Site

Notes

1 All dimensions and levels are in metres unless noted otherwise.

2 This drawing is to be read in conjunction with all relevant Architects and Service Engineers drawings.

3 Groundwater depth and ground gas monitoring wells to be installed in selected positions.

4 Exact positions of exploratory holes subject to receipt of complete service information.

Key

- Approximate Site Boundary
- Existing Site Features
- Approximate Historic Monsall Hospital / Ambulance Station Boundary

N

Rev	Drawn	Date	Description

Drawing Status
PRELIMINARY

Contract
ONE CENTRAL PARK, HARPURHEY

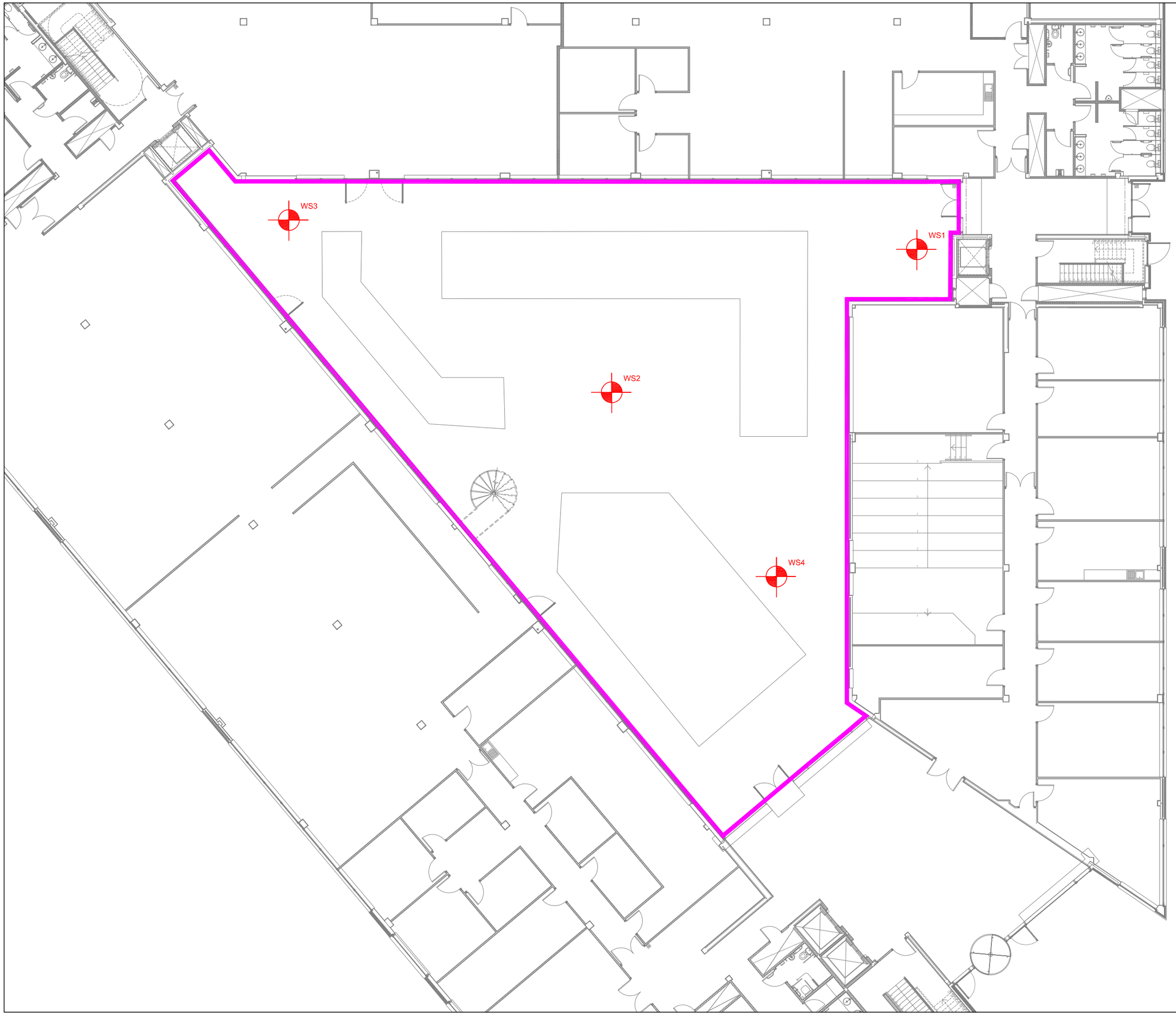
Drawing Title
SITE LOCATION PLAN

Integra
consulting environmental

Suite 4, 14-32 Hewitt Street, Manchester, M15 4GB
email: environmental@integraconsulting.co.uk
web: www.integraconsulting.co.uk
tel: 0161 237 9310

Scales	Date
1:200@A1	MAY 2017
Drawn AJ	**Checked** MB
Contract No 3010	**Drawing No** SI–01 P1

APPENDIX 2
PRELIMINARY EXPLORATORY HOLE PLAN



Notes

1 All dimensions and levels are in metres unless noted otherwise.

2 This drawing is to be read in conjunction with all relevant Architects and Service Engineers drawings.

3 Groundwater depth and ground gas monitoring wells to be installed in selected positions.

4 Exact positions of exploratory holes subject to receipt of complete service information.

Key

Approximate Site Boundary

Existing Site Features

WS1 Window Sample Location

N

Rev	Drawn	Date	Description

Drawing Status
PRELIMINARY

Contract
ONE CENTRAL PARK, HARPURHEY

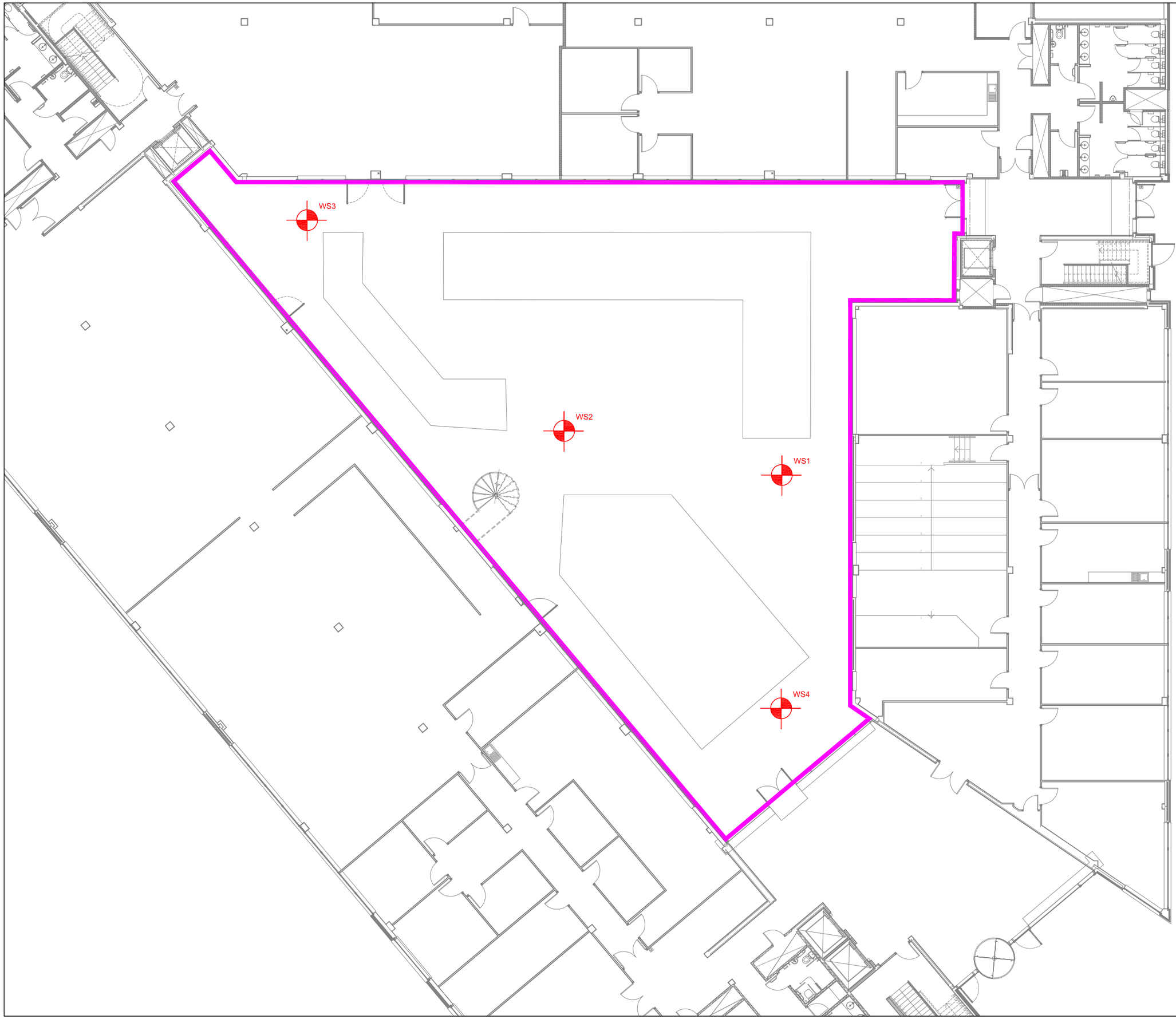
Drawing Title
PROPOSED EXPLORATORY HOLE LOCATION PLAN

Integra
consulting environmental

Suite 4, 14-32 Hewitt Street, Manchester, M15 4GB
email: environmental@integraconsulting.co.uk
web: www.integraconsulting.co.uk
tel: 0161 237 9310

Scales	Date	
1:200@A1	MAY 2017	
Drawn AJ	**Checked** MB	
Contract No 3010	**Drawing No** SI–05	P1

APPENDIX 3
EXPLORATORY HOLE LOCATION PLAN



Notes

1 All dimensions and levels are in metres unless noted otherwise.

2 This drawing is to be read in conjunction with all relevant Architects and Service Engineers drawings.

3 Groundwater depth and ground gas monitoring wells to be installed in selected positions.

4 Exact positions of exploratory holes subject to receipt of complete service information.

Key

Approximate Site Boundary

Existing Site Features

WS1 Window Sample Location

N

Rev	Drawn	Date	Description

Drawing Status
INFORMATION

Contract
ONE CENTRAL PARK, HARPURHEY

Drawing Title
EXPLORATORY HOLE LOCATION PLAN

Integra
consulting environmental

Suite 4, 14-32 Hewitt Street, Manchester, M15 4GB
email: environmental@integraconsulting.co.uk
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tel: 0161 237 9310

Scales 1:200@A1		Date MAY 2017	
Drawn AJ		Checked MB	
Contract No 3010		Drawing No SI–06	P1

APPENDIX 4
WINDOW SAMPLE LOGS AND PHOTOGRAPHS

integra consulting
Suite 4, 14-32 Hewitt St. Manchester, M15 4GB
email: environmental@integraconsulting.co.uk
web: www.integraconsulting.co.uk
tel: 0161 237 9310

Window Sample Log

ver. 0.3

Window Sample No.
WS01
Sheet 1 of 1

Project Name:	One Central Park	Co-ords:	
Location:	Harpurhey, Manchester	Level (m AOD):	75.76
Client:	Manchester City Council	Date:	20/05/2017
		Weather:	Clear and dry, recently dry

Project No. 3010
Logged By AJ
Checked By

Well / Backfill	Water Strikes	Sample and In Situ Testing Depth(m)	Type	Results	Depth (m)	Level (m AOD)	Stratum Description
					0.10	75.66	PAVING STONE. MADE GROUND
							Damp, brown, slightly gravelly, coarse SAND. Gravel is angular of fine mixed lithologies. SUB-BASE
					0.30	75.46	Damp, greyish brown, sandy, slightly clayey GRAVEL. Gravel is angular of fine to coarse mixed lithologies. SUB-BASE
					0.45	75.31	Dark brown to black, sandy, slightly clayey GRAVEL. Gravel is angular of fine to coarse mudstone (40%) and mixed lithologies (60%). MADE GROUND
					0.65	75.11	Firm to stiff, orangish brown, slightly gravelly, slightly sandy CLAY. Gravel is angular to subrounded of fine to coarse red brick (20%), mudstone (30%) and mixed lithologies (50%). MADE GROUND
							Becoming dark brown from 0.90m bgl.
		1.00	SPT(C)	N=10 (,/3,3,2,2)			
					1.40	74.36	Stiff, reddish brown, sandy CLAY. GLACIAL TILL
		1.60		HVP=112			
		1.75		HVP=120			
		1.83		HVP=100			
					1.85	73.91	Damp, reddish brown, fine to medium SAND. GLACIAL SAND
		2.00	SPT(C)	N=35 (,/6,9,10,10)			
							Pocket of yellowish brown sand at 2.70m bgl.
		3.00	SPT(C)	N=41 (,/7,11,11,12)			
					3.92	71.84	
		4.00	SPT(C)	N=30 (,/13,6,5,6)	4.00	71.76	Damp, black, medium to coarse SAND. Sand is suspected crushed coal. GLACIAL SAND
							Window Sample terminated at 4.00m.

Remarks:
Collapse of sand at 4.00m bgl.

Casing Details

Depth Top (m)	Depth Base (m)	Diameter (mm)
GL	1.00	101

Water Strike

Depth Strike (m)	Remarks

Sample Sleeve Runs

Depth Top (m)	Depth Base (m)	Diameter (mm)
0.00	1.00	87
1.00	2.00	87
2.00	3.00	76
3.00	4.00	66

Window Sample Photos

WS01

One Central Park



Image 1. :
All sleeves placed to be read left to right and top to bottom, unless otherwise stated.
0.10m - 1.00m bgl

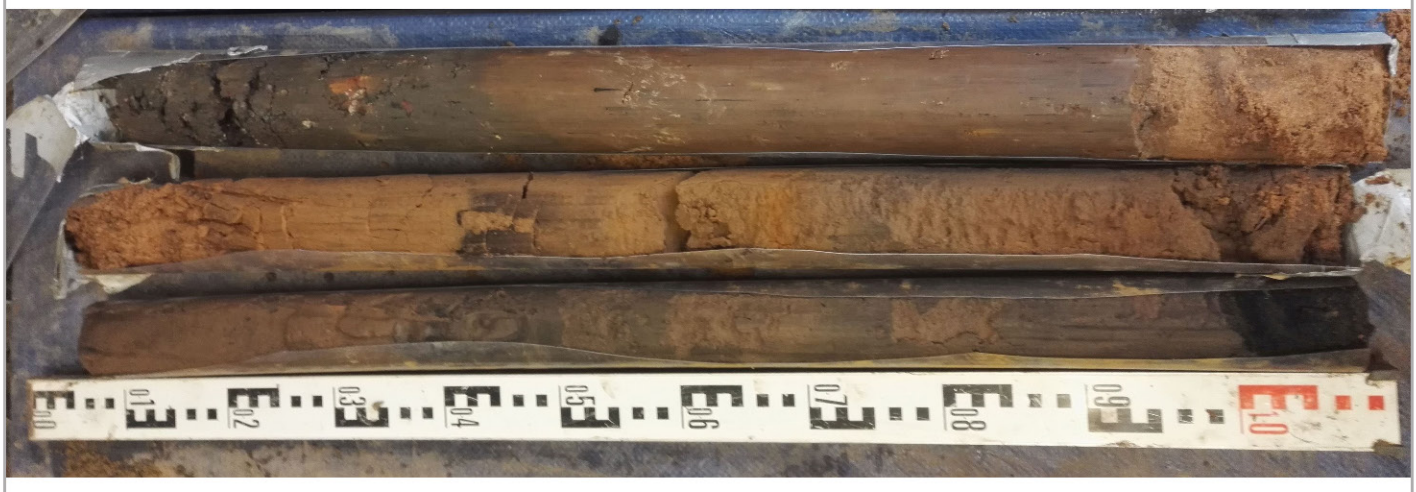

Image 2. :
All sleeves placed to be read left to right and top to bottom, unless otherwise stated.
1.00m - 2.00m bgl
2.00m - 3.00m bgl
3.00m - 4.00m bgl

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tel: 0161 237 9310

Window Sample Log

ver. 0.3

Window Sample No.
WS02
Sheet 1 of 1

Project Name:	One Central Park	Co-ords:	
Location:	Harpurhey, Manchester	Level (m AOD):	75.76
Client:	Manchester City Council	Date:	20/05/2017
		Weather:	Clear and dry, recently wet

Project No. 3010
Logged By AJ
Checked By

Well / Backfill	Water Strikes	Sample and In Situ Testing Depth(m)	Type	Results	Depth (m)	Level (m AOD)	Stratum Description
					0.10	75.66	PAVING STONE. MADE GROUND
					0.20	75.56	Damp, yellowish brown, slightly gravelly, medium to coarse SAND. Gravel is angular to subrounded of fine mixed lithologies. SUB-BASE
					0.40	75.36	Damp, brownish grey, sandy GRAVEL. Gravel is angular of fine to coarse mixed lithologies. SUB-BASE
					0.55	75.21	Dark brown, sandy, slightly clayey GRAVEL. Gravel is angular to subrounded of fine to coarse red brick (10%) and mixed lithologies (90%). MADE GROUND
							Angular cobble between 0.40m and 0.50m bgl.
					0.75	75.01	Dark greyish brown, slightly gravelly, clayey SAND. Gravel is angular to subrounded of fine to medium mixed lithologies. MADE GROUND
		1.00	SPT(C)	N=15 (,/4,6,3,2)			Firm to stiff, dark reddish brown, slightly gravelly, sandy CLAY. Gravel is angular of fine to coarse red brick (30%), concrete (10%) and mixed lithologies (60%). MADE GROUND
							Becoming firm from 1.40m bgl.
							Cobble sized timber fragment at 1.60m bgl.
					1.80	73.96	Firm, reddish brown, slightly gravelly, sandy CLAY. Gravel is subrounded of fine mixed lithologies. GLACIAL TILL
		2.00	SPT(C)	N=23 (,/4,5,7,7)	2.00	73.76	Damp, orangish brown, fine to medium SAND. Slightly clayey in places. GLACIAL SAND
							Becoming reddish brown from 2.70m bgl.
		3.00	SPT(C)	N=18 (,/2,5,5,6)			*Thin band (5mm in thickness) of black sand, suspected crushed coal, at 2.95m bgl.*
		4.00	SPT(C)	N=7 (,/0,1,3,3)	4.00	71.76	Damp, dark brown, fine to medium SAND. GLACIAL SAND
					4.10	71.66	Firm, dark reddish brown, silty CLAY with gravel sized inclusions of black sand of suspected crushed coal. GLACIAL TILL
		4.20		HVP=48			
		4.40		HVP=59			
		4.50	SPT(C)	N=34 (,/5,7,10,12)	4.50	71.26	Window Sample terminated at 4.50m.

Remarks:
Collapse of sand (approximately 500mm) at 4.00m bgl.

Casing Details

Depth Top (m)	Depth Base (m)	Diameter (mm)
GL	1.00	101

Water Strike

Depth Strike (m)	Remarks

Sample Sleeve Runs

Depth Top (m)	Depth Base (m)	Diameter (mm)
0.00	1.00	87
1.00	1.00	87
2.00	3.00	77
3.00	4.00	67
4.00	4.50	57

Window Sample Photos

WS02

One Central Park



Image 1. :
All sleeves placed to be read left to right and top to bottom, unless otherwise stated.
0.10m - 1.00m bgl
1.00m - 2.00m bgl
2.00m - 3.00m bgl
3.00m - 4.00m bgl
4.00m - 4.50m bgl (500mm of collapsed sand within sleeve)

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tel: 0161 237 9310

Window Sample Log

ver. 0.3

Window Sample No.
WS03
Sheet 1 of 1

Project Name:	One Central Park	Co-ords:	
Location:	Harpurhey, Manchester	Level (m AOD):	75.76
Client:	Manchester City Council	Date:	18/05/2017
		Weather:	Clear and dry, recently wet.

Project No.: 3010
Logged By: JG
Checked By: AJ

Well / Backfill	Water Strikes	Sample and In Situ Testing Depth(m)	Type	Results	Depth (m)	Level (m AOD)	Stratum Description
					0.08	75.68	PAVING STONE. MADE GROUND Wet, light brown, sandy GRAVEL. Gravel is subangular of fine to coarse limestone. SUB-BASE
					0.45	75.31	Brown, sandy, slightly silty, slightly clayey GRAVEL. Gravel is subangular to angular of fine to coarse sandstone (40%), coal (20%) and mixed lithologies (40%). MADE GROUND
					0.65	75.11	Firm, dark brownish black, slightly gravelly, slightly sandy, silty CLAY. Gravel is subangular to angular of fine to medium sandstone (40%), coal (10%), red brick (5%) and mixed lithologies (45%). MADE GROUND
		0.75		HVP=117			
		0.85		HVP=79			
		0.95		HVP=123	0.90	74.86	
		1.00	SPT(C)	N=14 (,/2,2,4,6)			Stiff to very stiff, brown, slightly gravelly, slightly sandy, silty CLAY. Gravel is subrounded to subangular of fine to medium coal and mixed lithologies. GLACIAL TILL
		1.50		HVP=207			
		1.60		HVP=230			
		1.70		HVP=230			
		1.80		HVP=230			
		2.00	SPT(C)	N=28 (,/4,7,8,9)	2.00	73.76	Damp, light brown, fine to coarse SAND. GLACIAL SAND
		3.00	SPT(C)	N=38 (,/4,8,13,13)			*Becoming fine to medium grained from 3.00m bgl.*
		4.00	SPT(C)	N=11 (,/0,2,4,5)	4.00	71.76	Firm, damp, greyish brown, silty CLAY. GLACIAL TILL
					4.50	71.26	Window Sample terminated at 4.50m.

Remarks:
Collapse of sand (500mm in height) at 4m bgl.

Casing Details

Depth Top (m)	Depth Base (m)	Diameter (mm)
GL	1.00	101

Water Strike

Depth Strike (m)	Remarks

Sample Sleeve Runs

Depth Top (m)	Depth Base (m)	Diameter (mm)
0.00	1.00	87
1.00	2.00	87
2.00	3.00	77
3.00	4.00	67
4.00	4.50	57

Window Sample Photos

WS03

One Central Park

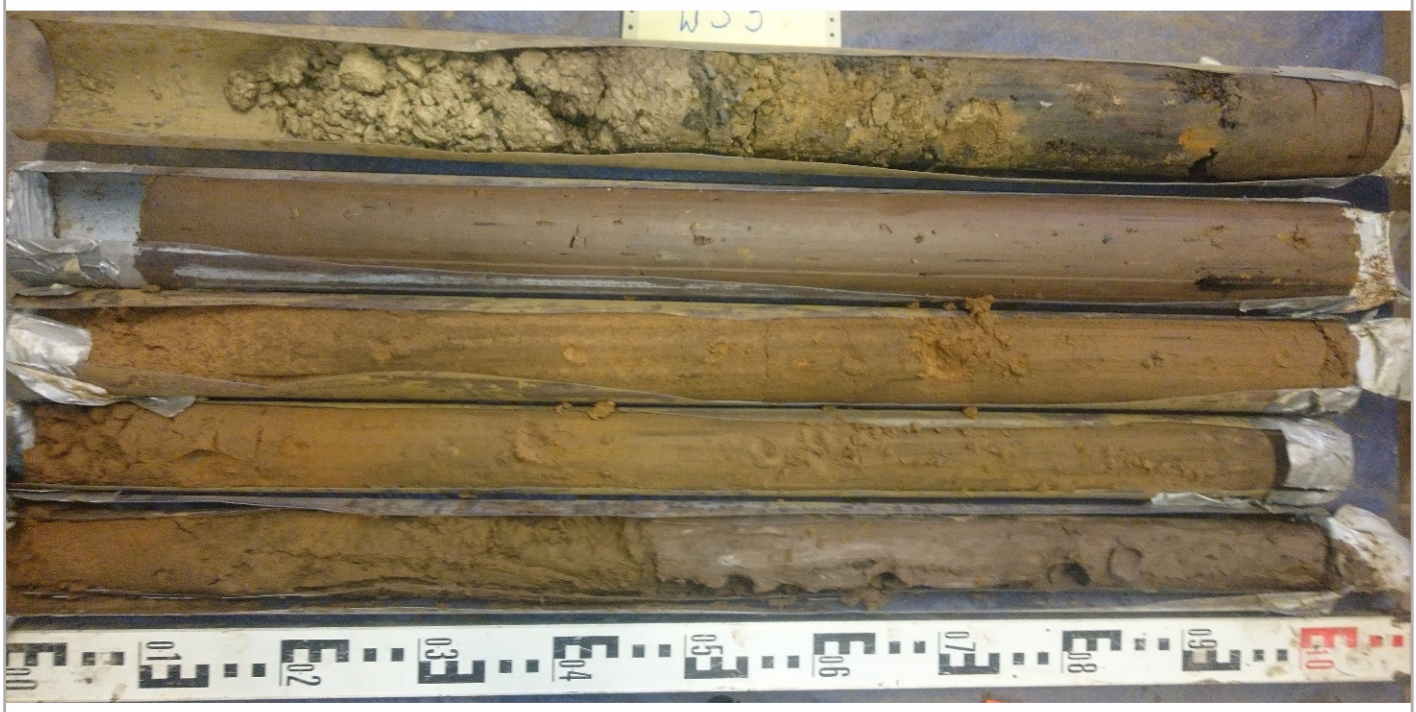

Image 1. :
All sleeves placed to be read left to right and top to bottom, unless otherwise stated.
0.10m - 1.00m bgl
1.00m - 2.00m bgl
2.00m - 3.00m bgl
3.00m - 4.00m bgl
4.00m - 4.50m bgl (500mm of collapsed sand within sleeve)

integra consulting
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Window Sample Log

ver. 0.3

Window Sample No.
WS04
Sheet 1 of 1

Project Name:	One Central Park	Co-ords:	
Location:	Harpurhey, Manchester	Level (m AOD):	75.76
Client:	Manchester City Council	Date:	20/05/2017
		Weather:	Clear and dry, recently dry

Project No. 3010
Logged By AJ
Checked By

Well / Backfill	Water Strikes	Sample and In Situ Testing Depth(m)	Type	Results	Depth (m)	Level (m AOD)	Stratum Description
					0.08	75.68	PAVING STONE. MADE GROUND
					0.25	75.51	Yellowish brown, slightly gravelly, medium to coarse SAND. Gravel is angular to subrounded of fine to coarse mixed lithologies. SUB-BASE
							Dark grey, slightly sandy, slightly clayey GRAVEL. Gravel is angular of fine to coarse sandstone (30%), mudstone (50%) and mixed lithologies (20%). SUB-BASE
					0.60	75.16	
					0.70	75.06	Dark grey, sandy, slightly clayey GRAVEL. Gravel is angular of medium to coarse mudstone (70%) and mixed lithologies (30%). MADE GROUND
		1.00	SPT(C)	N=20 (,/4,6,4,6)			Firm, reddish brown, slightly sandy, gravelly CLAY. Gravel is angular to subrounded of fine to medium red brick (20%) and mixed lithologies (80%). MADE GROUND
					1.10	74.66	Dark grey, sandy, slightly clayey GRAVEL. Gravel is angular to subrounded of fine to coarse red brick (50%), sandstone (20%) and mixed lithologies (30%). MADE GROUND
							Suspected brick encountered at approximately 1.50m bgl.
					1.80	73.96	Firm to stiff, reddish brown, sandy CLAY. GLACIAL TILL
		2.00	SPT(C)	N=51 (,/7,12,16,16)	1.95	73.81	Damp, reddish brown, grey in places, silty, fine to medium SAND. GLACIAL SAND
							Becoming fine to coarse grained from 2.40m bgl.
		3.00	SPT(C)	N=42 (,/7,9,12,14)	3.00	72.76	Damp, reddish brown, mottled dark brown to black, silty SAND. GLACIAL SAND
							Thin band (5mm) of black sand, suspected crushed coal, at 3.92m bgl.
		4.00	SPT(C)	N=15 (,/3,4,4,4)			*Becoming clayey in places with gravel sized inclusions of suspected crushed coal from 4.10m bgl.*
					4.30	71.46	Firm, reddish brown, slightly gravelly, silty CLAY. Gravel is angular of fine mixed lithologies. GLACIAL TILL
		4.50	SPT(C)	N=22 (,/3,6,6,7)	4.50	71.26	Window Sample terminated at 4.50m.

Remarks:
Collapse of sand at 4.00m (approximately 500mm in height) bgl.

Casing Details		
Depth Top (m)	Depth Base (m)	Diameter (mm)
GL	1.00	101

Water Strike	
Depth Strike (m)	Remarks

Sample Sleeve Runs		
Depth Top (m)	Depth Base (m)	Diameter (mm)
0.00	1.00	87
1.00	2.00	87
2.00	3.00	77
3.00	4.00	67
3.00	4.50	57

Window Sample Photos

WS04

One Central Park



Image 1. :
All sleeves placed to be read left to right and top to bottom, unless otherwise stated.
0.10m - 1.00m bgl
1.00m - 2.00m bgl
2.00m - 3.00m bgl
3.00m - 4.00m bgl
4.00m - 4.50m bgl (500mm of collapsed sand within sleeve)

APPENDIX 5
CHEMICAL LABORATORY TEST RESULTS

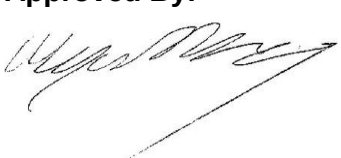
Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	17-12872-1		
Initial Date of Issue:	05-Jun-2017		
Client	Integra Consulting		
Client Address:	14 - 32 Hewitt Street Manchester M15 4GB		
Contact(s):	Angharad Jones		
Project	3010 One Central Park		
Quotation No.:	Q14-02166	**Date Received:**	24-May-2017
Order No.:		**Date Instructed:**	24-May-2017
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	31-May-2017
Date Approved:	31-May-2017		

Approved By:



Details: Glynn Harvey, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 3010 One Central Park

Client: Integra Consulting				**Chemtest Job No.:**	17-12872	17-12872	17-12872	17-12872	17-12872	17-12872
Quotation No.: Q14-02166				**Chemtest Sample ID.:**	457097	457098	457099	457100	457101	457102
				Client Sample ID.:	WS02	WS04	WS02	WS03	WS04	WS01
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.20	0.25	0.75	0.45	0.70	0.65
				Bottom Depth (m):	0.40	0.60	1.80	0.65	1.10	1.40
				Date Sampled:	23-May-2017	23-May-2017	23-May-2017	23-May-2017	23-May-2017	23-May-2017
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020			17	11	14	16
Stones	N	2030	%	0.020			< 0.020	< 0.020	< 0.020	< 0.020
pH	U	2010		N/A			7.8	8.0	9.0	7.6
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40			0.46	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010			0.36	0.036	0.084	0.024
Nitrate (Water Soluble)	N	2220	g/l	0.010			< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50			< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50			< 0.50	< 0.50	2.6	0.70
Arsenic	U	2450	mg/kg	1.0			11	9.7	21	16
Barium	U	2450	mg/kg	10			200	98	220	140
Beryllium	U	2450	mg/kg	1.0			1.2	< 1.0	1.1	1.1
Cadmium	U	2450	mg/kg	0.10			0.36	0.36	0.38	0.20
Chromium	U	2450	mg/kg	1.0			32	23	23	24
Copper	U	2450	mg/kg	0.50			66	35	55	55
Mercury	U	2450	mg/kg	0.10			0.17	0.13	0.25	0.20
Nickel	U	2450	mg/kg	0.50			37	31	29	27
Lead	U	2450	mg/kg	0.50			88	61	99	79
Selenium	U	2450	mg/kg	0.20			< 0.20	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0			30	23	27	29
Zinc	U	2450	mg/kg	0.50			150	110	94	80
Chromium (Hexavalent)	N	2490	mg/kg	0.50			< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40			2.2	3.8	4.7	4.0
TPH >C6-C10	N	2670	mg/kg	1.0			< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C21	N	2670	mg/kg	1.0			110	110	22	23
TPH >C21-C40	N	2670	mg/kg	1.0			200	210	25	18
Total TPH >C6-C40	U	2670	mg/kg	10			320	330	47	41
Naphthalene	U	2800	mg/kg	0.10			1.0	0.59	0.79	0.68
Acenaphthylene	N	2800	mg/kg	0.10			0.13	0.14	0.16	0.31
Acenaphthene	U	2800	mg/kg	0.10			1.5	0.36	0.43	0.71
Fluorene	U	2800	mg/kg	0.10			1.2	0.44	0.60	1.0
Phenanthrene	U	2800	mg/kg	0.10			14	3.7	4.6	7.7
Anthracene	U	2800	mg/kg	0.10			3.2	0.89	0.72	1.7
Fluoranthene	U	2800	mg/kg	0.10			19	5.5	6.6	12
Pyrene	U	2800	mg/kg	0.10			17	5.1	6.0	11
Benzo[a]anthracene	U	2800	mg/kg	0.10			7.8	2.4	2.6	5.3

Results - Soil

Project: 3010 One Central Park

Client: Integra Consulting			**Chemtest Job No.:**		17-12872	17-12872	17-12872	17-12872	17-12872	17-12872
Quotation No.: Q14-02166			**Chemtest Sample ID.:**		457097	457098	457099	457100	457101	457102
			Client Sample ID.:		WS02	WS04	WS02	WS03	WS04	WS01
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.20	0.25	0.75	0.45	0.70	0.65
			Bottom Depth (m):		0.40	0.60	1.80	0.65	1.10	1.40
			Date Sampled:		23-May-2017	23-May-2017	23-May-2017	23-May-2017	23-May-2017	23-May-2017
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Chrysene	U	2800	mg/kg	0.10			8.4	2.6	3.1	6.0
Benzo[b]fluoranthene	U	2800	mg/kg	0.10			9.3	3.2	3.4	6.5
Benzo[k]fluoranthene	U	2800	mg/kg	0.10			3.6	1.1	1.2	2.7
Benzo[a]pyrene	U	2800	mg/kg	0.10			7.4	2.6	2.6	5.5
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10			4.9	1.7	1.9	3.7
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10			0.90	0.28	0.30	0.70
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10			4.7	1.6	1.7	3.5
Total Of 16 PAH's	N	2800	mg/kg	2.0			100	32	37	69

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

APPENDIX 6

GROUNDGAS AND GROUNDWATER DEPTH MONITORING RESULTS

Gas Monitoring

Site:	One Central Park			Recent weather:	Rain	Precipitation:	20%
Job No.:	3010	Date:	08/06/2017	Air temperature:	14°C	Ground condition:	Damp
Engineer:	AJ	Start time:	10:30	Cloud cover:	100%	Pressure trend:	Falling
Visit No.:	1	End time:	11:00	Wind velocity and direction:	13mph N	On-site activities:	Active Courtyard

Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH_4		LEL		CO_2		O_2			H_2S		Flow	
		(m)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)			(ppm)		(l/hr)	
						peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady
WS01	10:35	1.00 - 2.00	Dry	1.94	991	0.0	0.0	0.0	0.0	2.6	2.6	20.0	14.1	14.1	0	0	3.0	0.7
WS03	10:45	2.00 - 3.00	Dry	2.94	991	0.0	0.0	0.0	0.0	2.2	2.2	20.3	16.5	16.5	0	0	2.5	0.7
WS04	10:30	0.00 - 2.00	0.76	1.97	992	0.0	0.0	0.0	0.0	0	0	19.4	17.4	17.4	0	0	0.0	0.0

Comments: *WS04 Bung slightly loose*

Gas Monitoring

Site:	One Central Park			Recent weather:	Dry & Overcast	Precipitation:	None
Job No.:	3010	Date:	14/06/2017	Air temperature:	19.4°C	Ground condition:	Dry
Engineer:	AJ	Start time:	10:15	Cloud cover:	50%	Pressure trend:	Steady
Visit No.:	2	End time:	10:30	Wind velocity and direction:	8 mph S	On-site activities:	Active Courtyard

Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH_4		LEL		CO_2		O_2			H_2S		Flow	
		(m)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)			(ppm)		(l/hr)	
						peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady
WS01	10:20	1.00 - 2.00	Dry	1.93	1022	0.0	0.0	0.0	0.0	1.6	0.8	21.4	18.9	18.9	0	0	0.0	0.0
WS03	10:15	2.00 - 3.00	Dry	2.89	1022	0.0	0.0	0.0	0.0	3.0	3.0	20.1	15.6	15.6	0	0	0.0	0.0
WS04	19:25	0.00 - 2.00	1.17	1.98	1022	0.0	0.0	0.0	0.0	0	0	21.5	18.2	16.6	0	0	0.0	0.0

Gas Monitoring

Site:	One Central Park			Recent weather:	Dry and sunny	Precipitation:	None
Job No.:	3010	Date:	21/06/2017	Air temperature:	20.4°C	Ground condition:	Dry
Engineer:	AJ	Start time:	10:15	Cloud cover:	80%	Pressure trend:	Steady
Visit No.:	3	End time:	10:35	Wind velocity and direction:	6 mph S	On-site activities:	Active Courtyard

Exploratory hole	Time	Response zone range	Water level	Base level	Atm. pressure	CH_4		LEL		CO_2		O_2			H_2S		Flow	
		(m)	(m bgl)	(m bgl)	(mbar)	(%)		(%)		(%)		(%)			(ppm)		(l/hr)	
						peak	steady	peak	steady	peak	steady	high	steady	low	peak	steady	peak	steady
WS01	10:23	1.00 - 2.00	Dry	1.93	1007	0.0	0.0	0.0	0.0	2.9	2.9	21.1	14.3	14.1	0	0	0.0	0.0
WS03	10:17	2.00 - 3.00	Dry	2.89	1007	0.0	0.0	0.0	0.0	2.4	2.4	20.7	16.5	16.4	0	0	0.0	0.0
WS04	10:30	0.00 - 2.00	0.83	1.98	1007	0.0	0.0	0.0	0.0	0.1	0.1	21.4	17.8	17.4	0	0	0.0	0.0

Comments:

HIRE INSTRUMENT CHECKLIST

GFM436 HAND HELD LAND FILL GAS ANALYSER

Serial No: 12928

Despatch Date: 5.06

Customer Name: integra - angharad

Admin Name: george

Sales Order No: 75082

Prior to despatch our Service Department have carried out the following tests to ensure the instrument is working correctly.

Test	Checked
Charging test	✓
Pump flow test	✓
Temperature test	✓
Velocity test	✓
Flow sensor test	✓
Differential pressure test	✓
Gas test	✓
Datalog and comms	✓
Physical Inspection	✓
PAT test	✓

Instrument configuration:

Sensors Fitted: CH_4 CO_2 O_2 CO H_2S LEL

Borehole flow, absolute pressure, borehole pressure

Derived: LEL, Hexane indicator, PID correlation

Datalogging ✓

Engineer Name:

Engineer Signature:

Service Check Date: 2/6/17.

Calibration Expiry Date: 25/4/18

SPECIAL REQUIREMENTS FOR THS HIRE:

Despatch Checklist

The following items have been sent with this order:

	Sent	Returned
GFM436 analyser	✓	
Leather case	✓	
Battery charger	✓	
*External water trap filters	✓	
Gas sampling tube assembly (GFM4103)	✓	
Pipe connection info sheet	✓	
Allen key	✓	
Peli Case	✓	

	Sent	Returned
Interface cable	✓	
Siteman software USB	✓	
Operation manual USB	✓	
*Internal filters	✓	
Flow tube assembly (GFM4104)	✓	
Field operation guide	✓	
Calibration certificate	✓	

*All items will be shipped in a transit case. Please use this case to return the instrument to us. All items except consumables (i.e. all items marked with a *) must be returned with the instrument in good order or you may be charged.*

Despatch signatory:

Date: 2/6/17

Return after Hire

(To be completed by Shawcity personnel on receipt of hire unit)

Have all items been returned after hire?

Checked by:

Date:

Health and Safety, Occupational Hygiene and Environmental Monitoring Solutions

Telephone: 01793 780622
www.shawcity.co.uk

Instrument House, 91-92 Shrivenham Hundred Business Park
Watchfield, Oxfordshire, SN6 8TY

Fax: 01793 784466
hire@shawcity.co.uk

TEST DATE AND CONDITIONS	
Date	24/4/17
Atmospheric Pressure	1002mB
Ambient Temp	22.1°C
Environics Serial No.	3268

GAS DATA LTD
Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711

GFM436-1 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

INSTRUMENT DETAILS	
Serial No	Customer
12928	Shawcity Ltd

INSTRUMENT CHECKS			
Keyboard	✓	Pump Flow	500cc/min
Display Contrast	✓	Pump Flow @ -200mB	300cc/min
Clock Set / Running	✓	S/W Version	G436-00.0027/0010
Labels Fitted	✓	Recalibration Date	24/4/18

GAS CHECKS							
Calibration Gas		Instrument Gas Channels Read					
Gas Type	Applied Conc.	CH4 (%)	tol. (% vol.)	CO2 (%)	tol. (% vol.)	O2 (%)	tol. (% vol.)
N2	100%	0.0	0.0	0.0	0.0	0.0	+/-0.1
CH4	5%	5.2	+/-0.3	0.0	0.0	0.0	+/-0.1
	60%	59.8	+/-3.0	0.0	0.0	0.0	+/-0.1
CO2	5%	0.0	0.0	4.8	+/-0.3	0.0	+/-0.1
	40%	0.0	0.0	40.2	+/-3.0	0.0	+/-0.1
O2	20.9%	0.0	0.0	0.0	+0.1	20.9	+/-0.5

OPTIONAL GAS CHECKS								
Calibration Gas		Instrument Gas Channels Read						
Gas Type	Applied Conc.	Label	H2S	CO			Hexane	tol. (% vol.)
		Range	5000ppm	2000ppm			2.00%	
N2	100%		0	0			0.0	+/- 5.0
H2S	1500ppm		1520	0				+/- 5.0
CO	1000ppm		40	997				+/- 5.0
Hexane	2.00%						1.953	+/- 10.0

PRESSURE CHECKS							
Calibration Pressure		Instrument Pressure Channels Read					
Pressure @	Applied Pressure	Atmospheric [Ap] (mB)	tol. (mB)				
All Ports	Current Atmospheric	1002	+/-2.0				
Ap Port (Internal)	+800mB(a)	802	+/-5.0				
	+1200mB(a)	1198	+/-5.0				

TEST DATE AND CONDITIONS	
Date	25/4/17
Atmospheric Pressure	1000 mB
Ambient Temp	20.6 °C
Environics Serial No.	26-33

GAS DATA LTD
Pegasus House
Seven Stars Estate
Wheler Rd.
Coventry
CV3 4LB
Tel: 024 76 303311 Fax: 024 76 307711

GFM436-1 OUTWARD INSPECTION & QUALITY CHECK SHEET

INSTRUMENT DETAILS					
SO Number	Instrument Banner	Instrument Serial Number + SW Version	Job Number(s)		
31693C	GFM436	129281 27-19	11646		

Calibration Technician ..... **DATE** 24-4-17

Inspection Technician ..... **DATE** 25/4/17

INSTRUMENT CHECKS		Pass (P). Fail (F) or not applicable(NA)
Function Tests	Dust Caps Fitted	P
	Keyboard Test (All keys)	P
	Backlight Test	P
	Clock Set / Running	P
	Comms Test	P
	Pump Flow Test (In & Out)	P
	Overall Leak Test (30mb)	N/A
	Battery Charge Test	P
	Service Date set to?	24/11/18
Channel Tests	Data Logging Enabled?	P
	Verify CH4/LEL/Hexane/PID	P
	Verify CO2	P
	Verify O2	P
	Verify H2S	P
	Verify CO	P
	Verify LEL	P
	Verify 1st Option gas	N/A
	Verify atmospheric pressure	P
	Verify differential pressure	P
	Verify flow	P
	Verify temperature probe input	P
	Verify vane anemometer input	P
DataBase Checks	Jobcard(s) completed and signed	P
	Jobcard(s) booked off database	P
	Calibration certificate completed	P
	Complete & print QI record	N/A
Label Checks	No. of Calibration label fitted	7669
	MCERTS label not displayed	P
	Warranty label fitted	N/A
H2S Range	H2S Range from SO	5000 ppm
	H2S Range from cal cert	5000 ppm
	Over-range value correct?	P

INSTRUMENT PACKING LIST		Tick if included
Instrument		✓
Leather Case		✓
Instrument Strap		✓
AC Battery Charger (UK)		✓
AC Battery Charger (EURO)		X
AC Battery Charger (US)		X
AC Battery Charger (AUS)		X
Gas Sample Pipe		✓
Hard Carry Case		✓
Spares Pot		✓
Allen Key		✓
Flow Sample Pipe		✓
Temperature Probe		X
Vane Anemometer		X
USB Cable		✓
USB Memory Stick		✓
SM V5 Software	Ver 6.05	✓
Internal Filter Pack	Qty	X
External Filter Pack	Qty	X
Field Guide		X

Extra Items:

Comments

TEST DATE AND CONDITIONS	
Date	24/4/17
Atmospheric Pressure	1002mB
Ambient Temp	22.1°C
Environics Serial No.	3268

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Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
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GFM436-1 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

FLOW CHECKS					
Calibration Flow		Instrument Flow Channels Read			
Applied Flow (l/hour)	Applied Pressure (Pa)	Flow [Flow] (l/hour)	tol. (l/hour)	Differential Pressure [Dp] (Pa)	tol. (Pa)
-30.0	-359	-30.1	+/-3.0	-364	+/-50
-3.0	-15	-3.1	+/-1.0	-17	+/-6
0.0	0	0.0	0.0	0	0.0
+3.0	14	3.0	+/-0.5	14	+/-3
+30.0	349	30.2	+/-3.0	367	+/-50
+60.0	1069	60.4	+/-6.0	1073	+/-130
+90.0	2118	90.9	+/-9.0	2174	+/-250

TEMPERATURE CHECK		
Calibration Temperature	Instrument Temperature Channel Read	
Applied Equivalent Temperature (°C)	Temperature [Temp] (°C)	tol. (°C)
-10.0	-10.0	+/- 2.0
0.0	0.0	+/- 1.0
30.0	30.0	+/- 1.0
60.0	60.0	+/- 1.0
100.0	100.0	+/- 1.0

Notes:

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2015. Certificate NQA 8374. Valid until 22/03/2019

TEST DATE AND CONDITIONS		
Date	05/06/2017	
Atmospheric Pressure	971	mB
Ambient Temperature	22.1	°C
Environics Serial No.	5089	

GAS DATA LTD
Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711

GFM430 Final Inspection & Calibration Check Certificate

Customer	Integra Consulting Engineers
Certificate Number	119345
Order Number	317298

Serial Number	10181	Recalibration DUE Date
Software Version	G430-00.0024/0013	*05/06/2018*

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	400	*Accept > 200 cc/min*	Pump Flow @ -200mB	200	*Accept > 200 cc/min*
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH_4		CO_2		O_2	
	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %
	59.5 *Accept +/- 3.0*	*60*	39.9 *Accept +/- 3.0*	*40*	20.8 *Accept +/- 0.5*	*20.9*
	4.9 *Accept +/- 0.3*	*5*	4.8 *Accept +/- 0.3*	*5*	6.0 *Accept +/- 0.3*	*6*
Zero Reading 100% N_2	0.0 *Accept +/- 0.0*	*0.0*	0.0 *Accept +/- 0.0*	*0.0*	0.0 *Accept + 0.1*	*0.0*

Optional Gas Checks						
Applied Gas & Range of GFM		Concentration Tested @ *(ppm)*	Instrument Readings *(ppm)*			
Toxic Gas	Range *(ppm)*		Zero Reading		Instrument Gas Reading	
H2S	2000	*1500*	0	*Accept +/-0.0*	1504	*Accept +/-5.0*
				Accept +/-0.0		*Accept +/-5.0*
				Accept +/-0.0		*Accept +/-5.0*
				Accept +/-0.0		*Accept +/-5.0*

Cross Gas Effects							
Applied Gas *(ppm)*		Instrument Readings *(ppm)*					
Toxic Gas	Concentration	Toxic 1:		Toxic 2:		Toxic 3:	Toxic 4:

Pressure Checks						
Atmospheric Pressure [AP] *(mB)*				Static Pressure [SP] *(mB)*		
Current Atmospheric Pressure *(mB)*	Instrument Atmospheric Pressure Reading *(mB)*			Applied Pressure *(mB)*	Instrument Pressure *(mB)*	
All Ports	*Open Ports*	971	*Accept +/- 2.0*	*0.0mB*		*Accept +/- 0.0*
AP Port (Internal)	*+800 mB*	800	*Accept +/- 5.0*	*+50mB*	*n/a*	*Accept +/- 2.0*
AP Port (Internal)	*+1200mb*	1200	*Accept +/- 5.0*	*-100mB*		*Accept +/- 2.0*

Flow Checks					
Borehole Flow	Instrument Flow Reading *(l/h)*		Differential Pressure		
Applied Flow Reading *(l/h)*			Instrument DP Reading *(Pa)*		Applied DP Pressure *(Pa)*
-30.0	-30.0	*Accept +/-3.0*	-272	*Accept +/-50*	*-271*
-3.0	-3.0	*Accept +/-1.0*	-13	*Accept +/-6.0*	*-12*
0.0	0.0	*Accept +/-0.0*	0.0	*Accept +/-0.5*	*0.0*
+3.0	2.9	*Accept +/-0.5*	12	*Accept +/-3.0*	*12*
+30.0	29.7	*Accept +/-3.0*	287	*Accept +/-50*	*290*
+60.0	59.8	*Accept +/-6.0*	869	*Accept +/-130*	*869*
+90.0	90.4	*Accept +/-9.0*	1761	*Accept +/-250*	*1727*

All test performed with equipment that is traceable to National Standards unless otherwise stated

TEST DATE AND CONDITIONS		
Date	05/06/2017	
Atmospheric Pressure	971	mB
Ambient Temperature	22.1	°C
Environics Serial No.	5089	

GFM430 Final Inspection & Calibration Check Certificate

GAS DATA LTD
Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711

Temperature Checks		
Calibration Temperature Applied Temperature °C	Instrument Temperature Reading °C	
-10.0	-10.0	Accept +/- 2.0
0.0	0.0	Accept +/- 1.0
30.0	30.0	Accept +/- 1.0
60.0	60.0	Accept +/- 1.0
100.0	100.5	Accept +/- 1.0

Technician:	Date Tested:
[signature]	5.6.17

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2015. Certificate NQA 8374. Valid until 22/03/2019