

Phase 2 Geo-Environmental Investigation & Assessment

For

Every Street, Manchester

Undertaken on behalf of

A&M Design and Build Ltd

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Revision Status / History

Rev	Date	Issue / Purpose/ Comment	Prepared	Checked	Authorised
	18/09/2019	Final	TPB	PGD	PGD
A	18/11/2019	Revised GQRA (Section 8) and ground gas risk assessment (Section 9).	-	-	SCS

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Executive Summary

Site Location	The site comprises land off Every Street in Manchester. It is centred on approximate Ordnance Survey National Grid Reference 385760E, 398166N with an indicative postcode of M4 7DQ.
Development Proposals	Demolition of an existing rectory to make way for a new four-storey residential block with associated hardstanding for access and car-parking together with localised areas of soft landscaping.
Ground Conditions	Ground conditions comprise made ground to depths of between 0.45m and 2.00mbgl, this being underlain by granular Glacial deposits to depths of between 2.40m and 2.55mbgl. These are underlain by Glacial Till which has been proven to a maximum depth of 5.00mbgl
Site Preparation	It is anticipated that a pre-demolition survey of any Asbestos Containing Material (ACM) will be required with any ACM so encountered being removed by a specialist licensed contractor. Relatively confined conditions during construction may preclude the re-use of demolition materials, which will need to be removed from site.
Foundations and Floor Slabs	Ground conditions are such that deep spread foundations would be required locally to depths of at least 2.40mbgl. This, together with the anticipated relatively heavy structural loads imposed by the proposed building, will probably determine that piled foundations are required, although this should be subject to further ground investigation, particularly following demolition of the building. Piling works may need to consider the proximity of services, and particularly the intermediate pressure gas main within Every Street, with the service provider needing to be consulted in this respect. In consideration of the presence of deep made ground at least locally beneath the site, new floor slabs should be suspended. This should be determined on completion of further ground investigations after demolition of the existing building.
Excavations and Groundwater	Excavations at the site will be feasible using conventional hydraulic plant and will need to be adequately supported or battered back to a safe angle where man-entry is required. Perched groundwater inflows should be anticipated within excavations deeper than around 2.00mbgl and groundwater exclusion measures such as interlocking sheet piles may be required to prevent excessive ingress of water during pumping operations.
Pavements	New pavement design should be based on a CBR value of no more than 2.5% in made ground and 5% in unsaturated granular deposits. The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation levels following any earthwork operations and prior to pavement construction. All formations should be proof-rolled with any soft, loose or otherwise unsuitable material being removed and replaced with compacted granular fill.
Concrete Classification	The typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively. However, further testing of sulphate and pH levels in deeper soils will be required should a piled foundation option be considered.
Soakaways	The ground may be sufficiently permeable for the adoption of soakaways drainage, although this might be precluded by the relatively shallow groundwater table. This should be confirmed by large-scale infiltration testing at detailed drainage design stage.
Ground Gas	Gas monitoring results indicate the site to classify as Characteristic Situation (CS) 1 – Very Low Gas Risk' in accordance with BS8485:2015, with no specific gas protection measures required. This will need to be confirmed on completion of the final ground gas monitoring and risk assessment in due course and should also be confirmed with the local authority Environmental Health / Building Control Officer prior to any building design being final.

Contamination Assessment	<u>Human Health</u> The results of the chemical analyses indicate that made ground beneath the site contains localised levels of certain contaminants that are elevated above their respective SL's. In addition, loose amosite and chrysotile asbestos fibres/clumps and board have been encountered within 1no sample of the made ground in the southern part of the site and it cannot be discounted that ACM and/or free fibres together with other unidentified contamination could occur on and/or beneath other areas of the site, including beneath the existing building. Where made ground is to remain in proposed landscaped areas, a 600mm clean cover, comprising 450mm of sub-soil and 150mm of topsoil will be required to break any exposure pathway to future site users. However, prior to the issue of a remediation strategy it is recommended that further investigation and assessment is undertaken within the central section of the site once the existing building is demolished. <u>Controlled Waters</u> Standing water at the site was noted to be perched in granular horizons of the glacial deposits. These are classified by the Environment Agency as a 'Secondary (Undifferentiated) Aquifer'. In terms of sensitivity, the groundwater within the superficial aquifer is considered to be of limited resource value and utilisation. In addition, the cohesive glacial till and its relatively low transmissivity rates would limit migration of any localised contamination from the site. Therefore risks to the underlying 'Principal Aquifer' are also considered low and can be discounted. Furthermore, no visual and/or olfactory evidence of significant contamination was detected in the soil or recorded within the chemical analyses results. There is 1no recorded Detailed River Network Feature within 250m of the site. This relates to the River Medlock, 92m east of the site. However, in consideration of the site history, lack of contamination sources, increase in surface hardstanding and the proposed positive drainage system, significant lateral movements of any localised groundwater contamination towards the river is unlikely. Therefore the perceived risk to surface water is considered very low. The site is not within an Environment Agency Source Protection Zone and there are no surface water abstractions within 1km of the site. Therefore, risks to groundwater/surface water abstractions are considered very low. Therefore, the risk to controlled waters from contamination arising from the site is considered low with no environmental remediation considered necessary.
Potable Water Supplies	The requirement for specific materials and measures to protect the water supply from ground contamination is not anticipated.
Waste Soils	Waste soil arisings comprising uncontaminated natural soil would be suitable, subject to confirmatory analysis, for re-use as sub-soil within planned landscaped areas. It is likely that made ground, would be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal. However, where excavated made ground, following inspection, is found to include significant ACM and/or fibres that cannot be segregated, it may classify as Hazardous, subject to further analysis. It will be the responsibility of the waste producer to undertake testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

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1.0 INTRODUCTION

Appointment

- 1.1 WML Consulting has been commissioned by A&M Design and Build Ltd to undertake a Phase 2 Geo-environmental Investigation and Assessment of a site located at Every Street, Manchester, M4 7DQ.

Proposed Development

- 1.2 It is understood that the development will comprise the demolition of an existing rectory to make way for a new four storey residential block with associated hardstanding for access and car-parking together with localised areas of soft landscaping.
- 1.3 The proposed development plans by Jennings Design Associates, referenced 909-A-001-B, dated July 2016, are presented in Appendix 01.

Objective

- 1.4 The objective of the ground investigation and assessment was to provide geotechnical recommendations for construction design purposes together with a geo-environmental risk assessment in terms of possible ground contamination.
- 1.5 To achieve the objective, the following tasks were undertaken:
- Review the existing desk study report for the site and design a Phase 2 Ground Investigation in accordance with the Environment Agency (2004) Model Procedures for the Management of Land Contamination, CLR11.
 - Characterise the ground conditions in terms of geology, soil geotechnical parameters and ground contamination from information provided by the ground investigation.
 - Provide recommendations regarding suitable foundations, floor slabs and new pavement construction, together with any other geotechnical considerations that could affect possible future development.
 - Determine a ground conceptual model for the site so as to undertake an appropriate Phase 2 ground contamination Generic Quantitative Risk Assessment (GQRA).

Scope

- 1.6 A Phase 1 Desk Study for the site area has been undertaken by WML and is presented in the following report:
- Phase 1 Desk Study and Preliminary Geoenvironmental Assessment Report, reference 7261G, dated August 2016.
- 1.7 This report includes the findings of a ground investigation designed on conclusions and recommendations provided in the desk study. For ease of reference, the findings of the desk study are summarised in the following sections. However, the two reports are not exclusive and should be read in conjunction.
- 1.8 The ground investigation comprised the formation of window sample probeholes undertaken with reference to BS5930:2015 Code of Practice for Ground Investigation and BS10175:2011 together with A1:2013, "Investigation of Potentially Contaminated Sites - Code of Practice" except where superseded by EN ISO 22475-1 "Geotechnical Investigation and Assessment – Sampling by Drilling and Excavation and Groundwater Measurements".
- 1.9 Geotechnical soil testing has been undertaken in general accordance with guidelines provided in BS1377:1990 – Parts 1-9, "Method of Test for Soils for Civil Engineering Purposes". Samples for chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175: 2011 and A1:2013).

- 1.10 The ground investigation has also been undertaken with reference to BS8576:2013, Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The site comprises land off Every Street in Manchester. It is centred on approximate Ordnance Survey National Grid Reference 385760E, 398166N with an indicative postcode of M4 7DQ.
- 2.2 It is bounded to the north-west by Every Street, to the south-west by Tutbury Street and to the north-east and south-east by Caterham Street with residential development beyond.
- 2.3 A location plan is presented in Appendix 01.

Site Description

- 2.4 The site is roughly rectangular in shape and covers an area of approximately 0.06 hectares. It occupies a generally level area with a centrally located 2-storey brick-built residential building with private garden.
- 2.5 The site is bounded by brick walls of varying heights and state of repair.
- 2.6 A short driveway forms vehicular access from Tutbury Street to a residential parking garage which forms the southern end of the existing building.
- 2.7 Several semi-mature trees of varying species are located within the private garden along with areas of grass and shrubbery.
- 2.8 Surrounding land is predominantly occupied by residential development.

3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

3.1 The following paragraphs summarise the most relevant findings of the desk study report.

Geology

- 3.2 The BGS plans indicate that the site is underlain by made ground of unknown thickness and provenance. This is underlain by Devensian Glacial Till, comprising mainly clay which may be more locally interbedded with sand and gravel horizons.
- 3.3 These superficial deposits are underlain at greater depths by Permian Collyhurst Sandstone which generally comprises red sandstone, locally interbedded with grey sandstones.
- 3.4 Several coal seams are conjectured to sub-outcrop at approximate distances of between 950m and 1700m to the north-east. The strata are indicated to dip to the west/south-west at an angle of between 15 and 20° and will therefore underlie the site at significant depths.
- 3.5 Therefore, risks to the development from subsidence relating to shallow, unrecorded abandoned mine workings are considered low and can be discounted.
- 3.6 There are no geological faults inferred within 500m of the site boundary.

Radon

- 3.7 The property is not in a Radon Affected Area as defined by the Health Protection Agency as less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.

Environmental Setting

- 3.8 The Glacial Till beneath the site is classified by the Environment Agency (EA) as a 'Secondary (Undifferentiated) Aquifer'. The underlying bedrock is classified as a 'Principal Aquifer' (former Major Aquifer).
- 3.9 The site is not within an EA Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 500m of the site.
- 3.10 The River Medlock is located 92m east of the site.
- 3.11 There are no active or non-operational landfills recorded within 1km of the site.
- 3.12 There is 1no historic landfill recorded within 750m of the site. This is located 201m south, at Palmerston Street and relates to the deposition of Inert and Industrial waste recorded between 1986 and 1987.
- 3.13 There are 7no potentially contaminative industrial sites within 250m of the subject site. The nearest relate to an 'Unspecified Works' 31m north-east, a warehouse 97m west and electronic equipment 188m north-east. An inspection of the 'Unspecified Works' during the site visit confirms that this is a church and is therefore unlikely to have had a contaminative use.
- 3.13.1 There are no records of sites which have been determined as Contaminated Land under Section 78R of the Environmental Protection Act 1990 within 500m of the study site.

Site History

- 3.14 The site was developed with residential structures prior to the first available map of 1848. Sometime between 1938 and 1953 the site was cleared and remained undeveloped until the late 1950's when the current residential structure was constructed.

- 3.15 The surrounding area has historically comprised, in the main, mixed residential and industrial developments. Nearby industrial use included a number of Cotton Mills, Iron Works, Dye Works, a Foundry and a Lime Works. The area immediately surrounding the site underwent extensive residential redevelopment during the 1950's and again during the 1990's.

4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

- 4.1 Based on the above findings, the Phase 1 desk study report concluded that potential pollution linkages were, on the whole considered unlikely with associated preliminary risks being assessed as very low to low.
- 4.2 However, the report recommended that assumptions in the conceptual model be verified by providing information on the physical and chemical ground conditions through site investigations.
- 4.3 The investigations were to comprise sampling and chemical analysis of the near surface soil and, if considered necessary, the installation of ground gas monitoring standpipe with subsequent monitoring for hazardous ground gas concentrations and flow.
- 4.4 In addition, investigations were to be undertaken to establish geotechnical parameters for the design of foundations, floor slabs and pavement construction.

5.0 SITE INVESTIGATION

Rationale

- 5.1 Intrusive investigations were undertaken primarily to provide geotechnical parameters for structural design purposes but also to verify the preliminary site conceptual model and confirm the anticipated low environmental risk.
- 5.2 In view of the access restrictions present at the time of the investigation, small diameter window sample probeholes and hand-excavated trial pits were adopted to provide information on near surface deposits and to obtain samples for chemical analysis.
- 5.3 In addition, investigations within the existing building were not possible. It is therefore recommended that further limited excavations be carried out once the existing building has been demolished and the site cleared.
- 5.4 Monitoring standpipes were installed in selected probeholes for the measurement of gas and groundwater levels. In view of the ground conceptual model indicating an unlikely source of ground gas either on or off-site, monitoring to confirm the low ground gas risk is to be undertaken on three occasions.

Intrusive Works

- 5.5 Ground investigation work was undertaken by DSUK Ltd on 23rd August 2019. This comprised the formation of 5no window sample probeholes to a maximum depth of 5.00 metres below ground level (mbgl) and 2no hand-excavated trial pits to a maximum depth of 1.00mbgl.
- 5.6 The exploratory hole records are presented in Appendix 02 of this report whilst the exploratory hole locations are shown on Drawing 7261G-SK01 in Appendix 01.

Monitoring Standpipes

- 5.7 Monitoring wells for groundwater and ground gas were installed in 3no probeholes as indicated on the logs presented in Appendix 02.

Geotechnical and Chemical Testing

- 5.8 In-situ geotechnical testing was undertaken at regular intervals during the formation of the probeholes in the form of Standard Penetration Tests (SPTs). The results for this testing are presented on the descriptive logs in Appendix 02.
- 5.9 Chemical analysis was undertaken on selected soil samples for the following contaminants of concern:
- Total Arsenic, Boron, Cadmium, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc.
 - Total Cyanide, Phenols, Sulphur, Sulphate.
 - Speciated USEPA Polyaromatic Hydrocarbons (PAH).
 - Asbestos Screen and Identification.
 - 2:1 water/soil sulphate extract, pH.
- 5.10 The results of the chemical analysis are presented in Appendix 03.

Gas and Groundwater Monitoring

- 5.11 Gas and groundwater monitoring has been carried out on two occasions to date on 2nd and 17th September 2019. The monitoring results are presented in Appendix 04.

6.0 GROUND CONDITIONS

Stratigraphy

- 6.1 Ground conditions encountered during the intrusive investigation comprise made ground to depths of between 0.45m and 2.00mbgl, this being underlain by granular Glacial deposits to depths of between 2.40m and 2.55mbgl. These are underlain by Glacial Till which has been proven to a maximum depth of 5.00mbgl.

Made Ground

- 6.2 Made ground was encountered within all exploratory holes from ground level to depths of between 0.45m and 2.00mbgl with the thickest deposit being encountered in WS1 in the south of the site.
- 6.3 This generally comprised an upper horizon of reworked topsoil of dark brown, locally slightly gravelly, slightly silty sand with rootlets to depths of between 0.15m and 0.45mbgl. Gravel sized fragments include ash, brick and sandstone.
- 6.4 Across the majority of the site (namely within HP1, WS2 and WS4) the reworked topsoil was underlain by made ground comprising dark greyish brown, gravelly sand and sandy gravel to depths of between 0.60m and in excess of 1.00mbgl. Gravel sized fragments included brick, sandstone, ash, clinker and ceramic.
- 6.5 In the south-western part of the site, namely within HP2 and WS1, the reworked topsoil was underlain by made ground comprising brownish grey, slightly sandy gravel and cobbles to a depth of 2.00mbgl. Gravel sized fragments included brick, concrete, sandstone, slate, ash and clinker. Cobble sized fragments included brick and concrete. This could represent an in-filled cellar to the old terraced houses indicated on historical plans.
- 6.6 Therefore, it cannot be discounted that made ground could extend to similar depths beneath other areas of the site.

Glacial Deposits

- 6.7 Within all of the exploratory holes which extended through the made ground, glacial deposits were encountered at depths of between 0.45m and 2.00mbgl. The glacial deposits extended to maximum depths of between 2.40m and 2.55mbgl.
- 6.8 These generally comprised locally slightly silty and gravelly, variably clayey sand interbedded with locally slightly silty, very sandy clay. Gravel sized fragments included sandstone, siltstone and mudstone.
- 6.9 Within WS4 between depths of 2.00m and 4.00mbgl no strata was recovered due to the likely presence of a cobble sized fragment within the base of the holes. Therefore, the actual depth between the more granular glacial deposits and the underlying glacial till could not accurately be determined.
- 6.10 SPT 'N' values within these granular deposits generally ranged between 12 and 30, indicating a loose to medium dense but overall medium dense state of compaction.

Glacial Till

- 6.11 Glacial till was encountered in all the window sample probeholes at depths of between 2.40m and 2.55mbgl and was proven to a maximum depth of 5.00mbgl.
- 6.12 This generally comprised firm to stiff, greyish brown, slightly silty, sandy and gravelly clay. Gravel sized fragments include sandstone, siltstone and coal.

- 6.13 SPT 'N' values within the glacial till ranged from 20 to 32 with an average of 23 indicating an overall stiff consistency.

Visual/Olfactory Evidence of Contamination

- 6.14 No visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

Groundwater

- 6.15 Groundwater seepages were encountered within granular glacial deposits during the formation of exploratory holes at depths of between 2.00m and 2.20mbgl.
- 6.16 During the initial monitoring visits, standing water has been recorded at depths of between 2.10m and 2.70mbgl.
- 6.17 It should be appreciated that the groundwater monitoring described above has been undertaken during a very short period of time. Significant variations in the long-term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

General

- 6.18 It should also be appreciated that ground conditions may vary between and away from the exploratory hole positions, and that no account can be taken in this report of such variations.

7.0 GEOTECHNICAL APPRAISAL

Site Preparation

- 7.1 It is anticipated that a pre-demolition survey of any Asbestos Containing Material (ACM) will be required with any ACM so encountered being removed by a specialist licensed contractor.
- 7.2 Demolition materials comprising concrete and brick, together with any hardstanding and below ground foundations removed as part of the clearance work, subject to appropriate screening, crushing and confirmatory testing, would be suitable for re-use as bulk fill beneath hard cover areas.
- 7.3 However, the relatively confined nature of the site may preclude such operations, with such materials having to be removed from site.

Foundations

- 7.4 Made Ground and incompetent superficial deposits at the site are considered unsuitable for the direct support of structural loads for the new building as they are variable in nature and generally loosely compacted, resulting in the potential for unacceptable total and differential settlements.
- 7.5 The majority of window sample probes have encountered medium dense sand at shallow depth. Spread foundations constructed within this granular deposit would achieve a net allowable bearing pressure of around 100kN/m² if constructed at a minimum depth of 0.70m below existing ground level.
- 7.6 However, the depth of made ground has been found to extend to a depth of 2.00mbgl with the underlying granular horizon being recorded as loose to 2.40mbgl.
- 7.7 Foundations at least within this area would therefore have to extend to the underlying glacial till at a depth of 2.40mbgl with similar conditions possibly occurring elsewhere.
- 7.8 Excavations for spread foundations taken to this depth would need to be adequately supported and would possibly need to incorporate groundwater exclusion measures such as interlocking sheet piles to facilitate dewatering. The disposal costs of excavated material would also need to be considered.
- 7.9 Such measures will probably render the use of deep spread foundation impractical and uneconomical.
- 7.10 It is also anticipated that structural loads from the apartment block will be such that a piled foundation solution will need to be considered with piles being taken down into the underlying stiff glacial till.
- 7.11 The final choice and design of pile type should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with local experience and following further ground investigations to establish the required length of pile once the existing building has been demolished.
- 7.12 It should also be noted that piling works may need to consider the proximity of services, and particularly the intermediate pressure gas main within Every Street, with the service provider needing to be consulted in this respect.

Floor Slabs

- 7.13 In consideration of the presence of deep made ground at least locally beneath the site, new floor slabs should be suspended. This should be determined on completion of further ground investigations after demolition of the existing building.

Excavations and Groundwater

- 7.14 Excavations at the site will be feasible using conventional hydraulic plant and will need to be adequately supported or battered back to a safe angle where man-entry is required.
- 7.15 Perched groundwater inflows should be anticipated within excavations deeper than around 2.00mbgl. Conventional 'sump and pump' dewatering measures may not be adequate to keep excavations dry and it cannot be discounted that groundwater exclusion measures such as interlocking sheet piles may be required to prevent excessive ingress of water.
- 7.16 Such support measures will also reduce the risk of 'running sand' conditions leading to loss of ground beneath any nearby adjacent structures or infrastructure.

Pavement Design

- 7.17 In consideration of the recorded ground conditions, it is recommended that new pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5% in made ground and 5% in unsaturated granular deposits.
- 7.18 The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation levels following any earthwork operations and prior to pavement construction.
- 7.19 In any event, all formations should be proof-rolled with any soft, loose or otherwise unsuitable material being removed and replaced with compacted granular fill.

Concrete Design

- 7.20 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive Ground). With reference to the site history, it is deemed appropriate to classify the site as "Brownfield", with respect to BRE Special Digest.
- 7.21 Values of 2:1 water/soil extract for sulphate for soils at shallow depths range from less than 10mg/l to 30mg/l. Values of pH range from 8.1 to 8.3 indicating slightly alkaline conditions.
- 7.22 On the basis of these results, the typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.
- 7.23 However, further testing of sulphate and pH levels in deeper soils will be required should a piled foundation option be considered.

Drainage and Soakaways

- 7.24 In consideration of the site being underlain by granular deposits at shallow depth, the ground may be sufficiently permeable for the adoption of soakaways drainage, although this might be precluded by the relatively shallow groundwater table.
- 7.25 This should be confirmed by large-scale infiltration testing at detailed drainage design stage.

8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

General

- 8.1 A review of the desk study information has concluded that potential pollution linkages are on the whole considered unlikely with associated preliminary risks being assessed as very low to low.
- 8.2 Furthermore, no visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the ground investigation.
- 8.3 However, it has been considered prudent to adopt a precautionary principal and undertake chemical analysis of the near-surface soils to establish in more detail the human health risk status of the site.

Human Health

- 8.4 Selected samples have been analysed for a general suite of contaminants of concern and compared against Screening Levels (SL's) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in CLR11, Model Procedures for the Management of Land Contamination, 2004.GQRA).
- 8.5 The criteria for a limited number of contaminants have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.
- 8.6 Within the document, Category 4 Screening Levels (C4SL's) are described as being more pragmatic than previous screening criteria and represent concentrations in soil that present an 'acceptable' level of risk within the context of Part 2A.
- 8.7 The National Planning Policy Framework states that 'after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990'. Therefore, by inference, the C4SL's are appropriate for use in the planning context.
- 8.8 Although the SP1010 document states that C4SL only apply for a 'sandy loam soil with 6% soil organic matter', it is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SL's have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.
- 8.9 Subsequent to SP1010, LQM/CIEH have published a document entitled 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015. In brief, the document provides updated assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance. The new screening criteria, or Suitable 4 Use Levels (S4ULs), are intended to provide a complete and updated replacement to the previous LQM/CIEH GAC of 2009. As such they are considered appropriate for use in this assessment for other contaminants not covered by C4SL's and/or for organic contaminants assuming a worst-case Soil Organic Matter (SOM) of 1% as an initial conservative assessment.
- 8.10 For each contaminant, S4UL's and C4SL's have been calculated for six land use scenarios, namely:
- Residential with homegrown produce.
 - Residential without homegrown produce.
 - Allotments.
 - Commercial.
 - Public Open Space near residential housing.
 - Public Parks (remote from residential housing).

- 8.11 In light of the proposed development, the SL's for a "Residential without homegrown produce" end-use are considered appropriate for assessment at this stage.
- 8.12 Due to measured Soil Organic Content (SOM) results for the soils all being above 2.5%, it has been considered appropriate to adopt SL's relevant for 2.5% SOM in accordance with CEIH/LQM.
- 8.13 A table of relevant SL's protective of human health for both 1% and 2.5% SOM are provided in Appendix 05.

Soil Test Results

- 8.14 7no samples of made ground were analysed for a suite of contaminants of concern. The majority of the concentrations measured were below the SL's for "Residential without homegrown produce" end-use, assuming a 2.5% SOM, with the following exceptions.

Contaminant	Number of Samples Exceeding SL	SL (mg/kg)	Recorded Concentrations (mg/kg)	Sample
Lead	5	310	330 – 450	WS1 – 0.10m WS1 – 0.50m WS2 – 0.20m WS3 – 0.30m HP1 – 0.40m HP2 – 0.30m
Mercury	1	1.2	1.5	WS3 – 0.30m
Benzo(a)anthracene	1	14	21	HP2 – 0.30m
Benzo(a)pyrene	1	3.2	20	HP2 – 0.30m
Benzo(b)fluoranthene	1	4.0	21	HP2 – 0.30m
Dibenzo(a,h)anthracene	1	0.32	3.2	HP2 – 0.30m

Notes

PAH's revised to assume values in accordance with a 2.5% SOM. Therefore, naphthalene is below the relevant screening levels.

- 8.15 Amosite and chrysotile asbestos fibres/clumps and board were detected in 1no of the soil samples analysed, namely WS2 – 0.20m.

Discussion and Conclusions

Human Health

- 8.16 The results of the chemical analyses indicate that made ground beneath the site contains localised levels of certain contaminants that are elevated above their respective SL's.
- 8.17 In addition, loose amosite and chrysotile asbestos fibres/clumps and board have been encountered within 1no sample of the made ground in the southern part of the site and it cannot be discounted that ACM and/or free fibres together with other unidentified contamination could occur on and/or beneath other areas of the site, including beneath the existing building.
- 8.18 Following site development, where surfaced with buildings and hardstanding, there will be no mechanism for a direct contact pollution linkage with any unidentified contaminants or for any asbestos fibres to become airborne. Therefore, the risk to end-users and to the general public will be negligible in such areas.

- 8.19 However, where made ground is to remain in proposed landscaped areas, a 600mm clean cover, comprising 450mm of sub-soil and 150mm of topsoil will be required to break any exposure pathway to future site users.
- 8.20 Notwithstanding the above, as there is a low possibility of asbestos fibres becoming airborne during site enabling and ground works, there is a perceived risk to construction workers and the general public of exposure, particularly during dry weather conditions.
- 8.21 Groundworks may therefore need to be undertaken under a watching brief in consultation with an asbestos specialist with any ACM so encountered being segregated for removal to landfill. Such operations may also need to incorporate specific control measures such as dust suppression, perimeter air monitoring and appropriate Personal Protective Equipment (PPE) as determined by the asbestos specialist.
- 8.22 Should ACM be encountered in significant quantities, consideration should be given to providing lined service trenches and clean in-fill to prevent possible exposure during any future maintenance work.
- 8.23 It is anticipated that a remediation strategy will be required to bring the site to a condition suitable for the intended use by removing unacceptable risks to human health. The strategy will need to be submitted to the Local Planning Authority for their approval prior to any development commencing.
- 8.24 However, prior to the issue of a remediation strategy it is recommended that further investigation and assessment is undertaken within the central section of the site once the existing building is demolished.

Controlled Waters

- 8.25 Standing water at the site was noted to be perched in granular horizons of the glacial deposits. These are classified by the Environment Agency as a 'Secondary (Undifferentiated) Aquifer'. In terms of sensitivity, the groundwater within the superficial aquifer is considered to be of limited resource value and utilisation.
- 8.26 In addition, the cohesive glacial till and its relatively low transmissivity rates would limit migration of any localised contamination from the site. Therefore risks to the underlying 'Principal Aquifer' are also considered low and can be discounted.
- 8.27 Furthermore, no visual and/or olfactory evidence of significant contamination was detected in the soil or recorded within the chemical analyses results.
- 8.28 There is no recorded Detailed River Network Feature within 250m of the site. This relates to the River Medlock, 92m east of the site. However, in consideration of the site history, lack of contamination sources, increase in surface hardstanding and the proposed positive drainage system, significant lateral movements of any localised groundwater contamination towards the river is unlikely. Therefore the perceived risk to surface water is considered very low.
- 8.29 The site is not within an Environment Agency Source Protection Zone and there are no surface water abstractions within 1km of the site. Therefore, risks to groundwater/surface water abstractions are considered very low.
- 8.30 Therefore, the risk to controlled waters from contamination arising from the site is considered low with no environmental remediation considered necessary.

9.0 GROUND GAS RISK ASSESSMENT

Methodology

- 9.1 Current guidance for the assessment of risk associated with the presence of hazardous ground gases (principally methane and carbon dioxide) is provided in two key documents, namely:
- - Code of practice for the Characterisation and remediation from Ground Gas in Affected Developments. British Standard Institution (BS 8485: 2015); and
 - Assessing Risks posed by Hazardous Ground Gases to Buildings CIRIA (C665, 2007).
- 9.2 The assessment presented herein is primarily based on the BS8485 document.
- 9.3 Hazardous ground gas qualitative risk assessment is based on a conceptual model similar to that used for soil and groundwater contamination sources (i.e., source-pathway-receptor pollutant linkages). A semi-quantitative estimate of risk can be assessed based on knowledge of the conceptual model and a measure of hazardous gas concentration and gas flow at the site within monitoring standpipes.
- 9.4 Based on the measured flow rates and hazardous gas concentrations, individual "hazardous gas flow rates" (Q_{hg}) can be derived for each monitoring point, from which the "site characteristic hazardous gas flow rate" (Q_{hgs}), and then the "Characteristic Situation" (CS) can be determined.
- 9.5 BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation and the proposed development based on building type as outlined in Table 3.

Table 3 - Building Types

	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ Public, possible multiple	Commercial / Public	Commercial / Industrial
Control (Change of use)	None	Some but not all	Full	Full
Room Sizes	Small	Small/ medium	Small to Large	Large Industrial/ Retail Park

- 9.6 The proposed development is indicated to comprise the construction of **Type B** buildings, the definition of which is provided in BS8485:2015 as:
- *Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground-floor and basement areas. May be conventional building or civil engineering construction.*

Ground Gas Conceptual Model

- 9.7 The property is not in a Radon Affected Area as defined by the Health Protection Agency which would require protection from radon.
- 9.8 The presence of ground gas resulting from shallow unrecorded mine workings can be discounted.
- 9.9 There is 1no historic landfill recorded 201m south, at Palmerston Road and relates to the deposition of Inert and Industrial waste recorded between 1986 and 1987. This could be considered a plausible source of ground gas although the likelihood of continued generation of landfill gas in significant volumes is

low. The regional presence of relatively impermeable glacial till likely to inhibit significant lateral flow of gas from off-site sources.

- 9.10 No visual signs of degradable materials capable of generating significant volumes of ground gas have been recorded in the ground investigation.
- 9.11 No visual / olfactory evidence of hydrocarbons were encountered during the investigations. Based on the historical use of the site and chemical analyses risks from hydrocarbon vapours are considered very low. In addition, although a value of naphthalene was elevated above the Lowest Order of Detection, this did not exceed the S4UL for 'Residential without plant uptake' when assuming a 2.5% SOM. Section 18.6.15.2 of 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015, outlines that the 'the S4UL is based on the lowest of the two values for inhalation or oral/dermal. Therefore, as the naphthalene was not elevated above the reference value, would not pose a risk and can be discounted.
- 9.12 In consideration of the above, the preliminary risk to the development from ground gas has been assessed low. Therefore, it has been considered prudent to undertake limited ground gas monitoring, primarily for methane and carbon dioxide, with associated flow rates, on 3no occasions between 2nd September and 8th October 2019.

Results and Recommendations

- 9.13 The results indicate no detectable concentrations of methane with a peak and steady state carbon dioxide concentrations ranging from 1.3% to 3.6% by volume in air (v/v).
- 9.14 No steady state ground gas flows of greater than 0.1l/hr have been recorded during the monitoring visits.
- 9.15 The results give a maximum composite Q_{hg} value of 0.0036l/hr and indicate the site to classify as Characteristic Situation (CS) 1 – Very Low Gas Risk' in accordance with BS8485:2015, with no specific gas protection measures required.
- 9.16 This will need to be confirmed with the local authority Environmental Health / Building Control Officer prior to any building design being finalised.

10.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

Excavated Soils

- 10.1 Groundworks undertaken during the development will produce excavated soil which will require appropriate site management. Principally, and in line with the sustainable development agenda, any soils arising from site excavations should firstly be considered for re-use where possible by incorporation into the development.
- 10.2 Waste soil arisings comprising uncontaminated natural soil would be suitable, subject to confirmatory analysis, for re-use as sub-soil within planned landscaped areas.
- 10.3 Where soils are surplus to requirements, they will need to be removed from site through appropriate waste management.
- 10.4 It should be noted that the chemical analysis results for disposal classification are assessed against different assessment criteria to those relating to contamination risk assessment. Soils that are deemed suitable for use in terms of risk to human health and the environment may not necessary be uncontaminated and could be classified as 'Non-Hazardous' or even Hazardous' for disposal purposes.
- 10.5 For preliminary guidance based on the current information, it is likely that made ground, would be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal.
- 10.6 However, where excavated made ground, following inspection, is found to include significant ACM and/or fibres that cannot be segregated, it may classify as Hazardous, subject to further analysis.
- 10.7 Any topsoil destined for landfill may need to be subjected to further Waste Acceptance Criteria (WAC) testing to determine the correct route of disposal due to its inherent organic content.
- 10.8 It will be the responsibility of the waste producer to undertake testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

Imported Fill

- 10.9 Imported fill will be subject to specific quality requirements and should be accompanied by appropriate certification to confirm its suitability. Allowance should also be made for testing imported fill materials prior to placement to ensure suitability.

Water Supply Pipes

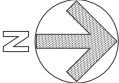
- 10.10 United Utilities will need to be consulted with regards the selection of suitable water supply pipe materials for the development. However, in light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination is not anticipated.
- 10.11 Consideration may need to be given to providing lined service trenches and clean in-fill to prevent possible exposure to ACM and asbestos fibres during any future maintenance work where the presence of such is found to be significant.

APPENDIX 01

Drawings

Notes

Jennings Design Associates take no responsibility for any dimensions obtained by scaling from this drawing. A no dimension is shown the user must be aware of the scale of the drawing and the scale of the site or by site measurement. Supplying the drawing in digital form is solely for convenience and no reliance may be placed on digital data. All data must be checked against hard copy. Dimensions must be taken from the drawing and not the hard copy. The drawing is the copyright of Jennings Design Associates.



Rev	Description	Date	By
1			

Jennings Design Associates

Architects

C	Concept	G	Tender
D	Planning	J	Construction
E	Building Regs	L	As Built
F	Production	Sk	Sketch

Architects Designers Project Managers	
The Warehouse, Saxon Street, Denton, Manchester M34 3DS	
T: 0161 336 5011 F: 0161 320 0512 E: jda@jda-architects.com	
Client: Mr Eln Beiko	
Project: Every Street, Manchester	
Scale: 1:500	Drawn By: JH
Scale: A3	Checked By: TK
Scale: 31-08-16	

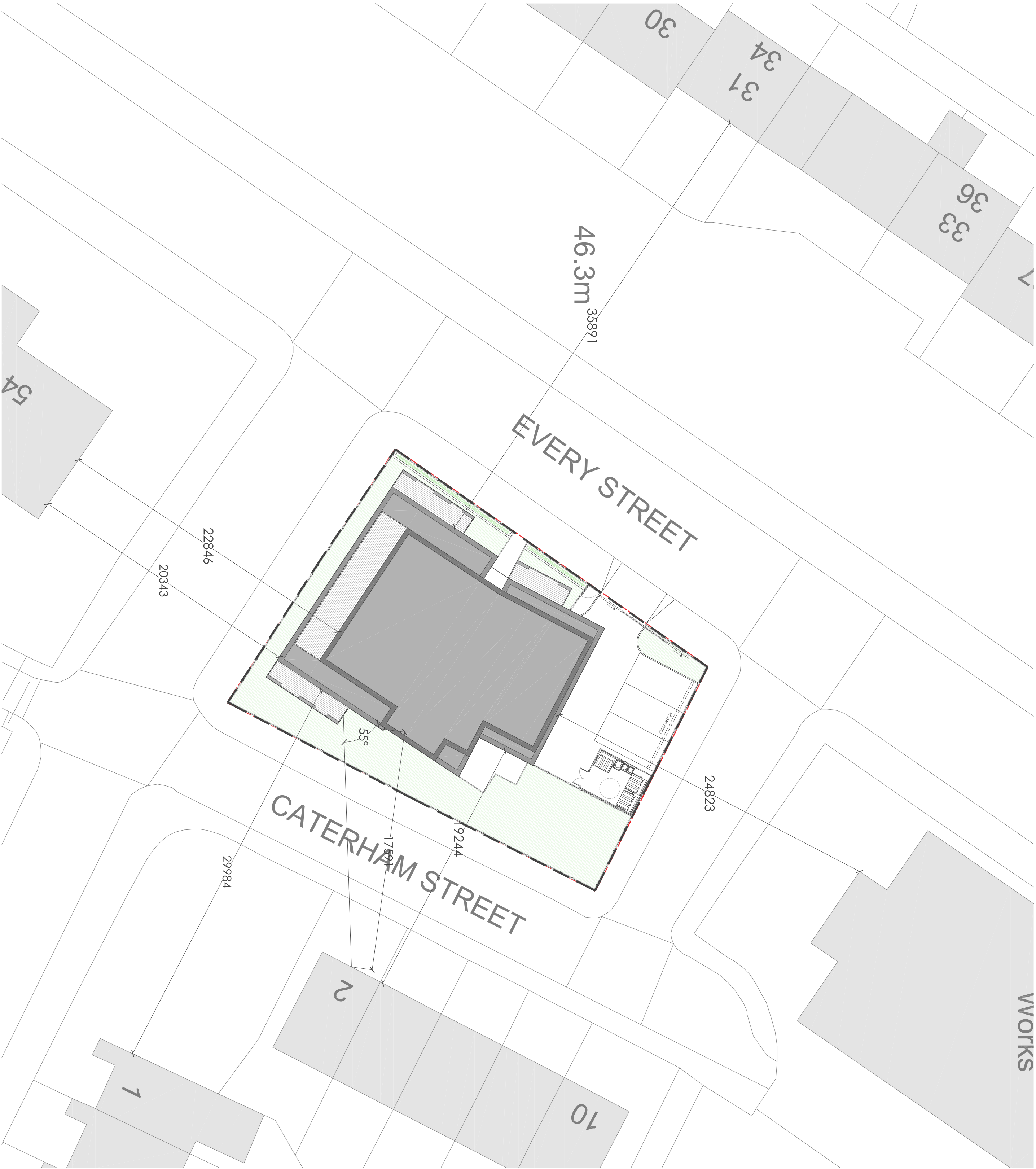
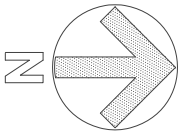
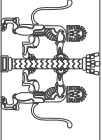
Job Number	Description	Rev
909	A 000 Location Plan	



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Notes

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B		Planning submission	15-09-16	TK
A		Planning submission	14-09-16	TK
Rev	Description	Date	By	

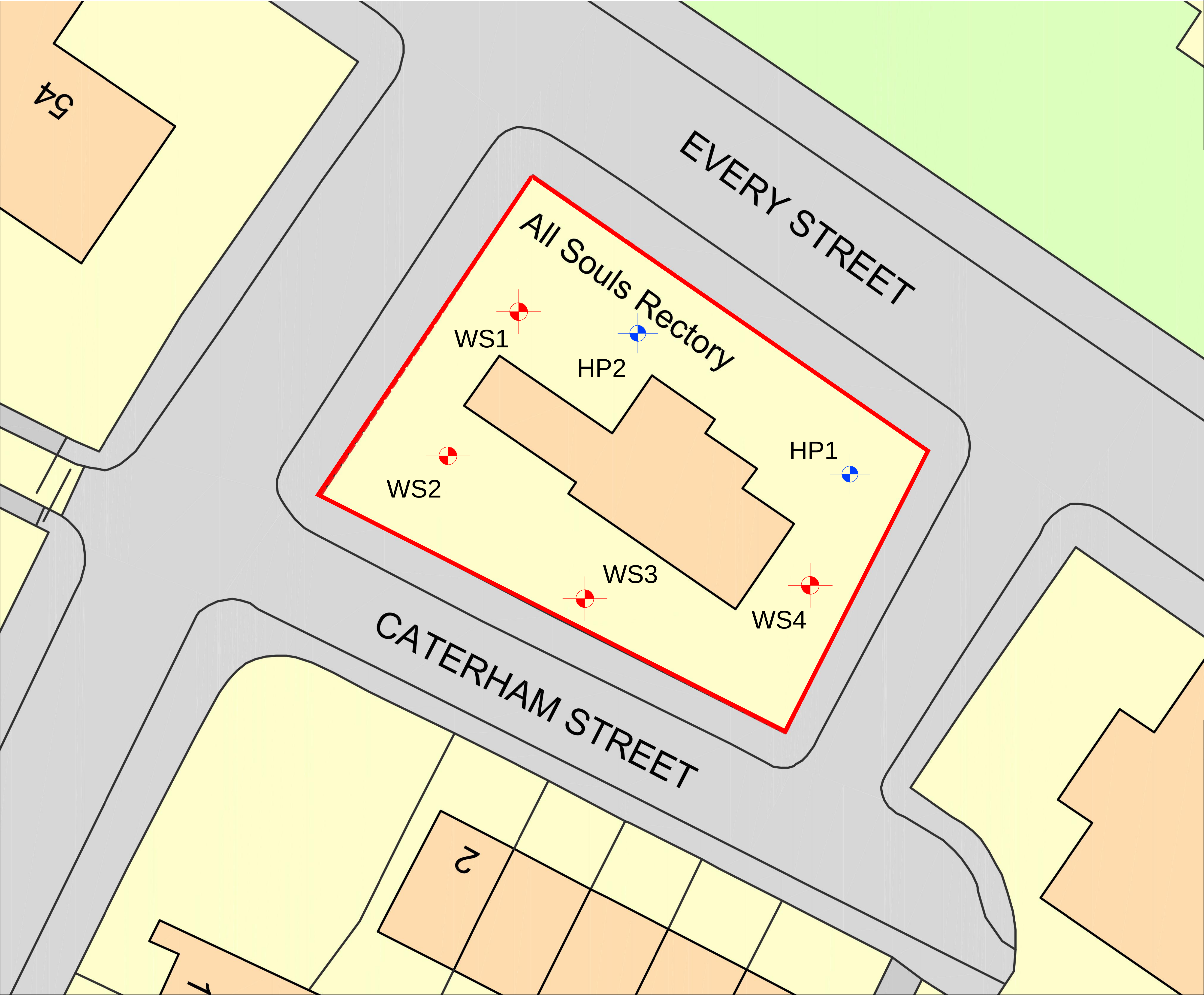
Jennings Design Associates

Architects

C	Concept	G	Tender
D	Planning	J	Construction
E	Building Regs	L	As Buil
F	Production	SK	Sketch

Architects Designers Project Managers			
The Warehouse, Saxon Street, Denton, Manchester M34 3DS			
T: 0161 336 5011 F: 0161 320 0512 E: jda@jda-architects.com			
Client: Mr E Bejko			
Project: Every Street, Manchester			
Scale:	to original size	Date:	Drawn by:
1:200	A2	08/07/2016	NS
		Checked by:	TK
JDS Number	Description		Rev
909	A 001	Proposed Site Plan	B





GENERAL NOTES

- 1. DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.
- 2. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
- 3. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
- 4. THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

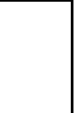
KEY

-  SITE BOUNDARY
-  WS1 WINDOW SAMPLE PROBEHOLES
-  HP1 HAND EXCAVATED TRIAL PITS

P1	FIRST PRELIMINARY ISSUE.	AUG '19	SCS	PGD
Rev.	Amendment	Date	By	Chkd
Project EVERY STREET				
Client A&M DESIGN AND BUILD				
Title EXPLORATORY HOLE LOCATION PLAN				
Drawn SCS	Checked PGD	Date 19-08-19	Scale NTS	
WML CONSULTING Chartered Civil and Structural Engineers			No.8 Oak Green Earl Road Stanley Green Business Park Cheadle Hulme Cheshire SK8 6QL Tel 0161 482 0600 Fax 0161 486 5210 e-mail info@wmlconsulting.com www.wmlconsulting.com	
Job No.	7261G	Drawing No.	SK-01	

APPENDIX 02

Exploratory Hole Records

			Project Title: Every Street				HP2																									
			Project Number: 7261G		Client: A&M Design and Build Ltd					Sheet 1 Of 1																						
			GL (mAOD):		N Coord: 0		E Coord: 0																									
Date: 23/08/2019			Method: Window Sample		Driller: DSUK		Logged By: TPB																									
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																								
0.30	E				0.15	Turf over dark brown, slightly silty SAND with rootlets. (MADE GROUND)																										
					0.60	Brownish grey SAND and subangular, fine to coarse GRAVEL and COBBLES including brick, sandstone, slate and ash. (MADE GROUND)																										
					1.00	End Of Borehole At 0.60 m																										
					2.00																											
					3.00																											
					4.00																											
					5.00																											
					6.00																											
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level			REMARKS No Groundwater Encountered 			Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			Date	Strike	Level	Minutes	Casing	Sealed																		
Date	Strike	Level	Minutes	Casing	Sealed																											
			Scale: 1:40			Daily Log Of Depths <table border="1"> <thead> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			Date	Casing	Water	From	To	Hours																		
Date	Casing	Water	From	To	Hours																											

Printed By GeoLogs (www.GeoLogs.com)

		Project Title: Every Street				WS3		
		Project Number: 7261G		Client: A&M Design and Build Ltd				
		GL (mAOD):		N Coord: 0		E Coord: 0		
Date: 23/08/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB		
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30	E	N=21			0.45	Turf over dark brown, slightly gravelly SAND with rootlets. Gravel is subangular, fine to medium, including sandstone, brick and ash. (MADE GROUND)		
					0.90	Soft, orange brown, slightly silty, very sandy, CLAY. (GLACIAL DEPOSITS)		
					1.00	Medium dense, orange brown, slightly clayey, silty, fine to medium SAND. (GLACIAL DEPOSITS)		
					1.70			
		N=13			2.00	Medium dense, orange brown, slightly gravelly, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse, including sandstone, siltstone and mudstone. (GLACIAL DEPOSITS)		
					2.40	Stiff, greyish brown, slightly silty, slightly sandy, slightly gravelly CLAY. Gravel is subangular, fine to coarse, including sandstone, siltstone and coal. (GLACIAL TILL)		
3.00	J	N=23			3.00			
					4.00			
		N=24						
					5.00			
		N=24						
								
								
								
								
								
								
								

		Project Title: Every Street				WS4	
		Project Number: 7261G		Client: A&M Design and Build Ltd			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 23/08/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	E	N=30			0.20	Turf over dark brown, slightly gravelly SAND with rootlets. Gravel is subangular, fine to medium, including brick. (MADE GROUND) Dark brownish grey SAND and subangular, fine to coarse GRAVEL including brick, sandstone, ash, clinker and ceramic. (MADE GROUND) Soft, orange brown, slightly silty, sandy CLAY. (GLACIAL DEPOSITS) Medium dense, orange brown, slightly clayey, slightly silty, fine to medium SAND. (GLACIAL DEPOSITS) Medium dense, orange brown, gravelly, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse, including sandstone, siltstone, mudstone and granite. (GLACIAL DEPOSITS) No recovery - suspected cobble in base of hole.		
					0.60			
					0.80			
					1.00			
					1.70			
4.00	D	N=32			2.00	Stiff, greyish brown, slightly silty, slightly sandy, slightly gravelly CLAY. Gravel is subangular, fine to coarse, including sandstone, siltstone and coal. (GLACIAL TILL) End Of Borehole At 5.00 m		
					3.00			
					4.00			
					5.00			
					6.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa - Groundwater Strike - Groundwater Level 	REMARKS Scale: 1:40	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="6">Water Strikes</th> </tr> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> <tr> <td>27/08/2019</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="3">Daily Log Of Depths</th> <th colspan="3">Chiselling</th> </tr> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>	Water Strikes						Date	Strike	Level	Minutes	Casing	Sealed	27/08/2019	2																	Daily Log Of Depths			Chiselling			Date	Casing	Water	From	To	Hours												
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Daily Log Of Depths			Chiselling																																																					
Date	Casing	Water	From	To	Hours																																																			

APPENDIX 03

Chemical Analytical Results



2183

Final Report

Report No.: 19-28632-1

Initial Date of Issue: 03-Sep-2019

Client WML Consulting Ltd

Client Address: No. 8 Oak Green
Stanley Green Business Park
Earl Rd
Cheadle
SK8 6QL

Contact(s): Sam Seddon

Project 7261G Every St

Quotation No.: **Date Received:** 28-Aug-2019

Order No.: 7261G **Date Instructed:** 28-Aug-2019

No. of Samples: 10

Turnaround (Wkdays): 5 **Results Due:** 03-Sep-2019

Date Approved: 03-Sep-2019

Approved By:



Details: Amy Parekh-Pross, Technical Projects
Manager

Project: 7261G Every St

Client: WML Consulting Ltd	Chemtest Job No.:				19-28632	19-28632	19-28632	19-28632	19-28632	19-28632	19-28632	19-28632
Quotation No.:	Chemtest Sample ID.:				879062	879063	879064	879065	879066	879067	879068	879069
Order No.: 7261G	Client Sample Ref.:				E	E	J	E	J	E	J	E
	Client Sample ID.:				1	2	3	4	5	6	7	8
	Sample Location:				WS1	WS1	WS1	WS2	WS2	WS3	WS3	WS4
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.50	2.60	0.20	1.80	0.30	3.00	0.40
	Date Sampled:				23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019
	Asbestos Lab:				LIVERPOOL	LIVERPOOL		LIVERPOOL		LIVERPOOL		LIVERPOOL
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A	-	-		Fibres/Clumps, Board		-		-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected		Amosite Chrysotile		No Asbestos Detected		No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-		Stereo Microscopy		-		-
Moisture	N	2030	%	0.020	16	16	11	21	10	16	10	16
pH	U	2010		N/A	8.4	8.5	8.3	8.1	8.1	8.1	8.2	8.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.50	< 0.40		1.5		0.52		< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	0.024	0.033	< 0.010	< 0.010	0.030	0.012
Total Sulphur	U	2175	%	0.010	0.071	0.11	0.099	0.11	0.11	0.019	0.13	0.084
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50		0.60		< 0.50		< 0.50
Sulphate (Total)	U	2430	mg/kg	100	1500	1300		1700		1400		1400
Arsenic	U	2450	mg/kg	1.0	19	16		18		31		18
Cadmium	U	2450	mg/kg	0.10	0.40	0.38		1.4		0.37		0.23
Copper	U	2450	mg/kg	0.50	51	36		65		79		47
Mercury	U	2450	mg/kg	0.10	0.32	0.32		0.45		1.5		1.2
Nickel	U	2450	mg/kg	0.50	24	19		23		30		19
Lead	U	2450	mg/kg	0.50	340	420		220		360		200
Selenium	U	2450	mg/kg	0.20	0.31	< 0.20		0.55		0.53		0.30
Vanadium	U	2450	mg/kg	5.0	29	24		28		33		21
Zinc	U	2450	mg/kg	0.50	120	80		220		120		64
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50		< 0.50
Organic Matter	U	2625	%	0.40	7.2	6.7		11		12		5.0
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10		< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10		< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10		< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10		< 0.10
Phenanthrene	U	2700	mg/kg	0.10	2.2	2.4		0.63		1.2		< 0.10
Anthracene	U	2700	mg/kg	0.10	0.65	0.62		0.18		0.27		< 0.10
Fluoranthene	U	2700	mg/kg	0.10	2.9	2.9		1.1		1.2		0.33
Pyrene	U	2700	mg/kg	0.10	3.1	2.8		1.1		1.2		0.22
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.6	1.3		< 0.10		0.64		< 0.10
Chrysene	U	2700	mg/kg	0.10	1.3	1.3		< 0.10		0.52		< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	1.5	< 0.10		< 0.10		< 0.10		< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.97	< 0.10		< 0.10		< 0.10		< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.5	< 0.10		< 0.10		< 0.10		< 0.10

Results - Soil

Project: 7261G Every St

Client: WML Consulting Ltd	Chemtest Job No.:		19-28632	19-28632	19-28632	19-28632	19-28632	19-28632	19-28632	19-28632
Quotation No.:	Chemtest Sample ID.:		879062	879063	879064	879065	879066	879067	879068	879069
Order No.: 7261G	Client Sample Ref.:		E	E	J	E	J	E	J	E
	Client Sample ID.:		1	2	3	4	5	6	7	8
	Sample Location:		WS1	WS1	WS1	WS2	WS2	WS3	WS3	WS4
	Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):		0.10	0.50	2.60	0.20	1.80	0.30	3.00	0.40
	Date Sampled:		23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019	23-Aug-2019
	Asbestos Lab:		LIVERPOOL	LIVERPOOL		LIVERPOOL		LIVERPOOL		LIVERPOOL
Determinand	Accred.	SOP	Units	LOD						
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	1.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.29	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	18	11	3.0	5.0	< 2.0	< 0.30
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Project: 7261G Every St

Client: WML Consulting Ltd	Chemtest Job No.:				19-28632	19-28632
Quotation No.:	Chemtest Sample ID.:				879070	879071
Order No.: 7261G	Client Sample Ref.:				E	E
	Client Sample ID.:				9	10
	Sample Location:				HP1	HP2
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.40	0.30
	Date Sampled:				23-Aug-2019	23-Aug-2019
	Asbestos Lab:				LIVERPOOL	LIVERPOOL
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	15	18
pH	U	2010		N/A	8.5	8.3
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	0.80
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.093	0.12
Cyanide (Total)	U	2300	mg/kg	0.50	0.90	0.50
Sulphate (Total)	U	2430	mg/kg	100	2200	1800
Arsenic	U	2450	mg/kg	1.0	28	19
Cadmium	U	2450	mg/kg	0.10	0.37	0.51
Copper	U	2450	mg/kg	0.50	38	75
Mercury	U	2450	mg/kg	0.10	0.88	0.67
Nickel	U	2450	mg/kg	0.50	16	23
Lead	U	2450	mg/kg	0.50	450	330
Selenium	U	2450	mg/kg	0.20	0.57	0.46
Vanadium	U	2450	mg/kg	5.0	20	26
Zinc	U	2450	mg/kg	0.50	120	130
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	6.2	7.2
Naphthalene	U	2700	mg/kg	0.10	< 0.10	2.8
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	1.2
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	9.8
Fluorene	U	2700	mg/kg	0.10	< 0.10	6.0
Phenanthrene	U	2700	mg/kg	0.10	1.3	45
Anthracene	U	2700	mg/kg	0.10	0.20	11
Fluoranthene	U	2700	mg/kg	0.10	1.8	54
Pyrene	U	2700	mg/kg	0.10	2.0	52
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.97	21
Chrysene	U	2700	mg/kg	0.10	0.85	22
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	21
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	9.1
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	20

Project: 7261G Every St

Client: WML Consulting Ltd	Chemtest Job No.:				19-28632	19-28632
Quotation No.:	Chemtest Sample ID.:				879070	879071
Order No.: 7261G	Client Sample Ref.:				E	E
	Client Sample ID.:				9	10
	Sample Location:				HP1	HP2
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.40	0.30
	Date Sampled:				23-Aug-2019	23-Aug-2019
	Asbestos Lab:				LIVERPOOL	LIVERPOOL
Determinand	Accred.	SOP	Units	LOD		
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	12
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	3.2
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	11
Total Of 16 PAH's	U	2700	mg/kg	2.0	7.1	300
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

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
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
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.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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 (Applies to LOI in Trommel Fines Only)

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.com

APPENDIX 04

Gas Monitoring Results

WMLCONSULTING

Atmospheric Pressure
Start:- 1014mb
End:- 1014mb
Trend:- Rising

Operator:- P Hobson

[illegible]

Additional Comments

WMLCONSULTING

Atmospheric Pressure
Start:- 1019mb
End:- 1018mb
Trend:- Rising

Operator:- P Hobson

[illegible]

Additional Comments

WMLCONSULTING

Atmospheric Pressure
Start:- 996mb
End:- 995mb
Trend:- Falling

Operator:- P Hobson

[illegible]

Additional Comments

TEST DATE AND CONDITIONS			
Date	14/08/19		
Atmospheric Pressure	993	mB	
Ambient Temperature	21.9	°C	
EnviroNics Serial No.	5089		

**GFM436 Final Inspection & Calibration
Check Certificate**

GAS DATA LTD

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311

Fax 02476307711



Customer	WML Consulting Ltd
Certificate Number	121220
Order Number	323564

Serial Number	12969
Software Version	G436-00.0027/0010

Recalibration DUE Date
14/08/20

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	500	Accept > 200 cc/min	Pump Flow @ -200mB	300	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	60	60	40	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
Zero Reading 100% N ₂	5	5	5	5	6	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
Zero Reading 100% N ₂	0	0	0	0	0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0
CO	2000	1000	0	Accept ±0.0	1000	Accept ±5.0
Hexane	2.0%	2.0%	0	Accept ±0.0	1.99	Accept ±10.0

Cross Gas Effects								
Applied Gas (ppm)		Instrument Readings (ppm)						
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	HEX	
H2S	1500	1500		0		0		
CO	1000	40		1000		0		
Hexane	2.0%	0		0		1.99		

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		993	Accept ± 2.0
AP Port (Internal)	+800 mB	800	Accept ± 5.0
	+1200mb	1200	Accept ± 5.0

Flow Checks					
Borehole Flow			Differential Pressure		
Applied Reading (l/h)	Instrument Reading (l/h)		Applied Pressure (Pa)	Instrument Reading (Pa)	
-30	-30.3	Accept ± 3.0	-556	-570	Accept ± 50
-3	-3	Accept ± 1.0	-23	-22	Accept ± 6.0
0	0	Accept ± 0.0	0	0	Accept ± 0.5
3	3	Accept ± 0.5	17	17	Accept ± 3.0
30	30	Accept ± 3.0	385	384	Accept ± 50
60	60	Accept ± 6.0	1192	1193	Accept ± 130
90	90.4	Accept ± 9.0	2362	>>>>	Accept ± 250

Temperature Checks		
Calibration Temperature	Instrument Temperature Reading °C	
Applied Temperature °C		
-10	-10	Accept ± 2.0
0	0	Accept ± 1.0
30	30	Accept ± 1.0
60	60	Accept ± 1.0
100	100	Accept ± 1.0

Technician:
<i>Jack Rutland</i>

Date Tested:
<i>15/08/19</i>

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 MONITORING METHODOLOGY

1. The following are recorded upon arrival or at each location as the monitoring progresses:-
 - Operator name;
 - Instrumentation name i.e. Gas Data - GFM436;
 - Atmospheric pressure;
 - Time of commencement of the monitoring visit;
 - Ground conditions e.g. wet, dry waterlogged etc.;
 - General weather conditions, as the prevailing conditions may affect the results; and
 - Condition of the monitoring point e.g. damaged, covered etc.
2. The background oxygen concentration in the vicinity of the monitoring point is recorded to ensure that the instrument is zeroed.
3. Where appropriate, both the flow and pressure differential are recorded at each monitoring point prior to obtaining the gas concentrations.
4. Concentrations of light hydrocarbon gas, comprising methane (%v/v), carbon dioxide (%v/v), oxygen (%v/v), hydrogen sulphide (ppm), carbon monoxide (ppm) and hexane % are monitored continuously over a 90 seconds period. The highest concentrations of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest concentration of oxygen are then recorded.
5. If/where concentrations stabilise after 90 seconds, the steady-state concentrations are recorded. If concentrations are still varying, monitoring is continued until steady-state conditions are attained and concentrations then recorded. The accuracy for light hydrocarbon gases is :-
 - Methane - +/-0.2% at 5%.
 - Carbon dioxide - +/-0.1% at 10%.
6. Depth to water level and base of installation are recorded as the movement of groundwater can affect gas migration and migration pathways to monitoring points.
7. The above steps are to be repeated at each monitoring point.
8. The following are then recorded upon completion of the monitoring process:-
 - Atmospheric pressure;
 - Time of completion of the monitoring visit.

Key For Gas Monitoring Records

BH/WS	- Readings taken from gas valve within borehole or window sample probehole.	PD	- Pressure differential measured in millibars
Flow	- Gas flow measured in litres per hour	%	- Percentage
<0.1	- Where flows are less than 0.1/hr are recorded	ppm	- Parts Per Million
CO ₂	- Carbon Dioxide	l/hr	- Litres per hour
O ₂	- Oxygen	CH ₄	- Methane
H ₂ S	- Hydrogen Sulphide	mbgl	- Metres below ground level
CO	- Carbon Monoxide	GSV	- Gas Screening Value

APPENDIX 05

Site Specific Acceptance Criteria

Site Specific Assessment Criteria for Residential (without homegrown produce) assuming a 2.5% SOM for hydrocarbons

Contaminant	Assessment Criteria for Residential (without homegrown produce) (mg/kg)
Metals	
Arsenic	40
Boron	11,000
Cadmium	85
Chromium III	910
Chromium VI	6
Copper	7,100
Lead*	310
Mercury	1.2
Nickel	180
Selenium	430
Vanadium	1,200
Zinc	40,000
Non – Metals	
Phenol	690
Polyaromatic Hydrocarbons (PAH)	
Benz[a]anthracene	14
Benzo[a]pyrene	3.2
Benzo[b]fluoranthene	4.0
Benzo[ghi]perylene	360
Benzo[k]fluoranthene	110
Chrysene	31
Dibenz[ah]anthracene	0.32
Fluoranthene	1,600
Indeno[123-cd]pyrene	46
Naphthalene	5.6
Pyrene	3,800

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* Where not included in the S4UL's criteria for a limited number of contaminants, namely lead, have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.