Ground Gas Addendum Report
Victoria Avenue,Blackley.

Reference:12-787-r3-1
Date: February 2020

GROUND GAS ADDENDUM REPORT

Land at Victoria Avenue
Higher Blackley
Manchester
M9 0RA

Prepared for:

MULBURY

Report Ref: 12-787-r3-1
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1. INTRODUCTION

1.1. BACKGROUND

E3P has previously completed a ground investigation on the site known as Victoria Avenue. The findings of the ground investigation are presented within the E3P report entitled 12-787-r2-v2 - Phase II Geoenvironmental Site Assessment - Victoria Avenue

During the investigation E3P installed ground gas monitoring wells, which were to be monitored over a period of six months after installation. The data collected from the gas monitoring wells are summarised in this report and this comprises the completed ground gas assessment.

1.2. PROPOSED DEVELOPMENT

E3P understands that Mulbury are considering the proposed acquisition and future redevelopment of land at Victoria Avenue for low-rise residential housing comprising 25 two and three-storey houses with associated adopted estate roads and utility infrastructure.

A snapshot of the proposed development layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the ground gas addendum report are to provide a detailed assessment of ground gas risk based on all available data from the E3P ground investigation works.

1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.

2. INVESTIGATION RATIONALE

The Initial Conceptual Site Model has identified that the underlying Made Ground and adjacent historic landfill may represent a potential source of ground gas generation. Ground conditions are discussed in more detail in Section 3. Based on the identification of these sources, E3P has determined that the site represents a moderate ground gas source generation potential.

Within the context of the proposed residential end use and ground gas generation potential, the gas assessment requires that nine visits are required over six months, with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

TABLE 1.1 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	MADE GROUND	0.50 - 4.00
WS102	MADE GROUND	0.50 - 2.00
WS103	Natural CLAY's	0.50 - 4.50
WS105A	MADE GROUND	0.50 - 1.40

2.1. MONITORING METHODOLOGY

Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) were measured using an infra-red gas analyser (GFM435) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 60 seconds at each location, at which point the maximum concentration of CH_4 and CO_2, together with the lowest concentration of O_2 were recorded. The results of the ground gas monitoring are presented in Table 2.1.

TABLE 2.1 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH_4 INITIAL (%V/V)	CH_4 STEADY (%V/V)	CH_4 GSV (l/hr)	CO_2 INITIAL (%V/V)	CO_2 STEADY (%V/V)	CO_2 GSV (l/hr)	O_2 (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	05/06/2019	0.1	0.1	0.00013	1.6	1.6	0.00208	19.3	990	Rising	0.13	0.50 – 4.00	3.56	dry
	19/06/2019	0.1	0.1	0.00026	1.4	1.4	0.00364	19.6	998	Falling	0.26		3.55	dry
	26/06/2019	Access to site impaired.												
	30/07/2019	0.1	0.1	0.00396	2.2	2.2	0.08712	18.6	993	Falling	3.96		3.55	dry
	19/08/2019	0.1	0.1	0.0027	1.9	1.9	0.0513	18.9	997	Rising	2.7		3.55	dry
	29/08/2019	0.1	0.1	0.00234	1.7	1.7	0.03978	19.0	992	Rising	2.34		3.54	dry
	20/09/2019	0.1	0.1	0.00194	1.8	1.8	0.03492	18.8	1001	Falling	1.94		3.55	dry
	25/10/2019	Access to site impaired.												
	20/11/2019	0.1	0.1	0.0023	1.8	1.8	0.0414	19.1	998	Falling	2.3		3.54	dry
WS102	05/06/2019	0.1	0.1	0.00128	0.8	0.8	0.01024	19.2	990	Rising	1.28	0.50 – 2.00	1.65	1.23
	19/06/2019	0.1	0.1	0.00098	0.6	0.6	0.00588	19.5	998	Falling	0.98		1.65	1.26
	26/06/2019	Access to site impaired.												
	30/07/2019	0.1	0.1	0.00013	1.3	1.3	0.00169	11.7	993	Falling	0.13		1.63	1.18
	19/08/2019	0.1	0.1	0.00026	1.1	1.1	0.00286	12.9	997	Rising	0.26		1.64	1.22
	29/08/2019	0.1	0.1	0.00052	1.2	1.2	0.00624	12.0	992	Rising	0.52		1.65	1.20
	20/09/2019	0.1	0.1	0.00089	1.0	1.0	0.0089	13.1	1001	Falling	0.89		1.65	1.24
	25/10/2019	0.1	0.1	-0.00013	2.1	2.1	-0.00273	15.0	997	Falling	-0.13		1.59	0.90
	20/11/2019	0.1	0.1	-0.00026	1.9	1.9	-0.00494	14.6	998	Falling	-0.26		1.59	1.02

WELL	DATE	CH_4 INITIAL (%V/V)	CH_4 STEADY (%V/V)	CH_4 GSV (l/hr)	CO_2 INITIAL (%V/V)	CO_2 STEADY (%V/V)	CO_2 GSV (l/hr)	O_2 (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS103	05/06/2019	**2.2**	**2.2**	0.01936	3.6	3.6	0.03168	15.2	990	Rising	0.88	0.50 – 4.50	4.32	1.52
	19/06/2019	**1.9**	**1.9**	0.00988	3.5	3.5	0.0182	15.8	998	Falling	0.52		4.31	1.50
	26/06/2019	Access to site impaired.												
	30/07/2019	0.1	0.1	0.0001	0.6	0.6	0.0006	20.1	993	Falling	0.1		4.40	0.88
	19/08/2019	0.1	0.1	0.00013	1.3	1.3	0.00169	19.3	997	Rising	0.13		4.38	1.02
	29/08/2019	0.1	0.1	0.00026	1.1	1.1	0.00286	19.5	992	Rising	0.26		4.37	1.09
	20/09/2019	0.1	0.1	0.00052	1.2	1.2	0.00624	19.3	1001	Falling	0.52		4.37	1.10
	25/10/2019	0.1	0.1	-0.00228	1.4	1.4	-0.03192	18.7	997	Falling	-2.28		4.30	1.30
	20/11/2019	0.1	0.1	-0.0016	1.1	1.1	-0.0176	19.1	998	Falling	-1.6		4.30	1.36
WS105A	05/06/2019	0.1	0.1	0.00013	2.3	2.3	0.00299	17.5	990	Rising	0.13	0.50 – 1.40	1.6	dry
	19/06/2019	0.1	0.1	0.00026	2.0	2.0	0.0052	18.2	998	Falling	0.26		1.6	dry
	26/06/2019	0.1	0.1	0.00144	1.3	1.3	0.01872	18.5	1017	Rising	1.44		1.6	1.55
	30/07/2019	0.1	0.1	0.00095	**6.7**	**6.7**	0.06365	14.2	993	Falling	0.95		1.6	1.56
	19/08/2019	0.1	0.1	0.00102	**5.4**	**5.4**	0.05508	15.3	997	Rising	1.02		1.6	1.57
	29/08/2019	0.1	0.1	0.00098	**5.1**	**5.1**	0.04998	15.8	992	Rising	0.98		1.6	1.54
	20/09/2019	0.1	0.1	0.00135	**5.3**	**5.3**	0.07155	15.2	1001	Falling	1.35		1.6	1.48
	25/10/2019	Access to site impaired.												
	20/11/2019	Access to site impaired.												

3. GROUND GAS RISK ASSESSMENT

3.1. GROUND GAS RISK ASSESSMENT METHODOLOGY

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings* (2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

CIRIA C665 and NHBC Report No 10627-R01 provide assessments for carbon dioxide and methane based upon gas screening values (GSVs) utilising flow rates and concentrations. The site-based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{concentration\ (by\ vol)}{100} \times flowrate\ (1\ /\ hr)$$

The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted.

For this development the NHBC thresholds have been adopted due to the use of a subfloor void.

The thresholds for GSVs based upon NHBC guidance are provided within Table 3.1.

TABLE 3.1 RESIDENTIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH NHBC REPORT NO 10627-R01 – RESIDENTIAL END USE

NHBC – SUBFLOOR VOID				
CLASSIFICATION	**Methane[1]**		**Carbon Dioxide[1]**	
	TYPICAL MAXIMUM CONCENTRATION[3] (%V/V)	**GAS SCREENING VALUE [2,4] (l/hr)**	**TYPICAL MAXIMUM CONCENTRATION[3] (%V/V)**	**Gas Screening Value[2,4] (l/hr)**
Green	< 1	< 0.16	< 5	< 0.78
Amber 1	< 5	< 0.63	< 10	< 1.56
Amber 2	< 5	< 1.56	< 30	< 3.10
Red	> 20	> 1.56	> 30	> 3.10

Notes
1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worstcase temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, as defined in Wilson and Card (1999), which is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

3.1.1. SOURCES OF GROUND GAS

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

- Made Ground deposits; and
- Adjacent historic landfill

3.1.2. GROUNDWATER

Within the wells, groundwater levels were observed to fluctuate over the monitoring period, with levels generally increasing over the monitoring period. The greatest groundwater change occurred within WS103 where levels increased by 0.64 m over the monitoring period. WS103 was set within a low-permeability clay stratum and groundwater may be a result of surface water collecting in the well rather than a measure of true groundwater.

3.1.3. GAS FLOW

During the monitoring a positive flow was noted in all wells. The measure of positive flow is considered to be the result of groundwater fluctuations and flooding of the well causing compression – as opposed to gas generation – as the highest flows are recorded during periods of high groundwater levels.

Negative flows are indicative of back pressure from wind being greater than the active flow from the wells. Negative flows were recorded in WS102 and WS103.

3.1.4. GAS CONCENTRATIONS

Methane has been recorded within all monitoring wells, WS103 at maximum concentrations of 2.2% v/v.

Carbon dioxide concentrations were recorded within all the monitoring wells at concentrations ranging from 0.6% v/v to 6.7% v/v (WS105A). The maximum carbon dioxide levels were also associated with low oxygen concentrations and appear to be associated with Made Ground, identified in WS105A.

3.1.5. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 3.2.

TABLE 3.2 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CO_2 (% v/v)	GSV (l/hr)	MAX CH_4 (% v/v)	GSV (l/hr)	CLASSIFICATION
WS101	2.2	0.08712	0.1	0.00396	CS1/ Green
WS102	2.1	0.0089	0.1	0.00128	CS1/ Green
WS103	3.6	0.03168	2.2	0.01936	CS2/ Amber 1
WS105A	6.7	0.07155	0.1	0.00144	CS2/ Amber 1

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Ground gas monitoring suggests that the site will be classed as CS2, therefore properties will require specialist protection measures as detailed below.

3.2. RESIDENTIAL BUILDING GAS RISK MITIGATION

British Standard BS8485 (2015)+A1(2019) provides two types of residential property that require assessment. These building types are:

- **Type A Building –** Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms are present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.

Based on the ground gas risk assessment and the proposed Type A Building, it is envisaged that a point score of 3.5 will be required for affected properties, as summarised in Table 3.3.

TABLE 3.3 BS8485 (2015)+A1(2019) POINTS REQUIRED FOR TYPE A AND TYPE B BUILDINGS

CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT SYSTEM	MINIMUM GAS PROTECTION SCORE (POINTS)	
		HIGH SENSITIVITY	
		TYPE A BUILDING	TYPE B BUILDING
1	Green	0	0
2	Amber 1	3.5	3.5
3	Amber 2	4.5	4
4	Red	6.5 A)	5.5 A)
5	N/A	– B)	6
6	N/A	– B)	– B)

BS8485 (2015)+A1(2019) Notes
A) Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.
B) The gas hazard is too high for this empirical method to be used to define the gas protection measures.

Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, for example, high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system such as in institutional and/or fully serviced contractual situations.

The requisite 3.5 points must be achieved by installation of a suitable combination of measures detailed in Table 3.4.

TABLE 3.4 SUMMARY OF GROUND GAS MITIGATION MEASURES – BS8485 (2015)+A1(2019)

GAS PROTECTION SCORES FOR THE STRUCTURAL BARRIER	SCORE[A]
Floor and Substructure Design	
Precast Suspended Segmental Subfloor (Beam and Block)	0
Cast In-Situ Ground-Bearing Floor Slab (With Only Nominal Mesh Reinforcement)	0.5
Cast In-Situ Monolithic Reinforced Ground-Bearing Raft or Reinforced Cast In-Situ Suspended Floor Slab With Minimal Penetrations	1 or 1.5[B]
Basement Floor and Walls Conforming to BS 8102:2009, Grade 2 Waterproofing[C D]	2
Basement Floor and Walls Conforming to BS 8102:2009, Grade 3 Waterproofing[C D]	2.5

Notes
A) The scores are conditional on breaches of floor slabs, etc., being effectively sealed.
B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see A.2.2.2).
C) The score is conditional on the waterproofing being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall).
D) If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas-resistant membrane in that table.
When practical, utilities should enter the building above floor level with any conduit or meter housing being properly vented outside of the building.

PROTECTION ELEMENT SYSTEM		SCORE	COMMENTS
Gas protection scores for ventilation protection measures			
(a) Pressure Relief Pathway – Usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.		0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is 0.
(b) Passive Subfloor Dispersal Layer – Media used to provide the dispersal layer are: • Clear void; • Polystyrene void former blanket; • Geocomposite void former blanket; • No-fines gravel layer with gas drains; and • No-fines gravel layer.	Very good performance	2.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 (2015). Passive ventilation should be designed to meet at least "good performance".
	Good performance	1.5	

PROTECTION ELEMENT SYSTEM	SCORE	COMMENTS
(c) Active Dispersal Layer – Usually comprising fans with active abstraction (suction) from a subfloor dilution layer with roof-level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.	1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least "good performance".
(d) Active Positive Pressurisation – Provided by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.	1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient "coverage" of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least "good performance".
(e) Ventilated Car Park – Floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park.	4	Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F [9].
Gas Protection Score for the Gas-Resistant Membrane		
Gas-resistant membrane meeting all of the following criteria: • Sufficiently impervious to the gases with a methane gas transmission rate < 40 ml/day/m^2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre-reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools); • Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet all the criteria opposite, then the score is zero.
A) Membrane with a methane gas transmission rate < 40.0 ml/day/m2/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1:2007 manometric method) is regarded as sufficiently impervious.		

B) For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m^2 and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs.

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

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

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. 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.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, 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.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

TERMS

ACM	Asbestos-containing material	**MMP**	Materials management plan
ADS	Acoustic design statement	**ND**	Not detected
AST	Above-ground storage tank	**NDP**	Nuclear density probe
BGS	British Geological Survey	**NMP**	Noise management plan
BSI	British Standards Institute	**NPSE**	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	**NR**	Not recorded
CA	Coal Authority	**PAH**	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	**PCB**	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	**PI**	Plasticity index
CIRIA	Construction Industry Research Association	**PID**	Photo ionisation detector
CLEA	Contaminated land exposure assessment	**POS**	Public open space
CML	Council of Mortgage Lenders	**PPE**	Personnel protective equipment
CoC	Contaminants of concern	**ProPG**	Professional practice guidance
CSM	Conceptual site model	**QA**	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	**SGV**	Soil guideline value
DWS	Drinking water standard	**SPH**	Separate-phase hydrocarbon
EA	Environment Agency	**SPT**	Standard penetration test
EQS	Environmental quality standard	**SVOC**	Semi-volatile organic compound
FFL	Finished floor level	**TPH**	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	**TPH CWG**	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	**UKWIR**	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	**UST**	Underground storage tank
HCV	Health criteria value	**VCC**	Vibro-concrete column
ICSM	Initial conceptual site model	**VOC**	Volatile organic compound
LEL	Lower explosive limit	**VRSC**	Vibro-replacement stone columns
LMRL	Lower method reporting limit	**VSC**	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	**WHO**	World Health Organisation

MCV	Moisture condition value	**WRAP**	Waste and Resources Action Programme
MIBK	Methyl isobutyl ketone	**WTE**	Water table elevation
m	Metres	**ppm**	Parts per million
km	Kilometres	**mg/m^3**	Milligram per metre cubed
% v/v	Percent volume in air	**m bgl bgl**	Metres below ground level
mb	Millibars (atmospheric pressure)	**m bcl**	Metre below cover level
l/hr	Litres per hour	**mAOD**	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	**kN/m^2**	Kilonewtons per metre squared
ppb	Parts per billion	**µm**	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	**SSRT**	Site Specific Remediation Target
PSD	Particle Size Distribution	**DD**	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	**Mc**	Moisture Content
ρ	Bulk Density	**GPR**	Ground Penetrating Radar
NDP	Nuclear Density Probe	**FFL**	Finished Floor Level
LEL	Lower Explosive Limit	**UKWIR**	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	**LOD**	Limit of Detection

APPENDIX III
DRAWINGS



Key:

Notes:

P1	-	09.08.2018	DRAFT	CB	BH
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Mulbury

Job No: 12-787

Date: 09.08.2019

Drawing No: 002

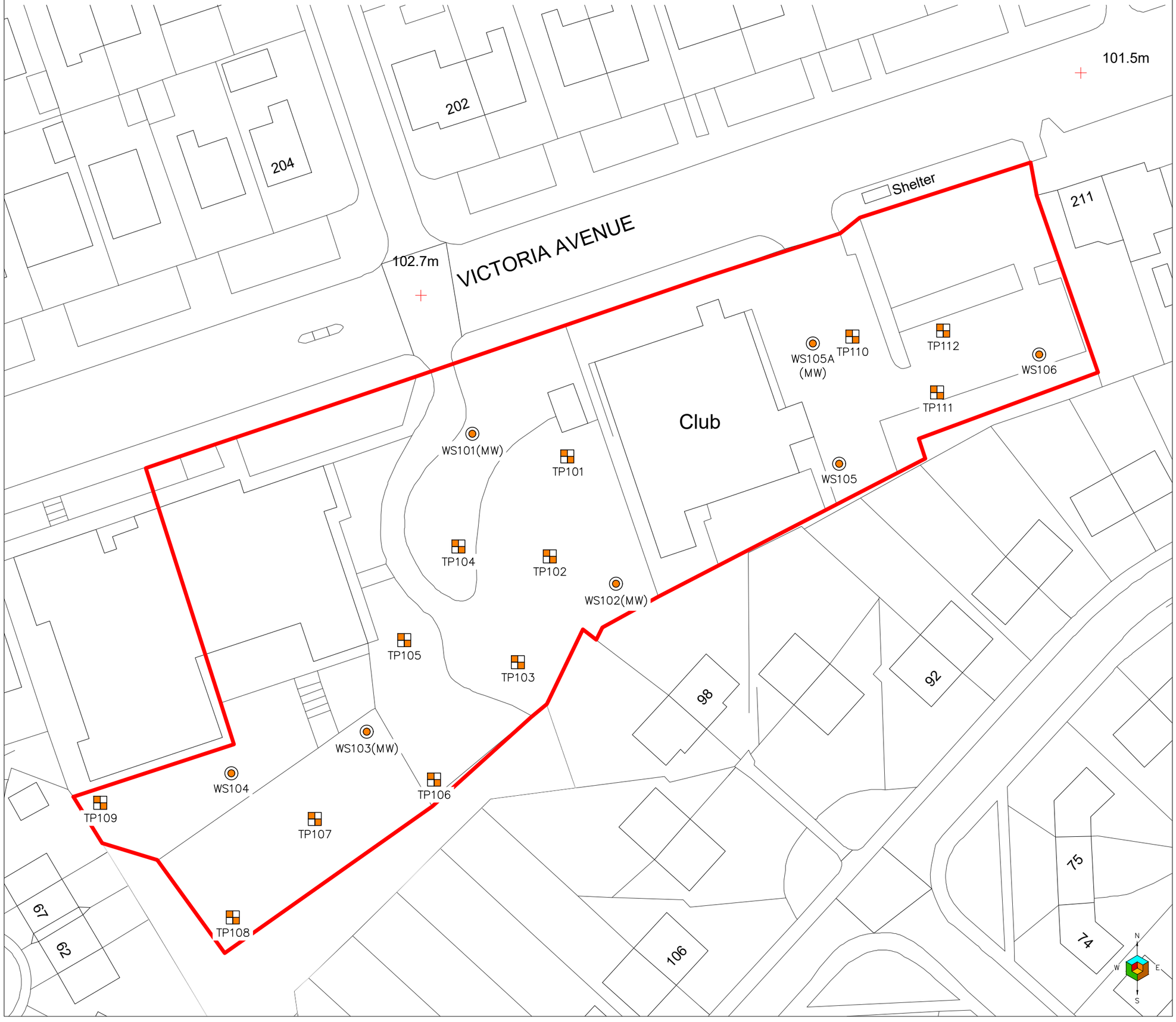
Scale: 1:500 @ A3

Job Title: Victoria Avenue, Blackley

Drawing Title: Draft Development Layout

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Key:

Location Symbols

WS101 — Approximate Window Sample Probehole Location

TP101 — Approximate Trial Pit Location

Notes:

P1 P1	R1 -	30.05.2019 21.05.2019	REVISION DRAFT	HM HM	EF EF
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Mulbury

Job No: 12-787

Date: 30.05.2019

Drawing No: 005

Scale: NTS

Job Title: Victoria Avenue, Blackley

Drawing Title: Exploratory Hole Location Plan

e3p

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