

Ray Liu
McGoff Construction Limited

By Email only

Dear Ray,

RE: Ground Gas Risk Assessment – Rochdale Road, Manchester

Further to the issue of the Waterman Remediation Strategy and following completion of the program of ground gas monitoring undertaken at Rochdale Road, Manchester (hereafter named 'the Site'). Please find below a ground gas risk assessment prepared on the basis of ground gas monitoring undertaken at the Site between 21st October 2022 and 16th January 2023.

Background

The Rochdale Road Site was subject to ground investigation in October 2022 and series of ground gas monitoring wells were installed as part of the ground investigation. The monitoring wells have been subject to ground gas monitoring on six occasions over period of three months.

Terms of Reference

This monitoring and assessment has been undertaken in accordance with:

- BS 8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- CIRIA Report C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings;
- BRE211 (2015) Radon - Guidance on Protective Measures for New Buildings;
- The scope of work, terms of appointment and limitations outlined in our proposal: dated 4th August 2022, ref: WIE19453-100-F-220803-RT Fee.

The initial conceptual model and preliminary assessment of ground gas risks contained in reports referenced WIE. Geo-Environmental Risk Assessment – Rochdale Road, Manchester. Ref. WIE19453-100-R-2.3.1-GQRA, dated January 2023 have been relied upon as the basis for design for the gas investigation and monitoring strategy.

The Proposed Development

The Proposed Development gained planning consent for the following defined development :

'The Erection of a part 11, part 13 storey building to form residential apartments (Use Class C3a) together with the erection of two blocks of 3 storey duplexes (Use Class C3a) to form 237 residential homes in total with associated commercial floor (Use Class E) (132 sqm), basement car parking, landscaping and public realm, and associated engineering and infrastructure works following demolition of existing buildings and structures'.

If the proposed layout is revised (especially the development type), it may be necessary to update this assessment and WIE should be contacted for further advice.

The proposed development is consistent with a Type B building as set out in Table 3 of BS8485:2015, i.e. a private or commercial property with limited or no central management control of the maintenance or the gas protection measures.

Potential Sources of Hazardous Gas

With regard to naturally occurring radon, BRE211 identifies the site as being in an area where no radon measures may be required.

The initial conceptual site model referenced above identified potentially significant sources of ground gas as summarised in Table 1.

Table 1: Summary of potential sources of hazardous gas in the vicinity of the site

Site Name/Ref	Location	Typical Description	Data Source
<i>Made Ground</i>	<i>On site</i>	<i>Varying depths of Made Ground recorded across the site up to a depth of 7.80m bgl.</i>	<i>Ground Investigation</i>
<i>Potential Hydrocarbon Contamination</i>	<i>On site</i>	<i>Visual and olfactory evidence of hydrocarbon contamination encountered during the ground investigation at the base of Made Ground and surface of the Glacial Till. Elevated TPH contaminants were recorded within the deeper soils and groundwater.</i>	<i>Ground Investigation</i>

No boreholes were advanced in the northern boundary of the Site due to the presence of an existing open tunnel network and potential underground voids. Therefore, two boreholes were advanced off-site to the north (BH106 and BH107).

Based on the above, the site has been classified as being subject to a low gas generation risk. In accordance with BS8576:2013 and Tables 5.5a and 5.5b of CIRIA Report C665, monitoring has therefore comprised 6 visits over a 3-month period.

Gas Monitoring Programme

Monitoring was undertaken using Geotechnical Instruments GFM 436 infra – red gas analysers, calibrated in accordance with manufacturer's instructions. A total of 6 monitoring visits were undertaken between 21st October 2022 and 16th January 2023.

The monitoring was undertaken under varying atmospheric pressures, with low or falling atmospheric pressure conditions (i.e., <1,000mb) prevailing during 1 of the 6 monitoring visits.

During each monitoring visit, the following parameters were recorded:

- Methane (peak and steady state conditions);
- Carbon dioxide (peak and steady state conditions);
- Oxygen (lowest and steady state);
- Borehole gas flow rates; and,
- Groundwater levels.

Results of the Monitoring Programme

Gas monitoring data sheets and exploratory hole location plan are enclosed, and the results are summarised in Table 2 below.

Table 2: Summary of gas monitoring data

BH Response Zone (m)	Ref / Response Zone (m) / Stratum	Methane (v/v%)	Carbon Dioxide (v/v%)	Oxygen (v/v%)	Boreholes Flow Rate (l/hr)	Water Level (m bgl)
BH101 / 1.0 – 3.0	Made Ground	<0.1	<0.1 – 2.4	20.1 - 18.0	0.0	Dry
BH102 / 6.0 – 8.0	Made Ground	<0.1	<0.1	20.9 - 20.4	0.0	5.65 – 5.11
BH103 / 6.0 – 10.0	Made Ground and Clay	<0.1	<0.1	20.8 – 20.2	0.0	5.68 – 5.34
BH104 / 4.0 – 6.0	Made Ground	<0.1	<0.1	20.7 - 20.4	0.0	Dry
BH105 / 4.5 – 7.0	Made Ground	<0.1	<0.1 - 0.2	20.5 - 20.0	0.0	5.32 – 4.98
WS101 / 1.0 - 3.4	Made Ground	<0.1	<0.1 – 0.5	20.6 - 20.0	0.0	1.25 - dry
WS102 / 1.0 - 3.0	Made Ground	Not recorded?	-		0.0	-
WS103 / 1.0 - 2.0	Made Ground	<0.1	<0.1 – 0.3	20.5 – 20.1	0.0	Dry
WS105 / 1.0 – 2.0	Made Ground	<0.1	<0.1 – 0.1	20.7 – 20.0	0.0	Dry
Off-Site						
BH106 / 1.0 – 4.0	Made Ground and Clay	<0.1	1.0 - 1.3	18.6 – 14.2	0.0	1.02 – dry
BH107 / 1.0 – 2.0	Made Ground	<0.1	0.1 – 0.6	20.2 – 18.9	0.0	1.15 – 0.86

The following patterns / trends / limitations are illustrated from the data summarised above:

- The response zones in BH101, BH104, WS103 and WS05 were generally dry and unobstructed.
- The response zones were observed to be flooded in BH107 during the 5th and 6th visits, BH102 and BH103 throughout the monitoring period, therefore data obtained during these visits in these locations is not considered valid and not used in the further assessment.
- The monitoring period included two periods of low and decreasing atmospheric pressure (range 993mb – 1004mb), during which gas flow would be expected to be higher.
- Methane concentrations of 0% v/v were recorded during all monitoring visits.
- Slightly elevated carbon dioxide concentrations (i.e. <3%) were recorded in BH101, BH105-7, WS101, WS103 and WS105 monitoring wells, with highest concentrations of 2.4% v/v recorded in BH101 during the first monitoring visit.
- Elevated carbon dioxide concentrations were associated with microbial decay of organic materials contained in made ground.
- Depleted levels of oxygen (i.e. <17% v/v) were recorded in BH106 during the first three monitoring visits.
- Flow readings of 0.0l/h were recorded in all monitored boreholes.
- No significant changes in the water table were recorded in BH102, BH103 and BH105 with BH101, BH104, WS103 and WS105 being dry throughout the monitoring visits.
- Groundwater levels were noted to fluctuate throughout the monitoring period and ranged from 1.02m bgl to dry in BH106 and from 1.25m bgl to dry in WS101.

Based on the above summary, it is considered that there is sufficient site investigation information available to define the conceptual site model and sufficient gas monitoring measurements to use the semi quantitative approach to gas characterisation outlined below.

Ground Gas Characterization and Hazard Assessment

An empirical, semi-quantitative approach has been used to characterize the ground gas risk for the Site. This approach derives an appropriate gas screening value (GSV), or several GSVs if the site is zoned. The GSV is then used to select an appropriate Characteristic Situation (CS) for design and selection of the choice of protective measures.

The borehole flow rate Q_{hg} (in L/h) has been calculated for each monitoring location and each monitoring event (for each hazardous gas) using the following equation:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where: -

Q_{hg} is the borehole hazardous gas flow rate
 q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in % volume/volume).

Calculation of borehole hazardous gas flow rate – Q_{hg}

The GSV for carbon dioxide is 0.0027 l/hr

The GSV for methane is 0.0001 l/hr

As the dataset is representative, comprehensive and captures temporal and atmospheric variation, the GSV is taken as the maximum Q_{hg} measured for all the monitoring events, i.e. **0.0027 l/hr**.

Notwithstanding this designation of GSV, a worst case check indicates that when the plausible worst case conditions are calculated for each stratum or zone, a greater hazard is not considered likely, hence the above GSV should be adopted to select protective measures.

A GSV of 0.0027l/hr is consistent with **Characteristic Situation 1, Very Low Hazard Potential**.

Selection of Appropriate Protective Measures

With reference to Table 4 of BS8485, a site falling into CS1 with proposed Type B buildings requires a gas protection score of 0 points. No protection measures are required for proposed structures at the site with reference to methane and carbon dioxide gas.

The guidance in CIRIA C665 (2007) requires a potential increase to a Characteristic Situation 2 (CS2) classification (low risk) where methane >1.0% and carbon dioxide is >5.0% with the overall ground gas conceptual to be considered to determine the appropriate ground gas classification. As no methane or carbon dioxide were recorded at or above these concentrations an increase from CS1 to CS2 is not considered appropriate.

Additionally, potential sources of hydrocarbons vapours have been identified at the site, in the form of benzene, naphthalene, trimethylbenzenes and phenol. Based on the GQRA report undertaken by WIE (report ref: WIE19453-100-R-2.3.1-GQRA) this is considered to pose an unacceptable vapour risk and remediation will be required. The most viable solution is considered to be the inclusion of a suitable vapour membrane within the proposed buildings and structures.

In 2009 the Health Protection Agency (HPA, now Public Health England) recommended that basic radon protection measures should be built into all new occupied buildings in the UK, even where radon maps identify the site as not being in a radon sensitive area. The current Building Regulations do not require this, however the provision of basic protection measures would reduce the residual risk and would be considered a cost effective and sensible precaution by some developers.

The overall level of risk associated with hazardous gas at the Site should be kept under review through the design process, particularly in the event that the end use of the site is changed or infrastructure is designed which could introduce pathways for gas (e.g. vibrated stone columns, deep drains, large/deep attenuation tanks, substantial earthworks etc). This may necessitate further monitoring of ground gas and/or a review of the above recommendations for gas protection.

Should you require any clarification please do not hesitate in contacting the undersigned.

Yours sincerely



Ugne Ankenaite

Consultant (Geo-environmental)

For and On Behalf of Waterman Infrastructure & Environment Ltd

Enc. Exploratory Hole Location Plan (Drawing Ref. 19453-100-WIE-ZZ-XX-DR-V-80-001 Rev P05)
 Gas Monitoring Data Sheets
 Proposed layout drawing ref. 2624-PLA-XX-XX-DR-L-0002/S1/P06

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.

This drawing is the property of Waterman Infrastructure & Environment Limited, and the drawing is issued on the condition that it is not copied, reproduced, related or disclosed to any unauthorised person, either wholly or in part without the consent in writing of Waterman Infrastructure & Environment Limited
Pickfords Wharf, Clink Street, London SE1 5DG 1 020 7928 7888 1 03333 444 501

GENERAL NOTES

-  SITE BOUNDARY
-  WS101 WINDOW SAMPLE LOCATIONS
-  BH101 15-20M CABLE PERCUSSIVE BOREHOLES WITH FOLLOW ON 10M ROTARY CORING
-  TP111 TRIAL PITS TO ESTABLISH EXISTING FOUNDATION ARRANGEMENTS
-  HDP101 HAND DUG PIT LOCATIONS (POSITIONED ON SITE, NOT SURVEYED)
-  EXPLORATORY HOLE LOCATIONS WITHIN BUILDING WERE POSITIONED ONSITE, NOT SURVEYED

P05	SO	22.11.22	AS BUILT ISSUE	DC	RT
P04	SO	17.10.22	AS BUILT ISSUE	DC	RT
P03	SO	20.09.22	UPDATED TOPO	DC	RT
P02	SO	15.09.22	GI LOCATIONS UPDATED	MC	RT
P01	SO	09.09.22	PRELIMINARY ISSUE	MC	RT
Status	Date	Description			By Csk

Amendments

Project

ROCHDALE ROAD

Title

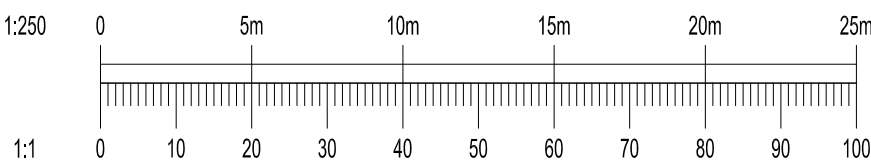
EXPLORATORY HOLE LOCATION PLAN

Client



6th Floor Trinity Court 16 John Dalton Street Manchester M2 6HY
t 0161 839 8392
mail@watermangroup.com www.watermangroup.com

Status					
AS BUILT					
Designed By	RT	Director	RT	Waterman Ref	WIE19453-100
Drawn By	MC	Date	NOVEMBER 2022	Scales @ A1	1:250
Project - Originator - Volume - Level - Type - Role - Number					Revision
19453-100-WIE-ZZ-XX-DR-V-80-001					P05



PERMANENT GROUND GAS MONITORING FORM



SITE NAME:	ROCHDALE ROAD, MANCHESTER				ENGINEER:	William Sandiford Mitchell				
CLIENT:	WATERMAN I & E				DATE:	21/10/2022				
JOB NO:	GRO-22292									
Pressure Trend:	Falling	Weather:	Overcast			Equipment:	GFM 436			
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)				
Start	20.8	0.0	0.0	0.0	0.0	0.0				
Finish	20.8	0.0	0.0	0.0	0.0	0.0				

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	2.7	2.4	18.4	18.6	0.0	0.0	0.0	0.0	0.0027	0.0000	993	-	N	N/A	N/A	NGW
BH101 (Piezo)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N/A	N/A	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.3	20.8	0.0	0.0	0.0	0.0	0.0000	0.0000	993	-	N	N/A	N/A	5.65
BH102 (Piezo)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N/A	N/A	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.4	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	993	-	N	N/A	N/A	5.56
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.4	20.7	0.0	0.0	0.0	0.0	0.0000	0.0000	994	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	993	-	N	N/A	N/A	5.32
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.1	1.0	14.3	14.7	0.0	0.0	0.0	0.0	0.0011	0.0000	992	-	N	N/A	N/A	NGW
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.6	0.6	19.4	19.5	0.0	0.0	0.0	0.0	0.0006	0.0000	992	-	N	N/A	N/A	1.11
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.6	0.5	20.0	20.3	0.0	0.0	0.0	0.0	0.0006	0.0000	993	-	N	N/A	N/A	NGW
WS102	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.5	0.3	19.6	20.1	0.0	0.0	0.0	0.0	0.0005	0.0000	993	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.2	0.1	20.5	20.7	0.0	0.0	0.0	0.0	0.0002	0.0000	992	-	N	N/A	N/A	NGW

Notes:

PERMANENT GROUND GAS MONITORING FORM



SITE NAME:		ROCHDALE ROAD, MANCHESTER				ENGINEER:		Jack Perkins			
CLIENT:		WATERMAN I & E				DATE:		11/11/2022			
JOB NO:		GRO-22292									
Pressure Trend:		Rising	Weather:		Overcast		Equipment:		GFM 436		
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)				
Start		20.5	0.0	0.0	0.0	0.0	0.0				
Finish		20.5	0.0	0.0	0.0	0.0	0.0				

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	0.6	0.6	20.0	20.1	0.0	0.0	0.0	0.0	0.0006	0.0000	1009	-	N	N/A	N/A	NGW
BH101 Piezo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N/A	N/A	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.9	20.9	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	5.53
BH102 Piezo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N/A	N/A	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.8	20.8	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	5.56
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1011	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.4	0.2	20.0	20.3	0.0	0.0	0.0	0.0	0.0004	0.0000	1011	-	N	N/A	N/A	5.14
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.0	1.0	14.7	14.9	0.0	0.0	0.0	0.0	0.0010	0.0000	1011	-	N	N/A	N/A	1.28
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.5	0.4	19.4	19.5	0.0	0.0	0.0	0.0	0.0005	0.0000	1011	-	N	N/A	N/A	1.09
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.6	20.6	0.0	0.0	0.0	0.0	0.0000	0.0000	1010	-	N	N/A	N/A	1.25
WS102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.2	0.2	20.4	20.4	0.0	0.0	0.0	0.0	0.0002	0.0000	1011	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.1	0.1	20.3	20.5	0.0	0.0	0.0	0.0	0.0001	0.0000	1009	-	N	N/A	N/A	NGW

Notes:

GROUNDTECH
CONSULTING

SITE NAME:		ROCHDALE ROAD, MANCHESTER				ENGINEER:		Jack Perkins			
CLIENT:		WATERMAN I & E				DATE:		21/11/2022			
JOB NO:		GRO-22292									
Pressure Trend:		Rising	Weather:	Sunny			Equipment:		GFM 436		
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)				
Start		20.6	0.0	0.0	0.0	0.0	0.0				
Finish		20.6	0.0	0.0	0.0	0.0	0.0				

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	0.6	0.4	20.3	20.1	0.0	0.0	0.0	0.0	0.0006	0.0000	1019	-	N	N/A	N/A	NGW
BH101 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.7	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1019	-	N	N/A	N/A	5.43
BH102 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.4	20.2	0.0	0.0	0.0	0.0	0.0000	0.0000	1019	-	N	N/A	N/A	5.42
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.3	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1019	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.2	20.0	20.0	0.0	0.0	0.0	0.0	0.0003	0.0000	1019	-	N	N/A	N/A	5.03
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.2	1.0	16.7	14.2	0.0	0.0	0.0	0.0	0.0012	0.0000	1019	-	N	N/A	N/A	1.16
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.4	0.3	19.6	18.9	0.0	0.0	0.0	0.0	0.0004	0.0000	1018	-	N	N/A	N/A	1.15
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.0	20.4	20.3	0.0	0.0	0.0	0.0	0.0003	0.0000	1018	-	N	N/A	N/A	1.34
WS102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.2	20.3	20.4	0.0	0.0	0.0	0.0	0.0003	0.0000	1019	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.1	0.0	20.1	20.0	0.0	0.0	0.0	0.0	0.0001	0.0000	1019	-	N	N/A	N/A	NGW

Notes:

PERMANENT GROUND GAS MONITORING FORM



SITE NAME:		ROCHDALE ROAD, MANCHESTER				ENGINEER:		William Sandiford Mitchell				
CLIENT:		WATERMAN I & E				DATE:		07/12/2022				
JOB NO:		GRO-22292										
Pressure Trend:		Steady	Weather:	Clear			Equipment:		GFM 436			
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)					
Start		20.7	0.0	0.0	0.0	0.0	0.0					
Finish		20.7	0.0	0.0	0.0	0.0	0.0					

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	2.1	1.4	19.1	18.7	0.0	0.0	0.0	0.0	0.0021	0.0000	1017	-	N	N/A	N/A	NGW
BH101 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	N/A	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.3	20.3	0.0	0.0	0.0	0.0	0.0000	0.0000	1017	-	N	N/A	N/A	5.61
BH102 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	N/A	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1017	-	N	N/A	N/A	5.68
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.7	20.7	0.0	0.0	0.0	0.0	0.0000	0.0000	1017	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1017	-	N	N/A	N/A	5.22
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.5	1.3	17.8	18.5	0.0	0.0	0.0	0.0	0.0015	0.0000	1016	-	N	N/A	N/A	1.24
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.4	0.1	19.7	20.1	0.0	0.0	0.0	0.0	0.0004	0.0000	1016	-	N	N/A	N/A	1.09
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.2	20.2	20.4	0.0	0.0	0.0	0.0	0.0003	0.0000	1017	-	N	N/A	N/A	NGW
WS102	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.6	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1017	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.1	0.1	20.6	20.6	0.0	0.0	0.0	0.0	0.0001	0.0000	1017	-	N	N/A	N/A	NGW

Notes:

PERMANENT GROUND GAS MONITORING FORM



SITE NAME:		ROCHDALE ROAD, MANCHESTER				ENGINEER:		Jack Perkins			
CLIENT:		WATERMAN I & E				DATE:		03/01/2022			
JOB NO:		GRO-22292									
Pressure Trend:		Falling	Weather:		Overcast		Equipment:		GFM 436		
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)				
Start		20.5	0.0	0.0	0.0	0.0	0.0				
Finish		20.5	0.0	0.0	0.0	0.0	0.0				

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	1.8	1.7	18.2	18.1	0.0	0.0	0.0	0.0	0.0018	0.0000	1004	-	N	N/A	N/A	NGW
BH101 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1004	-	N	N/A	N/A	5.32
BH102 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1004	-	N	N/A	N/A	5.51
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1004	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.4	20.2	0.0	0.0	0.0	0.0	0.0000	0.0000	1004	-	N	N/A	N/A	5.16
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.3	1.3	18.1	18.6	0.0	0.0	0.0	0.0	0.0013	0.0000	1004	-	N	N/A	N/A	1.18
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.3	20.1	20.0	0.0	0.0	0.0	0.0	0.0003	0.0000	1004	-	N	N/A	N/A	0.98
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.3	20.1	20.2	0.0	0.0	0.0	0.0	0.0003	0.0000	1004	-	N	N/A	N/A	NGW
WS102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1004	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.1	0.1	20.5	20.3	0.0	0.0	0.0	0.0	0.0001	0.0000	1004	-	N	N/A	N/A	NGW

Notes: Unable to locate WS102.

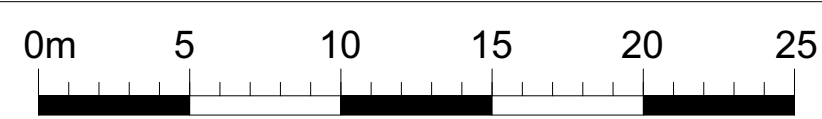
PERMANENT GROUND GAS MONITORING FORM



SITE NAME:		ROCHDALE ROAD, MANCHESTER				ENGINEER:		Jack Perkins			
CLIENT:		WATERMAN I & E				DATE:		16/01/2023			
JOB NO:		GRO-22292									
Pressure Trend:		Steady	Weather:		Overcast/Snowy		Equipment:		GFM 436		
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)				
Start		20.5	0.0	0.0	0.0	0.0	0.0				
Finish		20.5	0.0	0.0	0.0	0.0	0.0				

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH101	0.0	0.0	0.00	0.0	0.0	0.0	1.9	1.9	18.4	18.0	0.0	0.0	0.0	0.0	0.0019	0.0000	1009	-	N	N/A	N/A	NGW
BH101 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH102	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	5.11
BH102 (PIEZO)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NGW
BH103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.6	20.5	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	5.34
BH104	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.4	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	NGW
BH105	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.3	20.2	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	4.98
BH106	0.0	0.0	0.00	0.0	0.0	0.0	1.5	1.3	18.4	18.2	0.0	0.0	0.0	0.0	0.0015	0.0000	1009	-	N	N/A	N/A	1.02
BH107	0.0	0.0	0.00	0.0	0.0	0.0	0.4	0.2	20.0	20.2	0.0	0.0	0.0	0.0	0.0004	0.0000	1009	-	N	N/A	N/A	0.86
WS101	0.0	0.0	0.00	0.0	0.0	0.0	0.3	0.1	20.2	20.0	0.0	0.0	0.0	0.0	0.0003	0.0000	1009	-	N	N/A	N/A	NGW
WS102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WS103	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.5	20.3	0.0	0.0	0.0	0.0	0.0000	0.0000	1009	-	N	N/A	N/A	NGW
WS105	0.0	0.0	0.00	0.0	0.0	0.0	0.1	0.0	20.4	20.1	0.0	0.0	0.0	0.0	0.0001	0.0000	1009	-	N	N/A	N/A	NGW

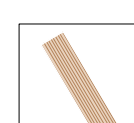
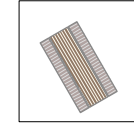
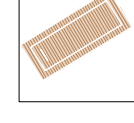
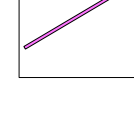
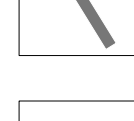
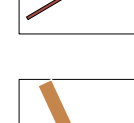
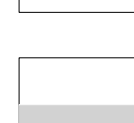
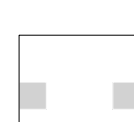
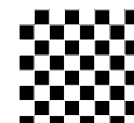
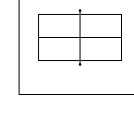
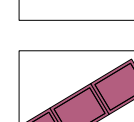
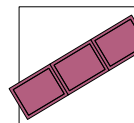
Notes: Unable to locate WS102.



Key

- **Mulbury Planning Application Boundary**
- **HARDWORKS**
Natural Stone Paving Mix 1
To public realm & shared community space
Type: Portuguese granite
Colour: TBC
Finish: TBC
Supplier: Hardscape or similar approved
Note: allow for galvanised 3x150mm exccell edge
- **Clay Paving Mix 2**
To match adjacent MCR site (H3 material) pedestrian areas throughout the site.
Type: Clay Paving
Colour: Various to complement architectural material palette
Finish: TBC
Supplier: Hardscape or similar approved
Note: allow for galvanised 3x150mm exccell edge
- **Clay Paving Mix 3**
To private garden space
Type: Neland Clay Paving
Colour: TBC
Finish: TBC
Supplier: Hardscape or similar approved
Note: allow for galvanised 3x150mm exccell edge
- **Green gap concrete paving**
To Residential spaces
Type: Concrete
Colour: TBC
Finish: TBC
Supplier: Hardscape or similar approved
Note: allow for galvanised 3x150mm exccell edge
- **Granite Planks**
To Residential spaces
Type: Portuguese granite
Colour: TBC
Finish: TBC
Supplier: Hardscape or similar approved
- **Natural Stone Paving**
To match approved MCR site Gould street highway paving
Size, colour finish, to MCC standard detail
Note: allow for 125x255mm kerb edge

FURNITURE & STRUCTURES

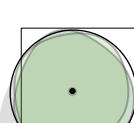
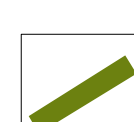
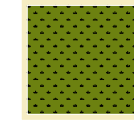
- **Seating Edge**
To Courtyards
Timber top corten frame
- **Picnic Table**
Timber top picnic table with powdercoated galvanised frame
- **Tiered Seating Feature**
Timber seating with integrated tree, details tbc
- **1.8m Rimini Galvanised Steel Fence**
details tbc
- **Retaining Structure**
Existing To Gould street & 87 Rochdale Road
- **1.1m Rimini Galvanised Steel Balustrade**
To private spaces, details tbc
- **Timber play feature**
To community shared spaces, details tbc
- **Proposed 1.1m wall with 500mm railing**
Brickwork finish to match building facade
- **1.5m Pillar Wall**
To courtyard edge
details tbc
- **Chess Board - Play**
To courtyard edge
- **Table tennis**
To courtyard edge
- **Planting Screen**
2.5m high Galvanised steel planting screen to courtyard
finish: tbc
- **Cycle Stands**
10no. Sheffield cycle stands to external spaces
- **Bin Store**
Controlled accessed 3 No. 1100L & 1no.240L bins to town house & duplex's

THIS DRAWING IS COPYRIGHT PROTECTED AND MAY NOT BE REPRODUCED IN WHOLE OR PART WITHOUT WRITTEN AUTHORITY FROM THE OWNER.

- NOTES:
- Do not scale from this drawing.
 - Always work to noted dimensions.
 - All dimensions are in millimetres unless otherwise stated.
 - All setting out, levels and dimensions to be agreed on site.
 - The dimensions of all materials must be checked on site before being laid out.
 - This drawing must be read with the relevant specification clauses and detail drawings.
 - Order of construction and setting out to be agreed on site.

NOTE:
General Arrangement drawing to be read in conjunction with drawings:
2624-PLA-XX-XX-DR-L-1001
2624-PLA-XX-XX-DR-L-1002
2624-PLA-XX-XX-DR-L-2000
2624-PLA-XX-XX-DR-L-3000

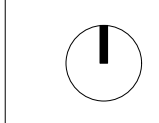
SOFTWORKS

- **Trees**
A combination of single & multi-stem trees. Refer to drawing 2426-PLA-XX-XX-DR-L-2000 for specification.
- **Clipped Instant Hedge**
To private garden boundaries
Size: 800mmW x 1200mmH approx.
Refer to drawing 2426-PLA-XX-XX-DR-L-2000 for specification.
- **Ornamental Shrub and Herbaceous Planting**
Biodiversity rich planting. Refer to drawing 2426-PLA-XX-XX-DR-L-2000 for specification.
- **Marginal Ornamental Planting**
To swales / rain gardens Refer to drawing 2426-PLA-XX-XX-DR-L-2000 for specification.
- **Lawn**
Medallion turf
Supplier: Rolawn or similar approved
- **Planting Bed**
450mm high timber planter, planting to residential community choice

S1-P06	06-12-21	Bin storage and boundary update	AS	KR
S1-P05	11-11-21	Updated boundary	AS	KR
S1-P04	01-09-21	Planning Issue	AS	KR
S1-P03	02-08-21	Draft Planning	AS	KR
S1-P02	20-07-21	For information	AS	KR
S1-P01	27-05-21	For coordination	AS	KR

Revision	Date	Description	Drawn	Apprvd.
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**Planit I.E. Limited**
E: info@planit-ie.com W: planit-ie.com
MANCHESTER
2 Back Grafton St., Altrincham, WA14 1DY
T: 0161 928 9281

**LEEDS**
No.1 Aire Street, Leeds Station, Leeds, LS1 4PR
T: 0113 824 6413
LIVERPOOL
Tempest 5.3, 12 Tiltham Street, Liverpool, L2 2DT
T: 0151 363 1230
LONDON
Unit 6 Waterside, 44-48 Wharf Road, London, N1 7UX
T: 0207 253 5678
STANDISH
Standish Gatehouse, Stonehouse, Gloucestershire, GL10 3BZ
T: 0145 360 7080

Client **Portwood Development Ltd**

Project **87 Rochdale Road**

Drg Title **General Arrangement**

Created on	Created by	Approved by
02.08.21	AS	KR

Scale	Size	Workstage
1:250	A1	RIBA Stage 2

Drg No.	Suitability	Revision
2624-PLA-XX-XX-DR-L-0002	S1	P06