

Date: 16th September 2024
Reference: 15-974 V15

GAS MEMBRANE VALIDATION – BENNETT STREET

Project Name:	Bennett Street
Project Number:	15-974
Client:	Kellen Homes
Date:	16-09-2024
Project Manager:	M. Dee
Engineer:	M. Dee
Ground Gas Risk Assessment:	Vapor Membranes Required
Gas Membrane Installers Name & Qualifications:	JCW Gas Membranes Ltd, NVQ Level 2 – Installation of Gas Membranes in Construction
Plot:	139 - 146

OVERVIEW

GeoEnginSteer attended site under the supervision of E3P to confirm the integrity of installed gas measures for Plots 139 – 146 through tracer gas testing.

At the time of the visit the plot floor areas had been screeded with lower brick course in place, as such, the gas protective system was covered and unable to be visually inspected. E3P have obtained photos showing the installation of a black membrane to plots, photos are included within this report. Additionally, E3P have obtained a copy of JCW Gas Membrane installers documentation confirming installation of Juta TitanFlex vapour membranes to plots 139-142 on 10th July 2024 and 143-146 on 31st May 2024. JCW installation documents are appended to this letter.

E3P inspected air vents and confirmed the installation of telescopic air vents at appropriate centres on exterior walls of plots 139-146.

GeoEnginSeer undertook integrity testing of the membrane under the full time supervision of E3P. Integrity testing was undertaken utilising tracer gas leak detection methodologies for all plots, with one test undertaken per plot. Integrity testing results/reports are appended to this letter. The test results show that the tracer gas was present under the foundation but wasn't migrating up into the property.

As per the Build Phase Contamination Risk Mitigation Strategy (report ref: 15-974-R5), sub-floor voids require inspection and validation at 50% ratio of substructures completed. E3P undertook subfloor void inspections for Plots 139-146 on 29th May 2024, inspections confirmed there was a minimum void space of 150 mm for each plot. Validation photographs included within this letter.

A list of plots requiring validation and their associated validation letters is presented in Table 1.



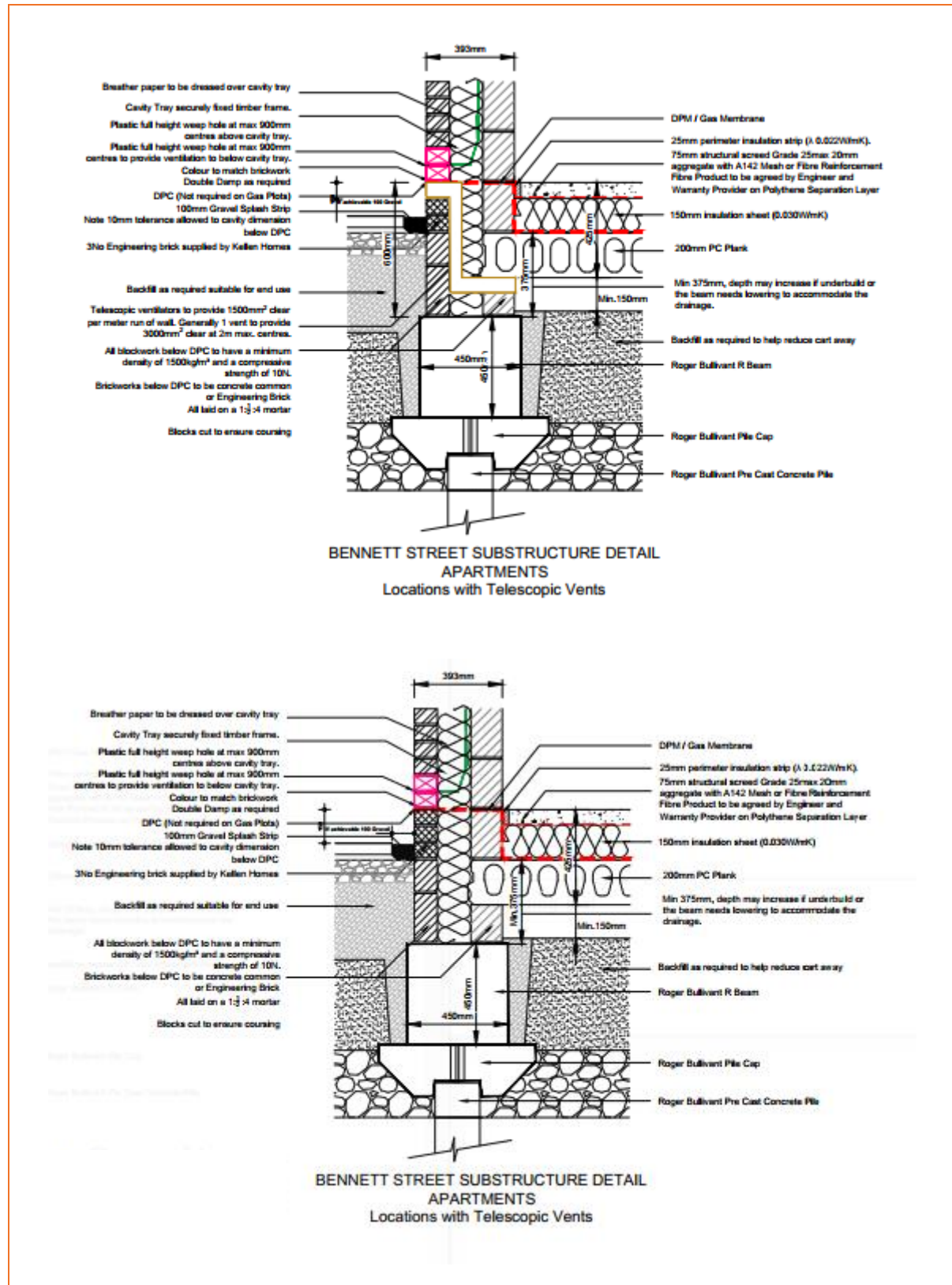


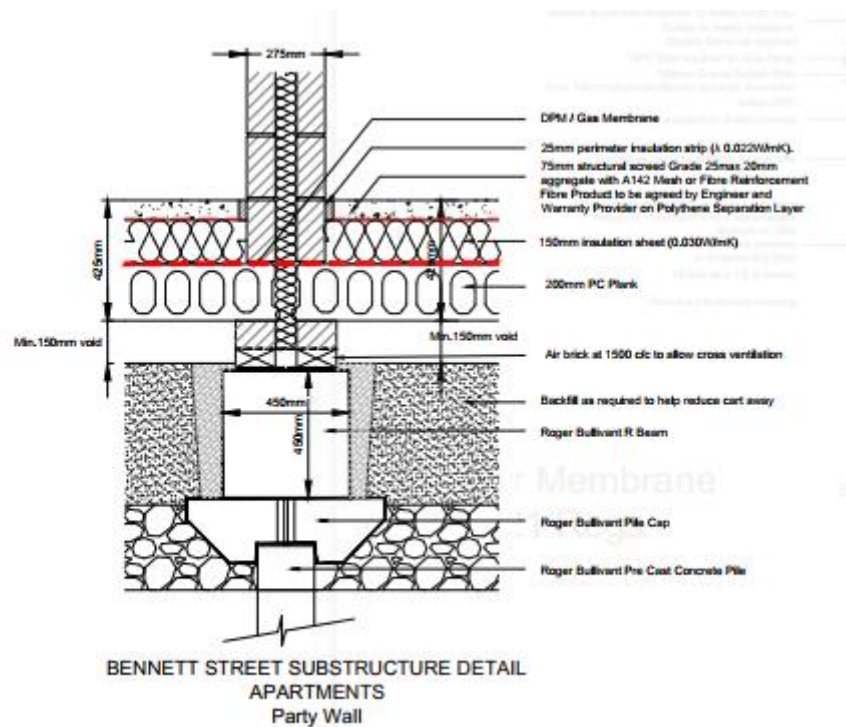
MEMBRANE SPECIFICATION: JUTA TITANFLEX (BLACK)

GROUND GAS PROTECTION GP[®] TITANFLEX[®] TECHNICAL DATA SHEET  GP[®] TITANFLEX[®]			
Feature	Characteristics	Test Method	GP [®] TITANFLEX [®]
Physical Properties	Thickness	EN 1849-2	0.5 mm
	Width	EN 1849-2	2 m
	Length	EN 1849-2	50 m
	Weight	EN 1849-2	500 g/m ²
Hydraulic Press	Water Vapour Transmission Rate	EN 1931	0.11 - 0.18 g/m ² /day
	Water Tightness (60 kPa)	EN 1928	Pass
	Water Tightness (196 kPa - 20 m Water Head) (Basement Application)	EN 1928	Pass
Mechanical Properties	Resistance to Static Load	EN 12730-B	≥ 20 kg
	Puncture Resistance	EN 12236	≥ 2.0 kN
	Tensile Strength (MD)	EN 12311-1	> 550 N/50mm
	Tensile Strength (CMD)	EN 12311-1	> 400 N/50mm
	Tensile Elongation (MD/CMD)	EN 12310-1	> 550 %
	Tear Resistance (MD/CMD)	EN 12310-1	> 300 N
	Resistance to Impact	EN 12691-B	650 mm
	Reaction to Fire	EN 13501-1	E Class
	Resistance to Artificial Ageing	EN 1296/EN 1928	Pass
Compliance and Certification	Resistance to Chemicals	EN 1296/EN 1928	Pass
	CE Mark - EN13967:2012		
	NHBC Standards Compliant		
	CIRIA C748 Compliant		
Vapour Permeability 100% Concentration	BS 8485:2015 Compliant		
	Transmission Rate of Benzene	EN ISO 15105-2	< 3.6 mg/m ² /day
	Transmission Rate of Toluene	EN ISO 15105-2	< 13.8 mg/m ² /day
	Transmission Rate of Ethyl Benzene	EN ISO 15105-2	< 2.7 mg/m ² /day
	Transmission Rate of Xylenes (M,P,O)	EN ISO 15105-2	< 7.7 mg/m ² /day
	Transmission Rate of Hexane	EN ISO 15105-2	< 0.6 mg/m ² /day
	Transmission Rate of Vinyl Chloride	EN ISO 15105-2	< 0.05 mg/m ² /day
	Transmission Rate of Trichloroethene (TCE)	EN ISO 15105-2	< 54.7 mg/m ² /day
	Transmission Rate of Tetrachloroethene (PCE)	EN ISO 15105-2	< 26.2 mg/m ² /day
Gas Permeability	Transmission Rate of Naphthalene	EN ISO 15105-2	< 0.0006 mg/m ² /day
	Transmission Rate of CIS-1,2-Dichloroethylene	EN ISO 15105-2	< 1.1 mg/m ² /day
	Methane Permeability	EN ISO 15105-1	0.13 ml/m ² /day/atm
	Methane Permeability (Jointed)	EN ISO 15105-1	1.00 ml/m ² /day/atm
	Carbon Dioxide Permeability	EN ISO 15105-1	3.01 ml/m ² /day/atm
	Vinyl Chloride Gas Permeability	EN ISO 15105-1	0.04 ml/m ² /day/atm
	Radon Permeability	K124/02/95	1.0 x 10 ⁻¹² m ² /S

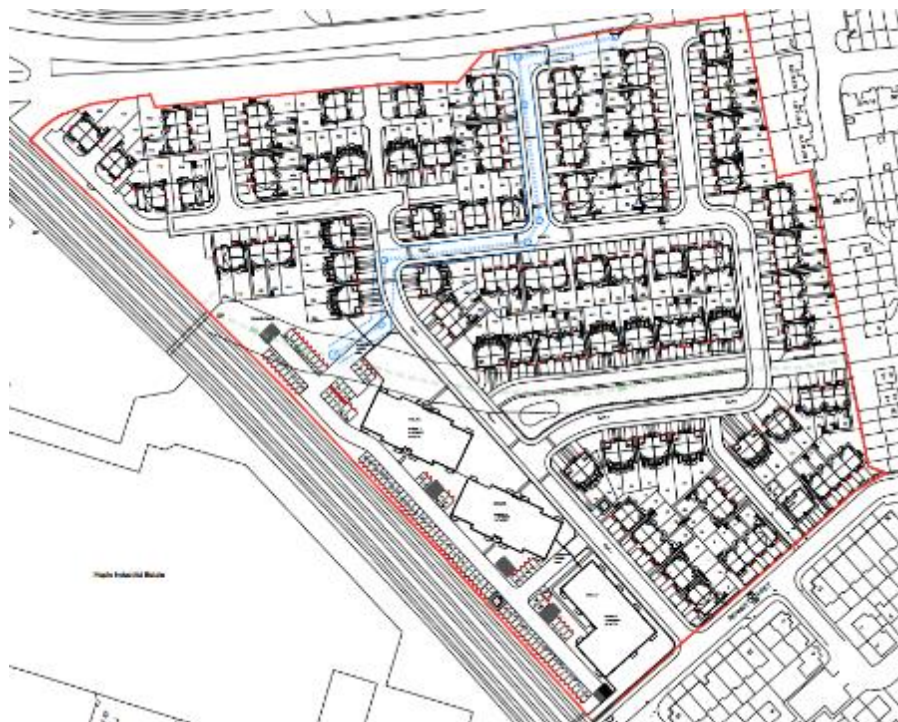


STRUCTURAL ENGINEER'S SUBSTRUCTURE DESIGN





PROPOSED DEVELOPMENT PLAN





The gas membrane validation photographs are enclosed within this letter. For information, Table 1 includes references and validation dates of previously validated plots.

Table 1 – Validation Letter Reference

PLOT NUMBER	DATE	REPORT REFERENCE
9-15	19-10-2023	V1
16 & 17	24-10-2023	V2
18 & 19	01-11-2023	V3
Apartment Block 3	08-03-2024	V4
Apartment Block 1	14-03-2024	V5
Apartment Block 2	19-03-2024	V6
136-138 and 147-148	15-05-2024	V7
130-135	28-06-2024	V8
123-127	06-08-2024	V9
119-122	22-08-2024	V10
112-114	23-08-2024	V11
117-118	06-09-2024	V12
105 - 111	16-09-2024	V13
95, 96, 101-104, 128, 129	23-09-2024	V14
139-146	16-09-2024	V15



SUB-FLOOR VOID PHOTOS



Plot 139



Plot 139



Plot 140



Plot 140



Plot 141



Plot 141



Plot 143



Plot 144



Plot 146



MEMBRANE PHOTOS



Membranes installed on plots 143 - 146



Membranes installed on plots 139-140 with JCW on site installing gas membranes



GeoEnginSeer

FREELANCE DILETTANTE GEOLOGIST

Bennett Street, West Gorton, Manchester,
E3P

Verification Completion Report for Ground Gas Protection Systems

Date	16.09.24
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Project Title	Bennett Street
GES Report Number	1851
Date	16.09.24
Client	Whittaker and Pointon Ltd.
Weather	15°C cloudy light wind 2 kmh
Development Type	Residential
Foundation Type	Block and beam
Plot Numbers	105 -111 & 139 - 146
GES Job Ref:	1851
Visit By	Paul Carter- Jones

Report By**Checked/Approved By***Signature**Name:* Paul Carter – Jones*Signature**Name:* Ben Crowther**Company Contact Details**

Kellen Homes,
 1st Floor 103 Dalton Avenue,
 Birchwood Park,
 Warrington,
 United Kingdom,
 WA3 6YF

1. GAS MEMBRANE

1.1 Condition Of Subgrade and Underside Of Gas Membrane

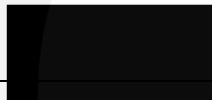
Check that the subgrade does not contain rough/uneven surfaces, is appropriately clean and that there are no hard/sharp objects. That protective sand blinding or geotextile (if specified) is present and meets the design criteria.

The subgrade appeared to have been clean, no debris or sharp objects protruding into membrane.

1.2 Gas Membrane Type

Manufacturer and product specification, gauge, colour, brand/name, material batch/roll numbers.

Juta GP Titan Flex Gas Membrane with GP Lap Tape



1.3 Laps, Welds and Joint Seals

Joints lapped and sealed in accordance with manufacturers requirements/specification. Minimum overlap insured? Welds complete? Appropriate joining/double sided tape used?

Joints had been hand welded together

1.4 Service Entries Seals

How many pipe penetrations? Top hats seal arrangements fixed around service entries? Use of jubilee clips? Etc.

The pipe penetrations were sealed with Juta GRSAM Tape in situ.

2. VENTILATION SYSTEMS

2.1 Subfloor Void

Is a check possible? Void former? Gravel (type/specification)? Height of void space? Is it clear?

Void space measured on a future plot between 150mm – 200mm.

2.2 External Wall Airbricks

How many? Size? Positioning? Spacing? Etc.

Air bricks (9"x3") were spaced around the properties.

2.3 Active Venting

Type of air supply: mechanical, natural, combined? Location/condition/number of fans/vents? Location and size of inlets? Provision of air cleaning devices and air heaters? Supply and exhaust duct work? Alarm provision/installation? Gas monitoring system in under-floor void?

N/A

2.4 Testing Of Air Flow

Is the air flowing sufficiently through ventilation? Anemometer reading? Smoke test? Tracer gas?

Air flow too low to register on anemometer 0.0kmh.

3. INSPECTION AND INTEGRITY DETAILS

On the 16th of September 2024 I attended Bennett Street site in Manchester, to carry out inspection and integrity test on plot 105 – 111 and a tracer gas test on plots 139 – 146.

On plots 105 – 111 Juta GP Titan Flex Gas Membrane (Black) and GP SAM (white) had been installed on the plot base, up over the cavity and to the edge of the outer brickwork. The pipe penetrations / service entries, corners and doorways, were sealed in situ with Juta GR SAM detailing Tape

The membrane joints were welded together. All joints were air lanced at a constant 50 psi. One (1) small burn hole was found on plot 105 that was patch repaired during my site visit.

On plots 139 – 146 a base line reading of background gasses was taken on the handheld GMI gas detector both outside and inside the property.

The air vents were then sealed, and a tracer gas (carbon dioxide) was pumped in through selected air vents (that were opened then re-sealed) and readings were taken on the opposite side of the property to show that the foundation of the property was filled sufficiently with the tracer gas.

A test was carried out with the gas detector to show the tracer gas was present under the foundation.

An internal walk around with the gas detector was then carried out.

Please see results below.

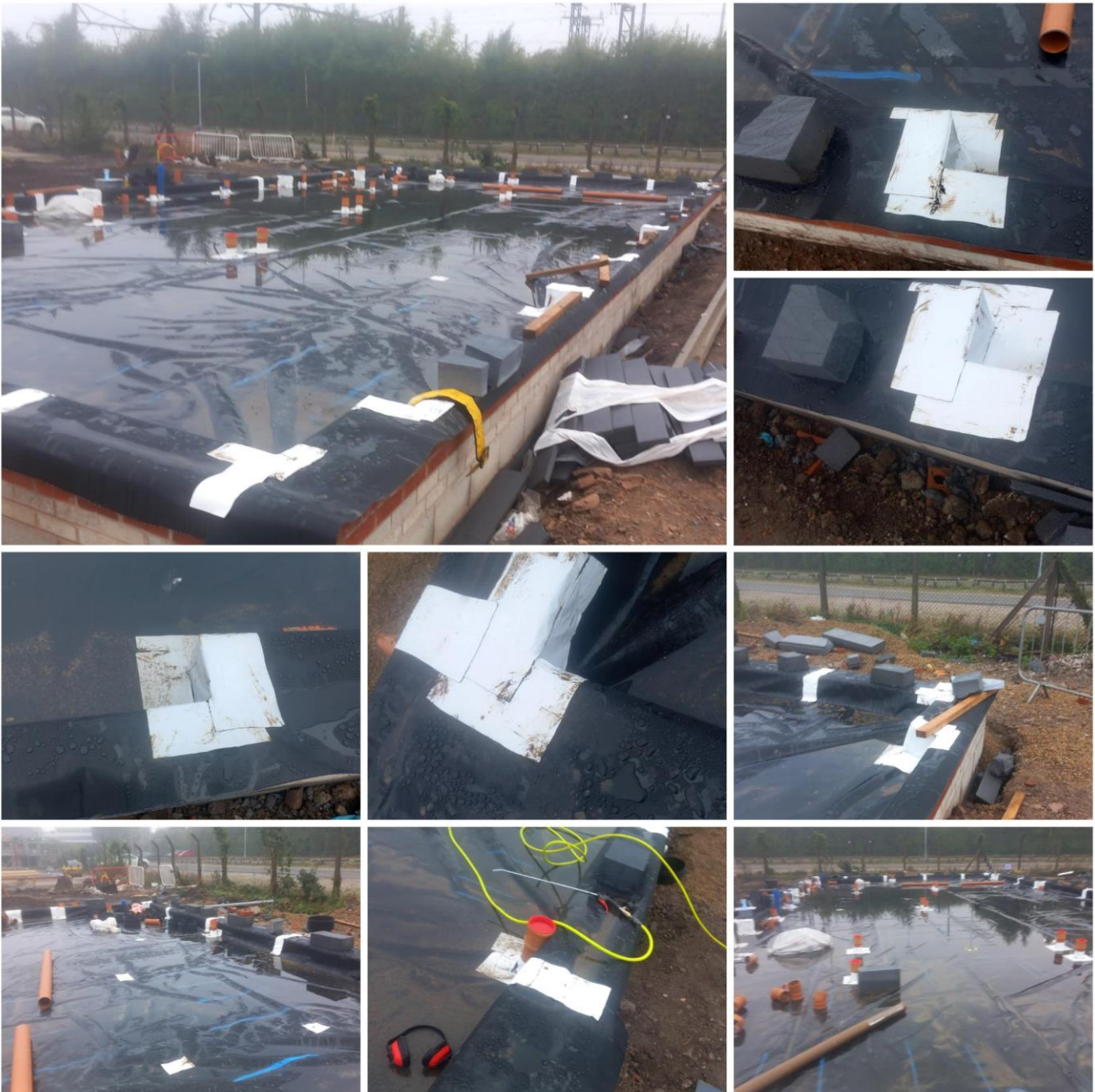
PLOT NO.	C02	LEL	BNZ	02	NOTES
139	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
141	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
142	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
143	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
144	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
145	0.00	00	0.0	20.7	Baseline reading before gas injection
	0.00	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected
146	0.01	00	0.0	20.7	Baseline reading before gas injection
	0.01	00	0.0	20.7	After gas injection. No leaks detected, membrane acting as expected

4. PHOTOGRAPHIC RECORDS

Plots 105 – 107:



Plots 108 – 111:



Repair carried out on plot 105:



Air flow test:



Example of subfloor void measurement (plot 104 & 103):



Tracer gas test overview plots 139 – 146:



Setup of tracer gas test:



Device readings:



5. CONCLUSION OF SITE VISIT

5.1 Details Of Installers

Are the installers suitably qualified / trained? Names of installers / company details?

JCW Group Ltd qualified installers of Gas Membranes.

5.2 Pass / Fail?

Are the measures inspected acceptable / NOT acceptable? Do they comply with the specifications? Is attention required to specific issues?

PASS

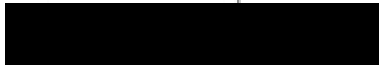
5.3 Additional notes

Remedial actions to be taken? Re-visit to be arranged?

N/A

If you have any questions regarding the above, please do not hesitate to contact me.

Yours sincerely



Ben Crowther B.Sc, M.Sc, PGCE, FGS, CIEH, PCA-QT, SGPV
For and on behalf of GeoEnginSeer Ltd.

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6.0 Limitations and Challenges of Verification Reporting

This report is based on the information that has been made available to us from the client, contractor and architect regarding the site. The conclusions drawn in the report are considered correct although any subsequent additional information or actions may allow refinement of the conclusions. It should be noted that: The report has been prepared under the express instructions and solely for the use of the Client.

The findings of this report represent the professional opinion of experienced Ground Gas System Surveyors. GeoEnginSeer Ltd does not provide legal advice and the advice of lawyers may also be required.

All work carried out in preparing this report has utilised and is based upon understanding of current relevant UK standards and codes, technology, and legislation. (BS8485:2015+A1:2019 & CIRIA 735).

Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

The report is limited to the boundaries identified by the Client on this site and confirmed within this document.

Should additional services be introduced, or service conduits are not sealed or have services provided through them at a later date that are not sealed to the conduit and or gas protection system, a retrospective fit may be required.

If a site is left open for prolonged periods following verification or works are conducted that may damage the integrity of the installation by follow on trades repairs may be needed, the standards observed in a positive verification report may be compromised. Intellectual rights to this document may be rescinded.

VISUAL INSPECTION OF GAS MEMBRANE

Site Name: <u>Bennett Street, Manchester</u>	Gas Characteristic situation: <u>V.O.C</u>
Plot #: <u>20-23</u> <u>139-142</u>	Type of development: (<u>Residential</u> /Commercial/Other)
Date: <u>10/06/24</u>	
Visit by: <u>M. Harris</u>	Foundation Type: (<u>suspended floor</u> /raft/other)

No.	Item	Comments (see notes)
1 Gas Membrane		
1.1	Condition of sub-floor and underside of gas membrane	<u>Good, Swept, Clean</u>
1.2	Gas Membrane Type	<u>JUTA TITANFLEX</u>
1.3	Gas Membrane Condition	<u>Good</u>
1.4	Joining Tape Product	<u>SAM Tape / Welded</u>
1.5	Lapping Design	<u>Welded</u>
1.6	Laps Welds and Joints Seals	<u>Welded</u>
1.7	Services Entries Seals	<u>SAM Tape</u>

The Gas Membrane Inspected:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">a) Is acceptable and complies with the specification</td> <td style="width: 20%; text-align: center;">✓</td> </tr> <tr> <td>b) Are acceptable but attention is drawn to issues related to item no -</td> <td></td> </tr> <tr> <td>c) Are not acceptable due to the issues related to item no -</td> <td></td> </tr> </table>	a) Is acceptable and complies with the specification	✓	b) Are acceptable but attention is drawn to issues related to item no -		c) Are not acceptable due to the issues related to item no -	
a) Is acceptable and complies with the specification	✓						
b) Are acceptable but attention is drawn to issues related to item no -							
c) Are not acceptable due to the issues related to item no -							

Name: M. Harris

Signature:



Date: 11/06/24

VISUAL INSPECTION OF GAS MEMBRANE

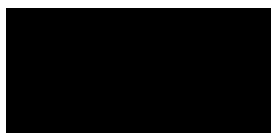
Site Name: <u>Bennett Street, Manchester</u>	Gas Characteristic situation: <u>V.O.C</u>
Plot #: <u>143 - 146</u>	Type of development: (<u>Residential</u> /Commercial/Other)
Date: <u>31/05/24</u>	
Visit by: <u>M. Harris</u>	Foundation Type: (<u>suspended floor</u> /raft/other)

No.	Item	Comments (see notes)
1 Gas Membrane		
1.1	Condition of sub-floor and underside of gas membrane	<u>Good, Swept, Clean</u>
1.2	Gas Membrane Type	<u>JUTA TITANFLEX</u>
1.3	Gas Membrane Condition	<u>Good</u>
1.4	Joining Tape Product	<u>SAM Tape / Welded</u>
1.5	Lapping Design	<u>Welded</u>
1.6	Laps Welds and Joints Seals	<u>Welded</u>
1.7	Services Entries Seals	<u>SAM Tape</u>

The Gas Membrane Inspected:	a) Is acceptable and complies with the specification
	b) Are acceptable but attention is drawn to issues related to item no -
	c) Are not acceptable due to the issues related to item no -

Name: M. Harris

Signature:



Date: 31/05/24