

Direct Tel:
Direct Email:

Our Ref: WIE17125-100-R-14.1.2-GGM
Your Ref:

Date: 7th April 2021

Mr R Midgley
Senior Project Manager
Turner & Townsend
2nd Floor,
1-3 East Parade,
Sheffield,
S1 2ET

Dear Richard,

Re: Ground Gas Monitoring – Trinity Academy, Barnsley - Temporary School

Following the completion of three of the six proposed monitoring visits at the Trinity Academy – Temporary School site between 17th February 2021 and 22nd March 2021, we are writing to present the findings of the monitoring, our assessment of the risk from ground gas at the site and our recommendations for gas protective measures in the proposed structure.

Terms of Reference

This monitoring and assessment have 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 initial conceptual model and preliminary assessment of ground gas risks contained in the Supplementary Geo-Environmental Assessment report (Ref: WIE17125-100-R-13.1.3-GeoEnv) have been relied upon as the basis for design for the gas investigation and monitoring strategy.

The Proposed Development / Assessment Methodology

The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site and associated infrastructure including a hard surfaced car park, playground and access road.

The proposed development is presented on Watson Batty Architects Drawing Ref: TRNTY-WBA-NB-00-DR-A-PL-101 P1.

The proposed development is consistent with a Type B building as set out in Table 3 of BS8485:2015, i.e. it is 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

The Preliminary Environmental Risk Assessment prepared for the wider Trinity Academy site (Ref: WIE17125_100_R_1_2_1_RJM) identifies the Site to be partially within an area of elevated radon levels (between 1% and 3%). Correspondingly, basic protective measures may be required in the proposed development. The approach should be confirmed with the Building Control Officer.

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

Source	Location	Status	Typical Description	Data Source
Made Ground	On site	Absent	Made Ground indicated to be present on BGS Maps, however, only a limited thickness of Made Ground identified during ground investigation. Not considered to be a viable source of ground gas.	BGS Maps, Ground Investigation
Shallow Mine Workings	On site – approx. 15m bgl	Open – i.e. not flooded or grouted	Worked Barnsley Coal Seam present at shallow depth beneath proposed building footprint.	Ground Investigation
Shallow Groundwater	On site	Not Present at shallow depth	No groundwater strikes encountered during fieldwork and no groundwater recorded during monitoring, therefore the potential for volatiles associated with the groundwater to impact the structure are considered to be low.	Ground investigation

Based on the findings of the ground investigation, that the risks associated with gas generated in Made Ground and volatiles associated with contaminated groundwater are considered to be low. Therefore, the primary potential source of ground gas is considered to be the open mine workings at relatively shallow depths beneath the Site. The monitoring installations were designed to collect data from this source.

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

Gas Monitoring Programme

Monitoring was undertaken using Gas Data GFM 436 gas analyser, calibrated in accordance with manufacturer's instructions. A total of three monitoring visits were undertaken between 17th February 2021 and 22nd March 2021. A further three monitoring visits are proposed.

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

Table 2: Summary of gas monitoring data

Monitoring Point	Peak Gas Concentration (%)			Steady Gas Concentration (%)			Steady Gas Flow Rate (l/hr)
	CH ₄	CO ₂	O ₂	CH ₄	CO ₂	O ₂	
Round 1							
RC201	<0.1	<0.1	20.8	<0.1	<0.1	20.8	<0.1
RC202	<0.1	<0.1	20.7	<0.1	<0.1	20.7	<0.1
RC203	<0.1	0.9	19.6	<0.1	<0.1	20.8	<0.1
RC204	<0.1	0.8	19.7	<0.1	<0.1	20.7	-0.1
Round 2							
RC201	<0.1	<0.1	20.0	<0.1	<0.1	20.1	<0.1
RC202	<0.1	<0.1	20.6	<0.1	<0.1	20.7	<0.1
RC203	<0.1	1.2	16.7	<0.1	<0.1	20.5	<0.1
RC204	<0.1	0.9	17.6	<0.1	<0.1	20.5	<0.1
Round 3							
RC201	<0.1	<0.1	20.6	<0.1	<0.1	20.6	<0.1
RC202	<0.1	<0.1	20.6	<0.1	<0.1	20.6	<0.1
RC203	<0.1	1.0	19.4	<0.1	0.4	19.9	<0.1
RC204	<0.1	0.7	19.8	<0.1	0.5	20.1	<0.1

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

- The response zones in the monitoring wells were generally dry and unobstructed;
- The monitoring period included periods of low and decreasing atmospheric pressure (986mb – 1020mb), during which gas flow would be expected to be higher;
- Only slightly elevated concentrations of carbon dioxide (1.2% v/v max.) were encountered;
- Occurrences of slightly depleted oxygen were recorded in boreholes RC203 and RC204, which correlates with elevated concentrations of carbon dioxide in these exploratory holes.

Ground Gas Characterization and Hazard Assessment

Calculation of the Gas Screening Value (GSV) from the available ground gas monitoring data gives a methane GSV of 0.0001l/hr and carbon dioxide GSV of 0.0012l/hr. The methane and carbon dioxide GSVs are consistent with a Characterisation Situation 1 (CS1) ground gas regime classification, in which the ground gas risk is low and mitigation measures in proposed structures would not be required.

However, due to the incomplete data set, and presence of a viable source of ground gas beneath the Site, it is recommended that basic gas protection measures in accordance with Characteristic Situation 2 are incorporated into the design of the proposed Temporary School. The requirement for gas protection measures is included in the design, as shown on Waterman Drawing Ref: TRIN-WSE-ZZ-ZZ-DR-S-10002, enclosed.

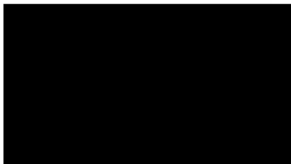
Any recommendations relating to gas protective measures in foundations should be considered provisional until issue of our hazardous gas risk assessment at the end of the monitoring period.

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.

The design installation and verification of the selected protection measures should be undertaken in accordance with BS8485:2015 and CIRIA report C735. An installation and verification report should be provided which as a minimum should include an accurate description of the measures actually installed and present the evidence gathered to confirm that installed measures are suitable for purpose.

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

Yours sincerely



Andrew Mould
Principal Consultant
For and On Behalf of Waterman Infrastructure & Environment Ltd

- Enc. Exploratory Hole Location Plan (Waterman Drawing Ref: 17125-100-WIE-ZZ-XX-DR-V-80-003-P02)
 Gas Monitoring Data Sheets
 Proposed Development Layout (Watson Batty Architects Drawing Ref: TRNTY-WBA-NB-00-DR-A-PL-101 P1)
 Gas Membrane Details (Waterman Drawing Ref: TRIN-WSE-ZZ-ZZ-DR-S-10002)



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.

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GENERAL NOTES

- LOCATION OF MINESHAFT
- TREATED CIRCULAR HOLE 18" DIAMETER
- ✦ PROPOSED ROTARY CORE BOREHOLE
- ▬ PROPOSED TRIAL TRENCH

P02	23.12.20	ADD PROPOSED LOCATIONS	DC
P01	15.12.20	PRELIMINARY ISSUE	DC
Rev	Date	Description	By

Amendments	
Project	TRINITY ACADEMY BARNSELEY
Title	EXPLORATORY HOLE LOCATION PLAN (PROPOSED LAYOUT)
Client	



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t 0161 839 8392
mail@watermangroup.com www.watermangroup.com

Status			
PRELIMINARY			
Designed By	AM	Checked By	AM
Drawn By	DC	Date	DECEMBER 2020
Waterman Ref		WIE17125-100	
Scales @ A3		1:1500	
Project - Originator - Volume - Level - Type - Role - Number			Revision
17125-100-WIE-ZZ-XX-DR-V-80-003			P02

Pressure Trend:	<i>Falling</i>	Weather:	<i>Overcast</i>			Equipment:	<i>GFM 436</i>
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)	
<i>Start</i>	20.7	0.0	0.0	0.0	0.0	0.0	
<i>Finish</i>	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)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
RC201	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	986	-	N	4.55
RC202	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	986	-	N	NGW
RC203	0.0	0.0	0.00	0.0	0.0	0.0	0.9	0.0	19.6	20.8	0.0	0.0	0.0	0.0	0.0009	0.0000	986	-	N	NGW
RC204	-0.1	0.0	0.00	0.0	0.0	0.0	0.8	0.0	19.7	20.7	0.0	0.0	0.0	0.0	0.0008	0.0000	986	-	N	NGW
Notes:																				

SITE NAME:	TRINITY ACADEMY, BARNSELEY	ENGINEER:	Joshua Turton
CLIENT:	WATERMAN I&E	DATE:	08/03/2021
JOB NO:	20063		

Pressure Trend:	<i>Falling</i>	Weather:	<i>Overcast</i>			Equipment:	<i>GFM 436</i>
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)	
<i>Start</i>	20.7	0.0	0.0	0.0	0.0	0.0	
<i>Finish</i>	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)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
RC201	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.0	20.1	0.0	0.0	0.0	0.0	0.0000	0.0000	1002	-	N	NGW
RC202	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	20.6	20.7	0.0	0.0	0.0	0.0	0.0000	0.0000	1002	-	N	NGW
RC203	0.0	0.0	0.00	0.0	0.0	0.0	1.2	0.0	16.7	20.5	0.0	0.0	0.0	0.0	0.0012	0.0000	1002	-	N	NGW
RC204	0.0	0.0	0.00	0.0	0.0	0.0	0.9	0.0	17.6	20.5	0.0	0.0	0.0	0.0	0.0009	0.0000	1002	-	N	NGW
Notes:																				

Pressure Trend:	Steady	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	20.6	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)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
RC201	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	1020	-	N	NGW
RC202	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	1019	-	N	NGW
RC203	0.0	0.0	0.00	0.0	0.0	0.0	1.0	0.4	19.4	19.9	0.0	0.0	0.0	0.0	0.0010	0.0000	1020	-	N	NGW
RC204	0.0	0.0	0.00	0.0	0.0	0.0	0.7	0.5	19.8	20.1	0.0	0.0	0.0	0.0	0.0007	0.0000	1020	-	N	NGW
Notes:																				

Trinity Academy Temporary School

Location:
Land at Keresforth Close
Barnsley
S70 6RS

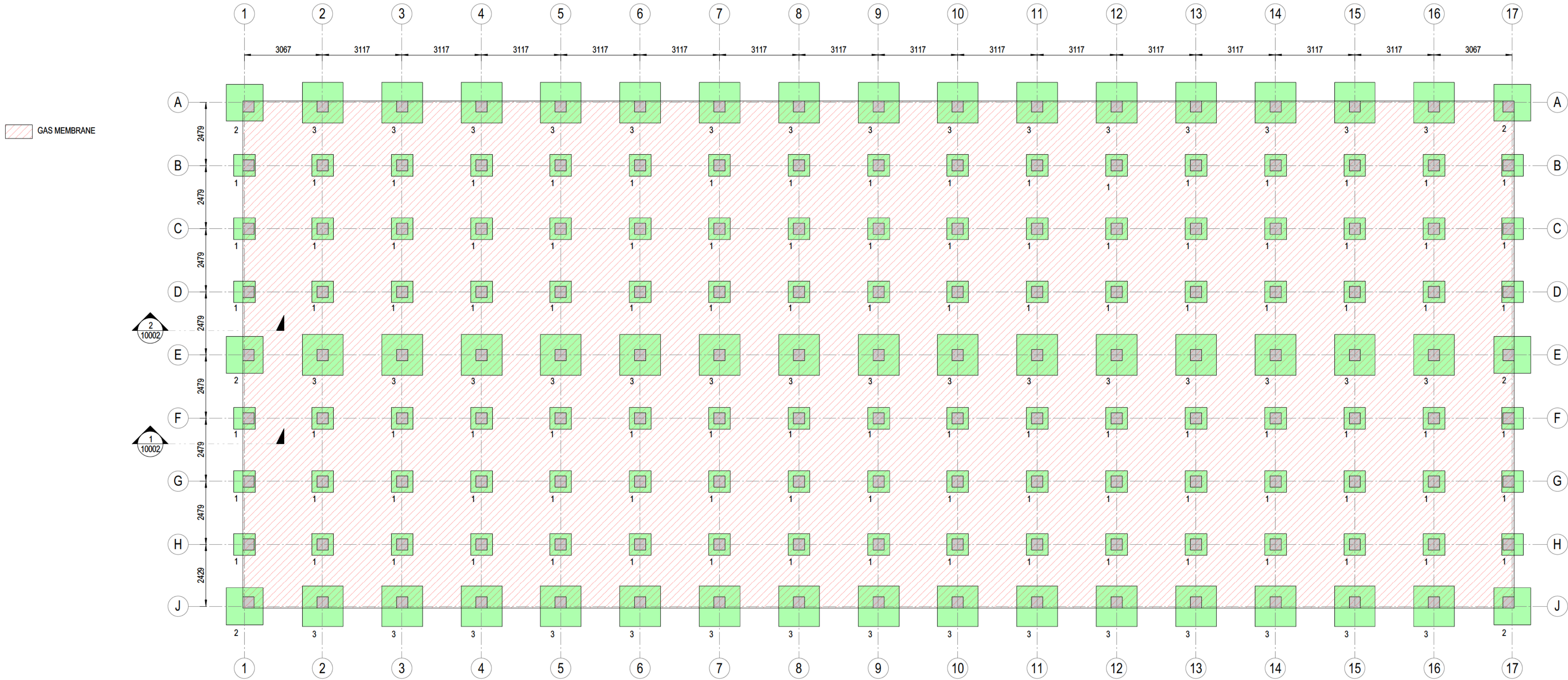
UPRN	Originator	Zone	Level	Type	Role	Number	Revision
TRNTY	WBA	NB	00	DR	A	PL_101	P1

Shires House, Shires Road
Guiseley, Leeds LS20 8EU
Leeds | Loughborough

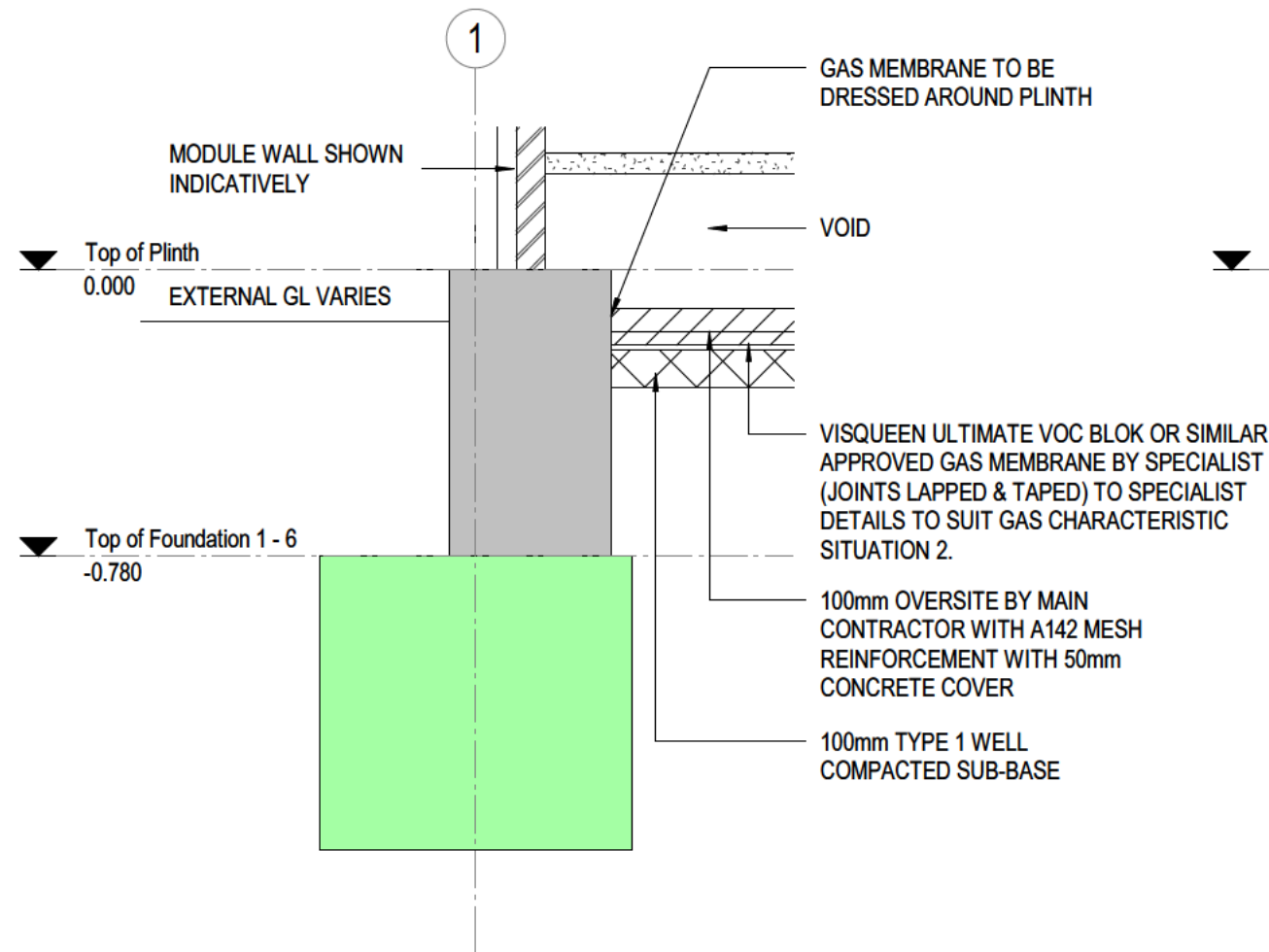
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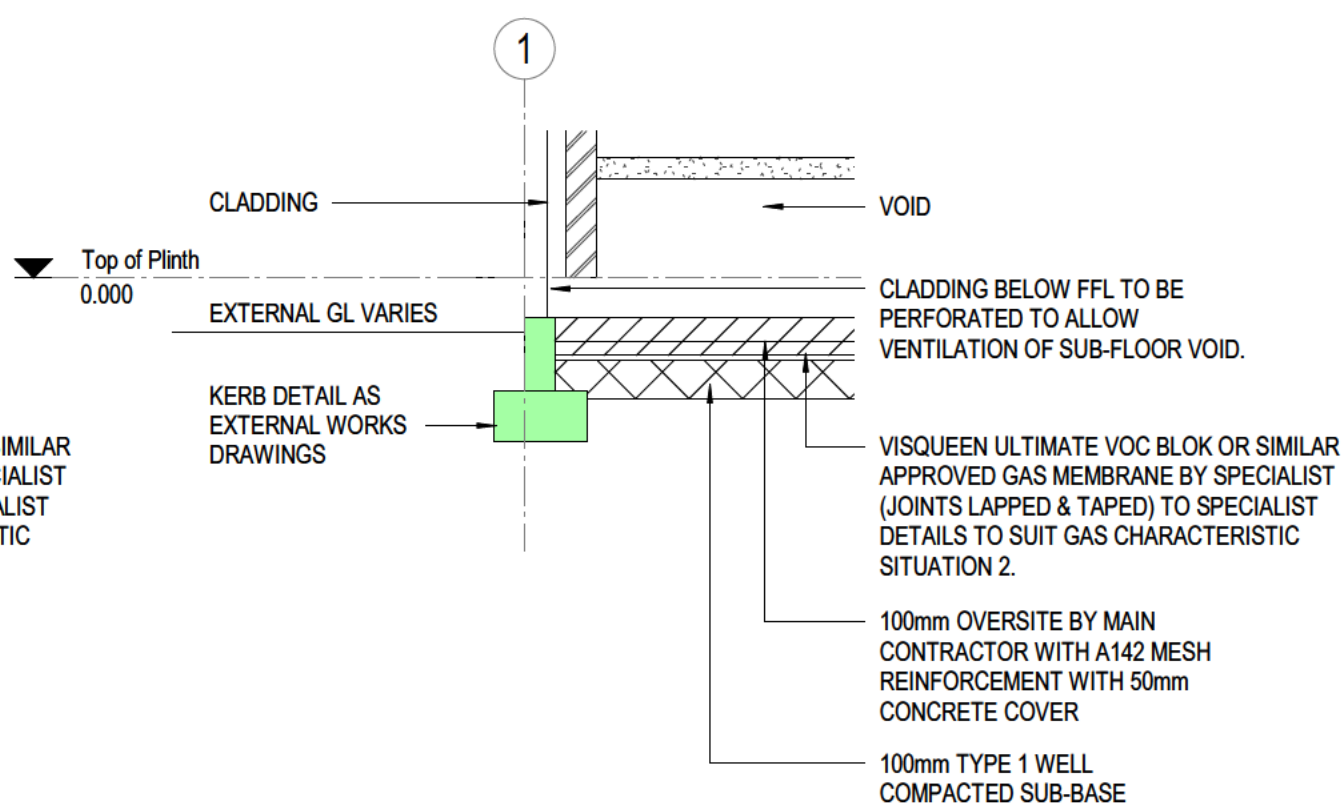
Note: Do not Scale from this drawing. All dimensions to be checked on site.



Membrane Plan
(1 : 100)



Gas Membrane at Plinth
(1 : 20)



Gas Membrane between Plinths
(1 : 20)

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GENERAL NOTES

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL LEVELS ARE BASED UPON THE TOP OF PLINTH LEVEL UNO.
4. ALL SETTING OUT IS TO BE TO ARCHITECTS DRAWINGS.
5. ALL DIMENSIONAL INFORMATION CONTAINED ON WATERMAN DRAWINGS IS TO BE CHECKED AGAINST THE CURRENT ARCHITECTS DRAWINGS BY THE CONTRACTOR PRIOR TO CONSTRUCTION, AND THE ENGINEER IMMEDIATELY NOTIFIED OF ANY DISCREPANCIES.
6. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE EMPLOYER'S REQUIREMENTS AND THE PROJECT SPECIFICATION, ALL RELEVANT ARCHITECTS AND M&E ENGINEERS DRAWINGS TOGETHER WITH ASSOCIATED WATERMAN LAYOUTS AND DETAILS.
7. ALL DETAILS WHICH RELATE TO EXISTING FEATURES OR BOUNDARIES ARE TO BE CONFIRMED ON SITE BY THE CONTRACTOR AND THE ENGINEER IMMEDIATELY NOTIFIED OF ANY DISCREPANCIES.
8. ALL BOUNDARIES AND LOCATIONS OF EXISTING BUILDINGS ADJOINING AND WITHIN THE SITE TO BE CHECKED AND VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
9. THE CONTRACTOR IS RESPONSIBLE FOR LIAISON WITH BUILDING CONTROL DURING THE COURSE OF THE WORKS IN RESPECT OF:
a) COMMENCEMENT NOTIFICATION (MINIMUM 7 DAYS NOTICE)
b) DRAIN TEST NOTIFICATION
c) CONNECTION PERMITS
d) ONGOING INSPECTIONS
e) ANY OTHER NOTIFIABLE ASPECT
10. BEFORE RELATED WORKS COMMENCES, THE CONTRACTOR SHALL SUBMIT A METHOD STATEMENT AND SEQUENCE OF WORKS TO THE ARCHITECT AND ENGINEER.
11. REFER TO ARCHITECTS AND BUILDING SERVICES ENGINEERS DRAWINGS FOR ALL ABOVE GROUND DRAINAGE, SERVICE ROUTES AND ASSOCIATED BUILDERSWORK INCLUDING STRUCTURAL OPENINGS.
12. DO NOT SCALE OFF THIS DRAWING, USE FIGURED DIMENSIONS ONLY. ALL DIMENSIONS MUST BE CHECKED AND VERIFIED ON SITE PRIOR TO COMMENCEMENT OF WORK
13. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL, LANDSCAPE, CIVIL AND STRUCTURAL, MEP, ICT AND FF&E DRAWINGS, OUTLINE SPECIFICATIONS AND WRITTEN RESPONSES WHICH COMPRISE THE ITT SUBMISSION DOCUMENTS
14. ALL ELEMENTS WILL BE IN ACCORDANCE WITH THE OUTPUT SPECIFICATION, BUILDING REGULATIONS, BRITISH STANDARDS, CODES OF PRACTICE AND ANY OTHER STATUTORY REQUIREMENTS CURRENT AT THE TIME OF WRITING, WHERE NO SUCH STANDARDS EXIST, WORKS SHALL BE IN ACCORDANCE WITH GOOD PRACTICE.

P01	24.02.21	FIRST ISSUE	JA	MB
Rev	Date	Description	By	Chk

Amendments

Project	TRINITY SCHOOL, BARNLEY
Title	Foundations Gas Membrane Details
Client	ELLIOT



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mail@watermangroup.com www.watermangroup.com

TENDER

Designed By	MB	Checked By	MB	Waterman Ref	STR-16757
Drawn By	JA	Date	February 2021	Scales @ A1	As indicated

Project	Originator	Volume	Level	Type	Role	Number	Revision
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TRIN-WSE-ZZ-ZZ-DR-S-10002	P01
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