Gas Protection Strategy & Verification Plan

Land at Westgate, Cleckheaton

For Strata Homes

Report no: 3043/9

Date: February 2026

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GAS PROTECTION STRATEGY & VERIFICATION PLAN FOR LAND AT WESTGATE, CLECKHEATON

1 Introduction

1.1 Strata Homes have commissioned Lithos Consulting as to prepare a Gas Protection Strategy and Verification Plan for land at Westgate, Cleckheaton.

1.2 Lithos have already issued the following reports relating to the site:

- Geoenvironmental Appraisal of land at Westgate, Cleckheaton. Report 3043/2D, dated July 2023.
- Detailed Quantitative Risk Assessment for land at Westgate, Cleckheaton. Report No. 3043/3A, dated July 2023.
- Remediation Strategy for land at Westgate, Cleckheaton. Report No. 3043/4D, dated
- July 2023.
- Gas Risk Assessment: Westgate, Cleckheaton. Report Ref. 3043/5A dated July 2023

1.3 Site details are summarised below:

Issue	Remarks
Location	1km west of Cleckheaton town centre
NGR	SE 184 250
Approx. area	6.5 ha (16 acres)

1.4 The proposed residential development comprises 180 'traditional' two/three storey domestic dwellings with associated gardens and adoptable roads and sewers. A site layout is included as Drawing 3043/2D, included in Appendix A.

1.5 The site can be considered as four distinct areas; each area is shown on Drawing 3043/3. Areas are based on former land uses. The areas are as follows:

- **Area A (1.1 ha)** – former chemical works in the north-west
- **Area B (1.7 ha)** – former rolling mill in the south & south-west; reservoir in the north-west
- **Area C (2.0 ha)** – former scrap yard, malthouse, brickworks and quarry in the east
- **Area D (1.6 ha)** – industrial area in the centre-north

2 Risk assessment

2.1 Desk study, investigation & monitoring

2.1.1 Consideration of the conceptual site model and potential linkages enabled a preliminary qualitative assessment of risks associated with sources of hazardous gas:

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Moderate**: made ground highly variable and in some areas likely to include degradable matter and organic contamination.
	Buildings	Explosion		
Off-site landfill (refuse tip to the south)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	**Low**: previous monitoring by Kirklees Council did not record ground gas and the landfill is on the opposite side of a valley, below ground migration of gas is therefore highly unlikely.
	Buildings	Explosion		

Source	Receptors	Hazard	Pathway	Initial risk
Shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Low**: no recorded shallow mineworking's in the area
	Buildings	Explosion		

2.1.2 As part of the Geoenvironmental Appraisal carried out by Lithos, gas monitoring wells were installed in BHs 501 to BH509 and PHs 501, 502, 505 to 520 across all four areas of the site. Details of the installations are given on the logs presented in the appendices of the ground investigation report.

2.2 Organic contamination

2.2.1 Targeted sampling of made ground and groundwater confirmed the presence of localised areas of petroleum products; possible tars and associated indictor compounds; as well as benzene, naphthalene and phenol.

2.2.2 Concentrations of volatile and semi-volatile organic compounds were also recorded, predominantly in Area A, although in most cases these may be attributed to leaching from coal tar. These included low levels of trimethylbenzene, tert-butylbenzene, methyl-naphthalene, dibenzofuran & carbazole.

2.2.3 If remnant sludge remains at the base of the reservoir in Area B, plots here would also require a hydrocarbon resistant membrane. However, remediation works (currently ongoing), supervised by Lithos, have confirmed that these sludges were removed by the remediation contractor (Sirius). As such these plots do not require hydrocarbon resistant membrane upgrade (from the CS2 classification for the site as discussed below).

2.3 Gas Risk Assessment (July 2023)

2.3.1 Based on the Gas Risk Assessment report (Ref. 3043/5A) the generation potential of the gas source was initially considered to be **Low** and consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 9 visits were completed over a 6-month period, between October 2020 and April 2021.

2.3.2 The gas risk assessment was based on the following reasonable worst-case parameters:

- Carbon Dioxide: **16%**
- Gas Flow: **0.1 l/hr**

2.3.3 Methane was present in Area A (PH515) between 0.6 to 2%, however this was discounted due to likely interference from hydrocarbons. No methane was detected in Areas B, C & D.

2.3.4 Based on the reasonable worst-case parameters outlined above, Gas Screening Values (GSVs) for carbon dioxide of **0.016** was derived. These GSV equated to a Green[1] classification which is considered to be comparable Characteristic Situation 1 (CS1) under the BS8485:2019 methodology.

2.3.5 However, elevated concentrations of carbon dioxide (between 5 and 16%), and depleted oxygen concentrations (less than 10%) were recorded in four different wells during 7 of the 9 visits and can therefore be considered as "Typical Maximum Concentrations". These concentrations suggest the site's classification for Areas B, C & D should be raised to Amber 1 or **CS2**.

[1] *Guidance on evaluation and development proposals on sites where methane and carbon dioxide are present. NHBC (2007) methodology of gas risk assessment has now been revoked.*

2.3.6 Remediation targets (presented in Lithos' QRA Report 3043/3A) have assumed that the membranes installed in plots within Area A, will be **hydrocarbon resistant**.

2.3.7 The presence of the hydrocarbon resistant membrane would also provide adequate protection against carbon dioxide and methane that could be generated by low level organic contamination, even after remediation has been completed.

2.3.8 Based on the GSV and the proposed end use of private housing (Building Type A[2]) the gas protection measures must achieve a minimum score of **3.5**. Strata have confirmed that this will be achieved by incorporating the following mitigation measures into all new buildings on the site:

BS8485 Classification and Gas Score	Floor slab (BS8485 Score in Red)	Protective measures	
		Sub-floor ventilation (BS8485 Score in Red)	Membrane Type (BS8485 Score in Red)
Areas B, C & D **CS2** **(Plots 1-86, 111-119,135-180)** **(3.5)**	Block & Beam – **(0)**.	Passive sub-floor ventilation; venting layer with a min. 150mm clear void **(2.5)** Min. ventilation = 1,500 mm^2/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.	Gas resistant membrane meeting all of the following criteria: • sufficiently impervious to gases with a methane gas transmission rate <40.0 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, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • a minimum 0.4 mm thickness (1600g polyethylene) reinforced membrane (virgin polymer) Verified in accordance with CIRIA C735 **(2.0)**
Area A **CS2/Hydrocarbon** **(Plots 87 - 110, 120-134)** **(3.5)**			**Hydrocarbon resistant** membrane meeting the following: • all of the criteria specified for Amber 1 (above) • including additional protection against organic hydrocarbon vapours • increased frequency of independent validation including air lance integrity testing Advice should be sought from membrane manufacturer based on SI data **(2.0)**

2.4 Updated radon assessment

2.4.1 On 1st December 2022 the British Geological Society (BGS) and the UK Health Protection Agency (UKHPA) published an updated radon potential map for Great Britain. Based on the updated radon map, the site is in an area where **1-3%** of properties are estimated to be above the action level. Consequently, basic radon protection measures are **not required**. However, in light of Public Health England advice, the Developer might consider providing all new dwellings with basic radon protection measures.

2.4.2 The gas protection measures detailed above provides adequate protection for the ingress of radon gas into the properties.

[2] *Table 3 and Section 7 BS 8485:2015+A1:2019 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2019)*

2.5 Gas protection – plot specific

2.5.1 The gas/hydrocarbon protection measures will be installed as follows:

- **CS2**: Plots 1-86, 111-119,135-180
- **Upgraded hydrocarbon resistance**: Plots 87 -110, 120-134

2.5.2 Refer to Gas Protection Validation Plan Drawing (Ref. 3043/21) in Appendix A.

3 Roles & responsibilities

3.3 The following companies will be responsible for design, installation and verification of the gas protection measures:

Role	Company	Remarks
Main Client	Strata Homes	House builder
Designer	Eastwood & Partners Lithos	Construction drawings Producer of this strategy
Sub Floor Void Construction	M&J Evans Construction	Groundworker
Membrane Installer	UK Membranes	Specialist Installer
Sealing of Water Duct Annulus	M&J Evans Construction	Groundworker
Third Party Independent Verifier	Lithos Consulting	Geoenvironmental consultant
Internal QA/QC[3]	UK Membranes M&J Evans Construction	Specialist Installer Groundworker

4 Material specification

4.3 Strata have confirmed that the following membranes will be installed in plots:

- Juta **GP1** or **GP5** gas membrane will be installed in all dwellings in Areas B, C & D.
- Juta **GP Titanflex** gas membrane will be installed in all dwellings in Area A

4.4 Joints will be sealed using heat welding techniques. The manufacturer's datasheets for the membranes are presented in Appendix B.

4.1 The membrane specifications have been reviewed by Lithos and is deemed to be suitable based on the following:

- The thickness of the membrane is greater than the minimum required of 0.4 mm thickness (1600g polyethylene)
- The membrane is supplied unfolded i.e. supplied on a roll
- The membrane is made up of a virgin polymer
- The methane transmission rate is below the maximum permissible methane gas transmission rate of 40ml/m^2/day/atm[4,5].
- **Chemical (hydrocarbon) resistance** of Titanflex membrane for Area A plots

4.2 Service penetrations will be sealed using self-adhesive gas membrane (SAGM).

[3] *For plots not subject to independent 3rd party verification*
[4] *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS8484:2015+A1:2019.*
[5] *Hazardous ground gas – an essential guide for housebuilders. NF94. NHBC Foundation. April 2023.*

4.3 Service ducting will also require internal sealing via either, a minimum thickness of 300mm expanding foam injected into the duct with liquid gas membrane applied to the top of the trimmed foam, or a minimum thickness of 150mm expanding resin poured into the duct (foam flange required at base of seal). The product utilised on this site for this purpose will be agreed with Lithos and confirmed on the final gas protection certificate and also the construction phase Verification Report(s).

4.4 Corner detail is to be undertaken using SAGM.

5 Construction & installation

5.1 The sub-floor ventilation will be installed by Strata's groundworker (M&J Evans).

5.2 The gas membranes will be installed by experienced installers (UK Membranes) who hold an NVQ2 Diploma in Substructure Work Occupations (Installation of Gas Membranes-Construction) qualification. Professional installer qualifications are included in Appendix C.

5.3 Site specific construction drawings detailing all aspects of the gas protection system, including membrane and ventilation, are presented in Appendix A. These include foundation cross sections demonstrating the sub floor void, position of the concrete slab and insulation at the permitter, level changes and sleeper/party walls.

5.4 Integral garages will be provided with the same protective measures as the rest of the dwelling. External garages do not require specific gas protection measures to be installed.

5.5 The sub-floor void will comprise a clear open space with a minimum depth of 150mm[6].

5.6 Strata have confirmed that the following will be installed in the sub structure:

- Sub-floor ventilation will be provided via airbricks each with a free airflow area of **c.6,100mm²**, installed in at least 2 opposite walls, to provide minimum ventilation of **1,500mm²/m** run of wall or **500mm²/m²** of floor area (whichever gives the greater opening area), as presented in the Foundation Plan Drawings (by Strata) in Appendix A.
- The bottom of the air bricks will be at **least 75mm above finished ground level**
- Cross ventilation will be provided in sleeper/party walls via 100mm pipes at **2.5m** centres run of internal wall (a minimum of 2) or alternatively via removal of blocks or honeycombing. Only internal walls parallel to the minimum two ventilated external walls require cross ventilation, which should be set **450mm** from the end of any internal wall and the top of the pipe/duct should be a minimum **300mm** from final floor level.

5.7 Sub structure plans (showing air brick and cross ventilation positions) are included in Appendix A for the following property types that will be constructed at the site:

- Terrace (M3-301 & MY AL-251)
- Semi-detached (M3-301, MY AL-251 & MY AL-451)
- Detached (M3-604 & HT2A)

Note: The drawing for MY AL-251 house type shows a conjoined plot partially cut off for illustration purposes with only one air brick in the front and back. Strata have confirmed that 2 air bricks in front & back will be installed (4 total) in all these plot types.

[6] *Assessing risks posed by hazardous ground gases to buildings. CIRIA C665. 2007.*

5.8 During appropriate weather conditions (e.g. not under strong winds and/or heavy rain) the membrane will be loosely laid on a clean surface which is free from debris. The membrane will be lapped and sealed in accordance with the manufacturer's specification. The membrane will be **continuous** across **internal walls** and the **cavity**.

5.9 All laps and penetrations of the membrane (to be kept to a minimum), including the open portion of any service duct annulus, will be sealed in line with Section 4.3 creating an airtight seal. This can be undertaken at any time between pulling the water pipe through the ducting and the installation of the kitchen.

5.10 Where conjoined plots are subject to a level change any extruding wall ties must be sealed by **gas resistant sealant** (product to be agreed with Lithos).

5.11 In plots where the **GP1** membrane is being installed the **Juta 300TT** protective fleece should be placed on top of the membrane prior to concrete screed pour. For plots with the **GP5** and **Titanflex** membrane this fleece should also be installed if the concrete pour is going to be more than 24 hours after installation of the membrane has been completed.

5.12 Follow on trades will receive a **toolbox talk** by Strata explaining they are not to cut or drill into the membrane and the need for care when working in the membrane's vicinity.

5.13 Prior to placement of insulation or slab pour, Strata will need to ensure that the membrane (GP5, Titanflex with no protective fleece only) is in the same condition as when inspected/ approved.

6 Sub floor ventilation calculations

6.1 The Foundation Plan drawings in Appendix A have been reviewed by Lithos and there are no obvious sub floor areas where reduced ventilation may occur i.e. dead spots.

6.2 The equilibrium concentration of carbon dioxide within the ventilation layer has been calculated to be below **0.004% v/v** across all property types. This is below the requirement of **1% v/v** for **very good** performance of the sub floor void system.

6.3 The maximum period of still wind in the UK is 10 hours[7]. Theoretical calculations for the time taken for the carbon dioxide concentrations to rise to 1% v/v where there where there is no wind/ventilation for this site is **938 hours**. As such it is considered **highly unlikely** that equilibrium concentrations of carbon dioxide will reach the design limit of 1% v/v.

6.4 The calculations are included in Appendix D.

7 Verification plan

7.1 Beam & block floor

7.1.1 Independent **third-party** verification (not the installer or any associated company) of both the ventilation and the membrane will be carried out on the first **five plots**. This will allow issues with quality of installs to be rectified at an early stage of the buildout.

7.1.2 **CS2 only-** Subsequent verification will be carried out at a minimum frequency of **1 in 20** plots. Plots selected for inspection will be located across the development and not clustered.

[7] *DETR and Partners in Technology (1997) Passive venting of soil gases beneath buildings, guide for design. Research report, Volume I, Ove Arup and Partners.*

7.1.3 **Hydrocarbon resistant and CS2-** Subsequent verification will be carried out at a minimum frequency of **1 in 5** plots. Plots selected for inspection will be located across the development and not clustered.

7.1.4 This frequency is in accordance with the requirements of both the YALPAG[8] and CIRIA[9] guidance documents.

7.1.5 At least **two** visits will be required per plot subject to independent inspection:

- **Visit 1** – to inspect the sub-floor ventilation:
  - Depth (min 150mm)
  - Voids (clear and unobstructed)
  - Vents (located in accordance with the design drawing and unobstructed)
  - Cross ventilation in sleeper/party walls
- **Visit 2** - to inspect the membrane, joints and service penetrations including sealing of water duct annulus **Note.** Another visit (**Visit 3**) may be required if the water seal has not been undertaken at the same time as the membrane installation.

7.2 Integrity testing

7.2.1 Independent inspection will be undertaken by Lithos and will include integrity testing[10] of the joints as follows:

- **CS2 only -** via mechanical point stress testing (pick testing).
- **Hydrocarbon resistant-** via air lancing (due to the hydrocarbon contamination) in addition to mechanical point stress testing (pick testing).

7.2.2 A sample of a heat welded joint should be requested to undertake shear and peel tests to assess the quality of the joint.

7.3 Training & competence

7.3.1 Lithos engineers will have undertaken a training course on the installation of gas membranes and will have undertaken sufficient inspections to be deemed to be competent to this task for up to and including CS3[11] designated sites. Gas competency CVs of Lithos staff undertaking verification visits are included in Appendix C.

7.4 Workmanship & non-conformities

7.4.1 Where installers are able to do so, non-conformities will be repaired on site in the presence of the verifier. The verifier should make a record of these repairs and if everything else checked is to their satisfaction 'PASS' the specific plot. In instances where the installer is either not on site or not available to rectify the non-conformities in the presence of the verifier, the verifier will mark up[12], record and photograph the non-conformities for later repair. The plot(s) shall be identified as a 'FAIL' until the verifier has confirmed that the repairs have been adequately undertaken.

[8] *The Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) guidance document "Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants", Version 1.1 dated December 2016*
[9] *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases (C735). CIRIA. 2014.*
[10] *ASTM D4437/D4437M-16(2023). Standard practice for non-destructive testing (NDT) for determining the integrity of seams used in joining flexible polymeric sheet geomembranes. 2023*
[11] *Sites that are categorised towards the upper limit CS3 will require additional integrity testing and as such will need to be undertaken by a specialist verification contractor who has the required equipment and competent persons to use it to verify membrane installation*
[12] *Marking up should be undertaken with either marker tape or permanent white pen marker. Spray paints should not be used.*

7.4.2 Independent inspection frequency will be increased, i.e. the next constructed/installed plots, if any concerns are raised regarding the level of workmanship. Strata, and/or their appointed installer should inform Lithos if any significant changes to personnel involved in the installation of membranes is going to occur. The first plot undertaken by the new installers must then be independently inspected too.

7.4.3 After completion of plot construction and landscaping works Strata or their appointed contractor will undertake a final inspection of **all** airbricks at finished ground level to confirming these have not been partially or fully obscured.

7.5 Reporting

7.5.1 Strata or their appointed installer will undertake their own QA/QC inspection of **all** plots not subject to independent inspection. Details will be recorded on an appropriate proforma (example included in Appendix E) or via certification and photographs taken. **This may be required to clear NHBC conditions for plots not subject to independent verification.**

7.5.2 Independent verification details will be recorded on the proforma presented in Appendix E (or similar) with photographs presented.

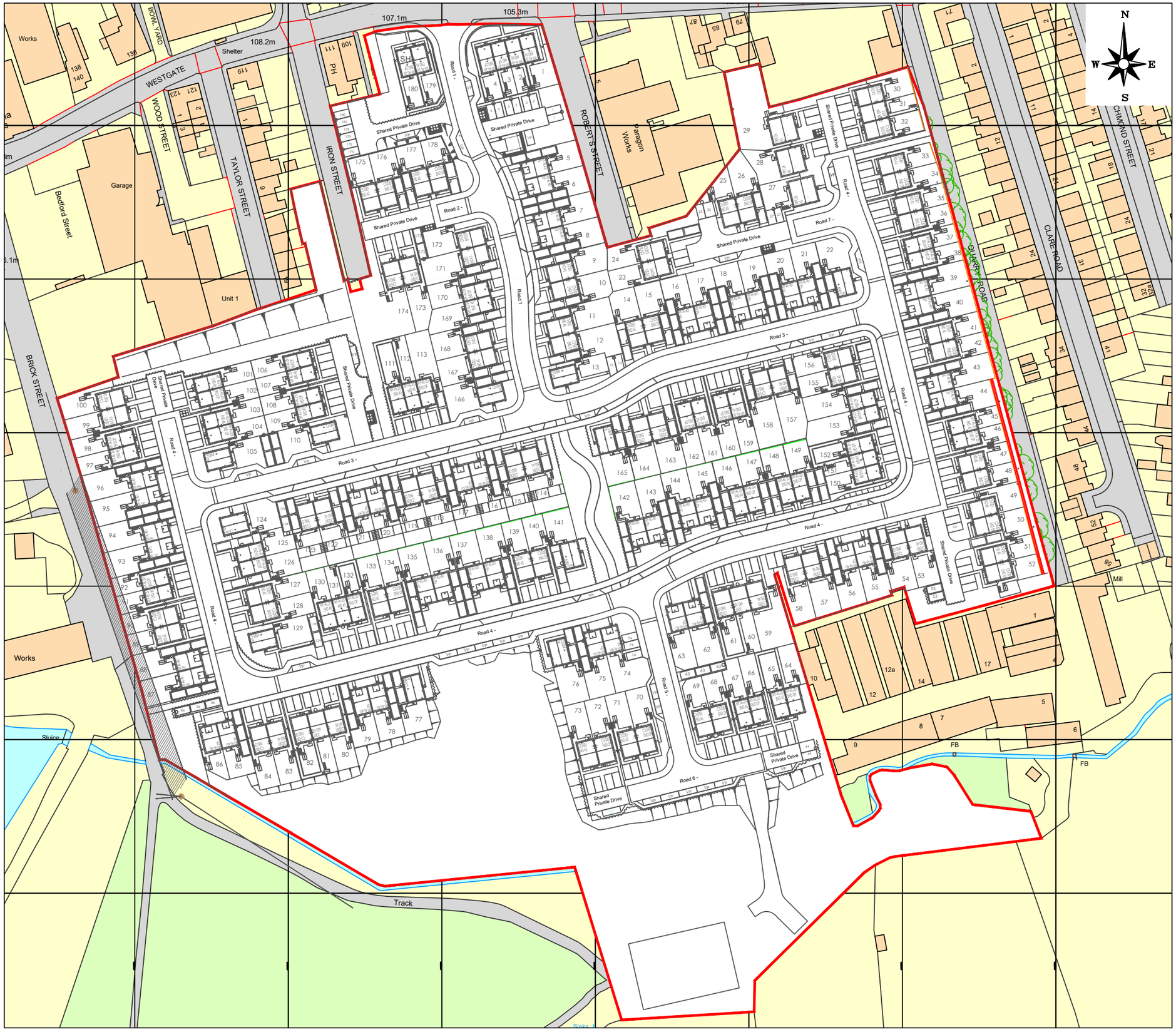
7.5.3 On completion of the development, or any sub-phase of the development, all inspection records will be compiled into a **Verification Report** to be produced by Lithos. The Verification Report will include, but not limited to, the following:

- Gas protection measures certificates for individual plots including photographs.
- Inspection summary sheet
- Confirmation that air bricks numbers and spacing are broadly in line with the foundation plan drawings
- Confirmation that cross-ventilation has been adequately considered/installed
- Confirmation that the inspection frequency has been adhered to
- A plan showing which properties have been independently inspected
- CQA sheets from the installer for plots not subject to independent verification
- Details of site personnel involved in the gas protection measures installation and any changes in personnel

APPENDIX A
DRAWINGS

LITHOS CONSULTING
info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT	STRATA
JOB TITLE	WESTGATE, CLECKHEATON
DRAWING TITLE	SITE LOCATION PLAN
DRAWN	GLM
DATE	23/11/2020
CHECKED	ASw
DATE	23/11/2020
STATUS	FOR COMMENT ☐ DRAFT ☐ FOR APPROVAL ☐ FINAL ☑
SCALE	1:25,000
SHEET	A4
DRAWING NO.	3043/1
REVISION	



NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM STRATA HOMES' DRAWING BY00099-STH-B01-XX-DR-A SL001 REV U, DATED 01 12 2025

REV.	DESCRIPTION	DATE
D	UPDATED WITH NEW CLIENT LAYOUT	16/01/26
C	UPDATED WITH NEW CLIENT LAYOUT	26/07/23
B	UPDATED WITH NEW CLIENT LAYOUT	05/05/21
A	UPDATED WITH NEW CLIENT LAYOUT	23/02/21

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

STRATA

JOB TITLE

WESTGATE, CLECKHEATON

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
GLM	23/11/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	23/11/2020	DRAFT ☐
		FINAL ☑

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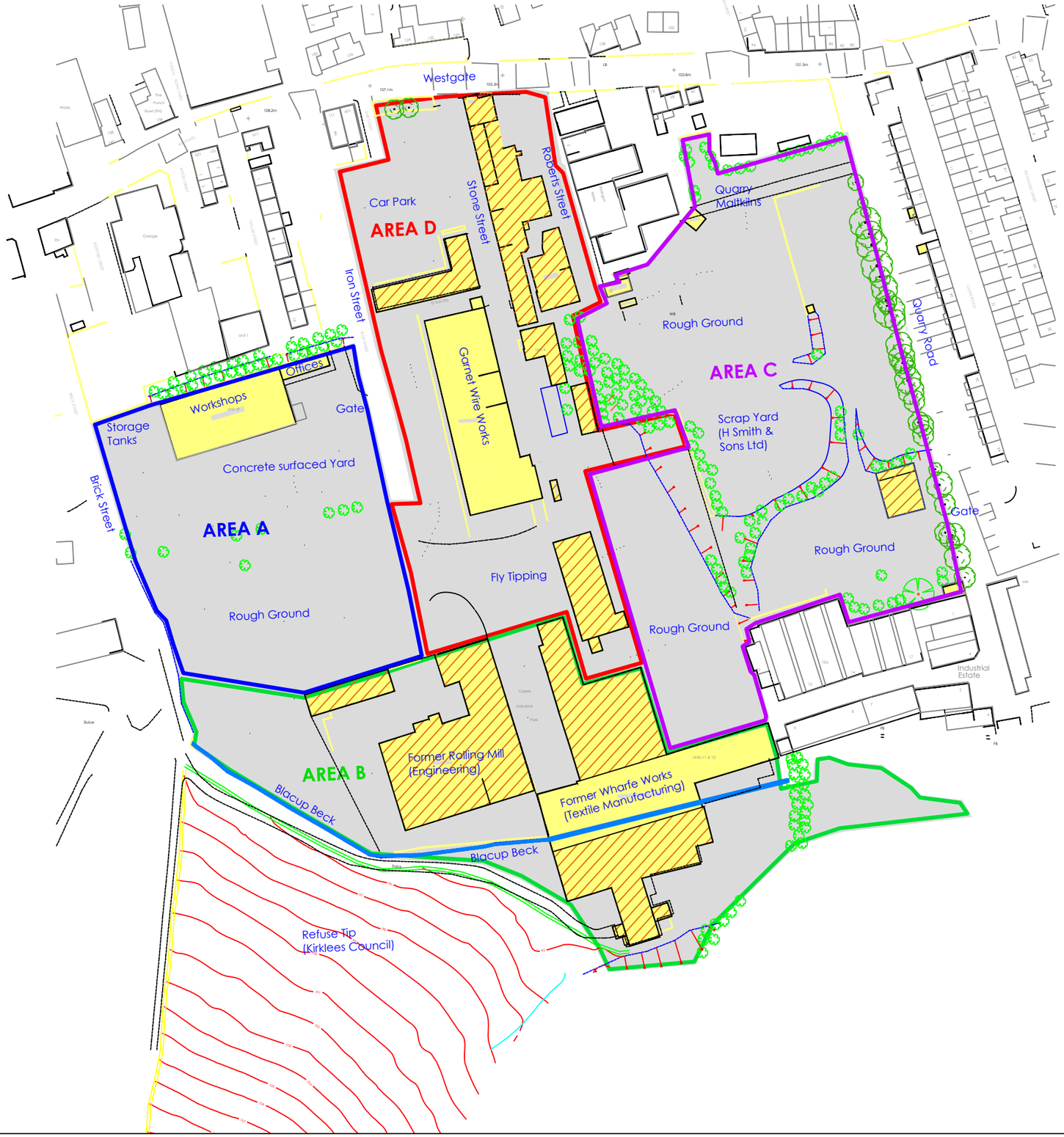

NOTES

- EXISTING BUILDING
- CONCRETE HARDSTAND (FORMER BUILDING FOOTPRINT)
- EXTERNAL SURFACING (CONCRETE HARDSTAND/TARMAC/ ROUGH GROUND)

REV.	DESCRIPTION	DATE
A	UPDATE OF SITE FEATURES & CONDITION	23/11/2020

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

STRATA

JOB TITLE

WESTGATE, CLECKHEATON

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
GLM	23/11/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
ASw	23/11/2020	DRAFT ☐
		FINAL ☑

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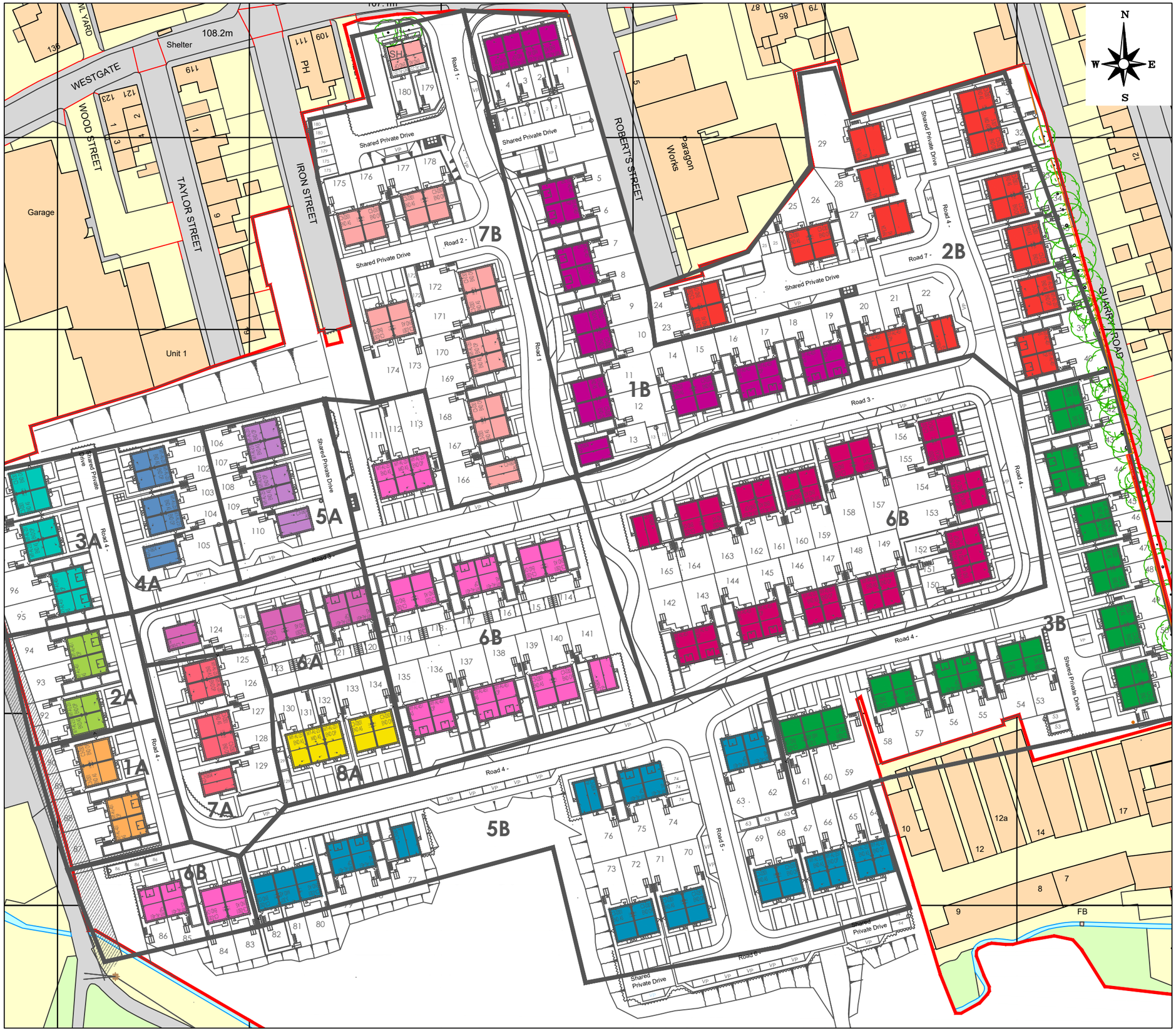

NOTES

FIRST FIVE PLOT BY A NEW INSTALLER TO BE INSPECTED

HC RESISTANT & CS2	CS2 Only
BLOCK 1A (1 IN 5)	BLOCK 1B (1 IN 20)
BLOCK 2A (1 IN 5)	BLOCK 2B (1 IN 20)
BLOCK 3A (1 IN 5)	BLOCK 3B (1 IN 20)
BLOCK 4A (1 IN 5)	BLOCK 4B (1 IN 20)
BLOCK 5A (1 IN 5)	BLOCK 5B (1 IN 20)
BLOCK 6A (1 IN 5)	BLOCK 6B (1 IN 20)
BLOCK 7A (1 IN 5)	BLOCK 7B (1 IN 20)
BLOCK 8A (1 IN 5)	APPROXIMATE SITE BOUNDARY

REPRODUCED FROM STRATA HOMES' DRAWING BY00099-STH-B01-XX-DR-A SL001 REV U, DATED 01 12 2025

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

STRATA

JOB TITLE

WESTGATE,
CLECKHEATON

DRAWING TITLE

GAS PROTECTION VALIDATION PLAN

DRAWN	DATE	STATUS
ET	16/01/2026	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
DJ	16/01/2026	DRAFT ☐
		FINAL ☑

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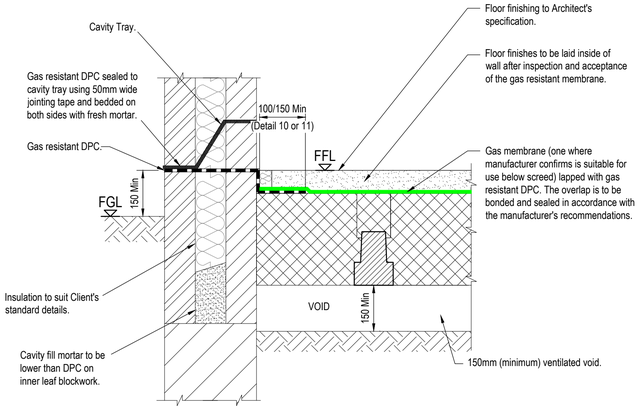
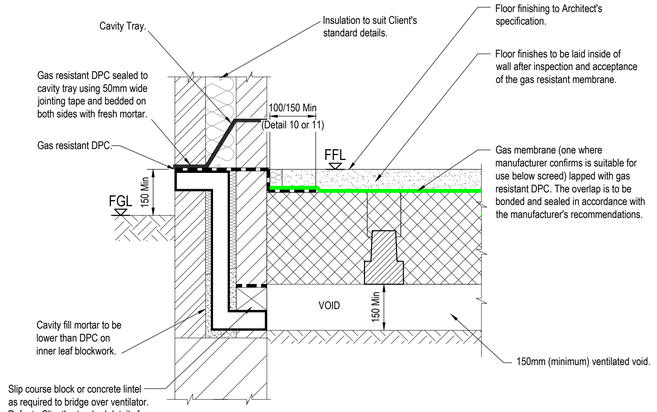
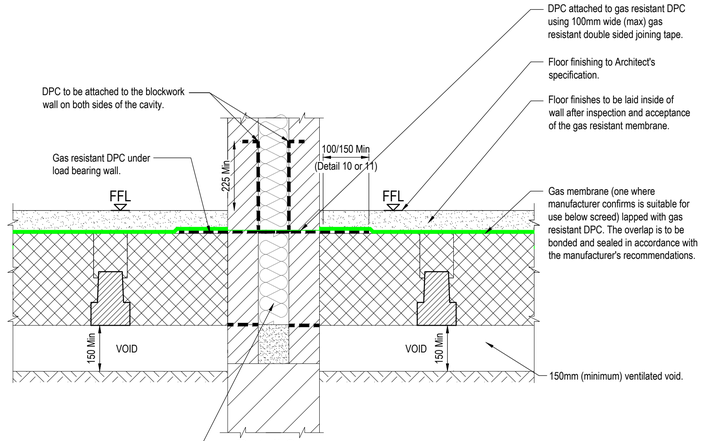


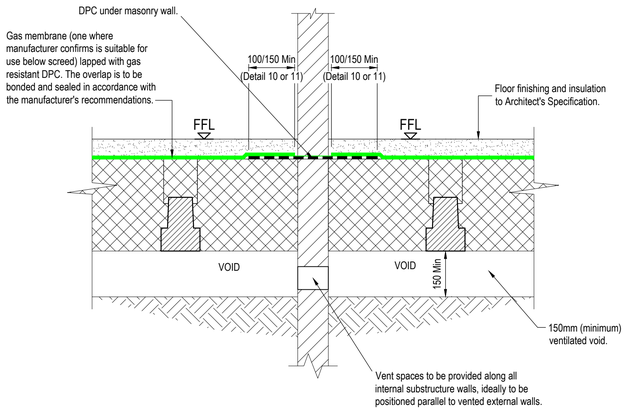
Detail 1
External Wall Detail Where DPC Is At FFL (Away From Ventilator Position)
(Scale 1:10)



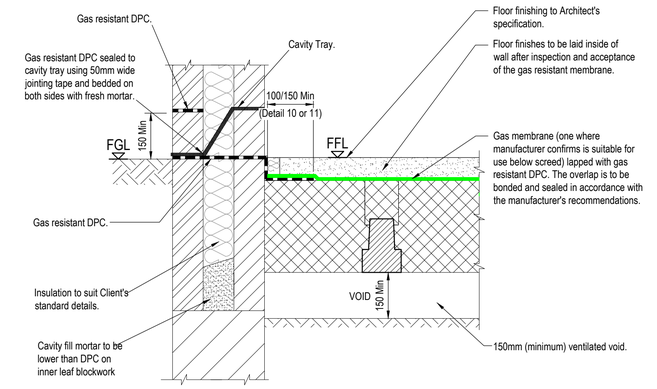
Detail 2
Typical Perimeter Detail Where D.P.C. Is At Finished Floor Level (With Ventilator)
(Scale 1:10)



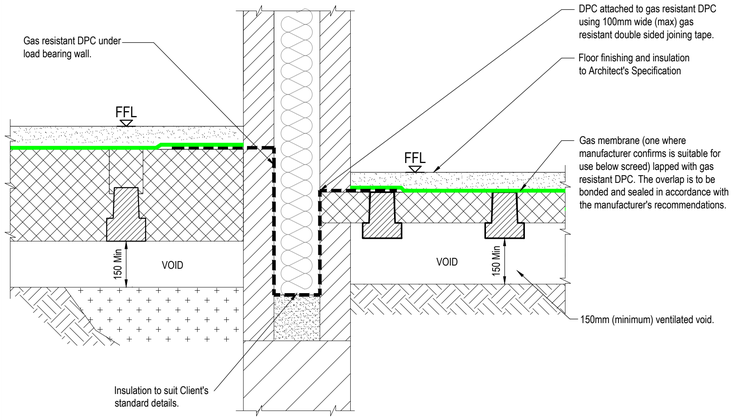
Detail 3
Party Wall Detail
(Scale 1:10)



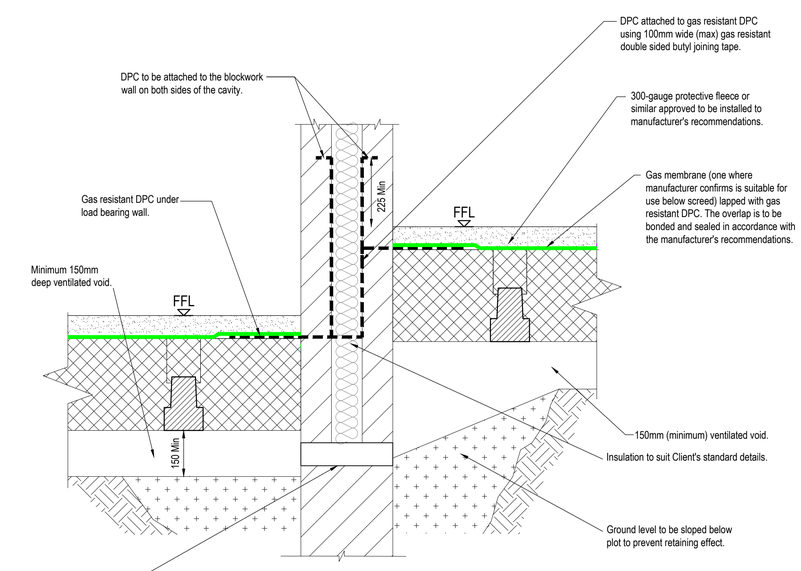
Detail 4
Details Of Gas Barrier Construction At Internal Loadbearing Wall
(Scale 1:10)



Detail 5
Detail Where Ground Level Is Locally Raised To Suit Finished Floor Level
(Scale 1:10)



Detail 6
Wall Between House & Integral Garage Detail
(Scale 1:10)



Detail 7
Typical Section Through a Stepped Party Wall
(Scale 1:10)

1. The details shown on this drawing for construction of precast concrete ground floors with a ventilated void and gas membrane are to be used in conjunction with Eastwood Consulting Engineer's documents prefixed 50064.
2. Lithos' Gas Risk Assessment (report number 3043/5A, July 2023) notes the gas measures in Area A need to be 'hydrocarbon resistant'.

Ventilation

3. The client is to provide mark ups of each house type showing where air bricks are to be positioned, and where vent spaces are to be positioned on internal substructure walls.
4. Through-wall ventilation to be achieved using telescopic ventilators and air bricks; their spacing should conform to relevant statutory and mandatory requirements. In accordance with NHBC Standards Chapter 5.2, void ventilation should be provided to whichever gives the greater opening area i.e. 1500mm^2/ per metre run of external wall, or 500mm^2/ per m^2/ of floor area. All internal substructure walls parallel to ventilated external walls are to be vented using cavity sleeve ventilators.
5. Sleeve ventilators must not be located directly under bearing of a precast floor beam.
6. As part of the Verification Plan, the amount of ventilation will need to be calculated and the positions of air bricks and vent spaces approved by the regulators.
7. Wall cavity to be ventilated with perpend weepholes at 900c/c above cavity trays at DPC level and all lintels, to Architect's details.
8. Void heights to be minimum 150mm and may need to be increased to suit site specific volume change potential. See Foundation Schedule for foundation sections and void heights.

Gas Membrane

9. It is recommended that all gas membranes are fitted by qualified installers. Strata Homes has informed ECE that UK Membranes Ltd are installing the gas membranes.
10. All gas membranes and ancillary products must be installed in accordance with the manufacturer's recommendations and the requirements of BRE 414 Protective Measures for Housing on Gas Contaminated Land, CIRIA Documents C665 & C735, BR8485:2015 and AI:2019.
11. The gas membranes to be used include Juta GP Titanflex with associated products GP TitanTank (or equivalent) for Area A.
12. All overlaps in the gas membrane to be at least 150mm and bonded with gas resistant double sided butyl Tape. The joint should then be sealed with gas resistant single sided tape. Prior to sealing, all surfaces are to be cleaned to ensure a good bond. Seals can also be welded, should the membrane specification indicate welding is appropriate.
13. All horizontal DPCs must be bedded on both sides with fresh mortar and must extend the full width of the wall including any rendering and project 5mm beyond external face.
14. Preformed cloaks can be used at corners and change in levels exceeding 75mm in height to suit cavity tray profiles.
15. DPC where FGL is level with FFL must be suitable for tanking/water proofing as well as being gas proof. Tanking details to be designed by a CSSW certified specialist.

Verification

16. Verification of gas measures (ie. of ventilated void and membrane installation) should be carried out in accordance with C735 and the site specific Verification Plan.

Legend:

FGL	-	Finished Ground Level
FFL	-	Finished Floor Level
DPC	-	Damp Proof Course

REV	DESCRIPTION	SIG	CHK	DATE
P01	First issue.	JL	KE	30.01.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREA A

STANDARD DETAILS FOR GAS MEMBRANE WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 1 OF 2

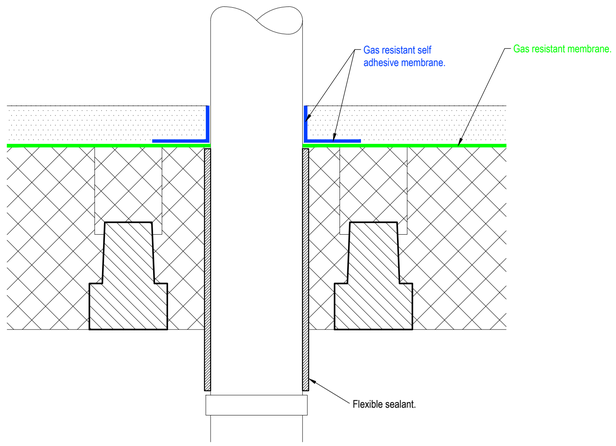
Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

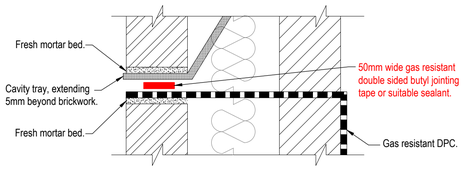
DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
50064	- ECE -	XX -	XX -	DR -	C -	0001	C01

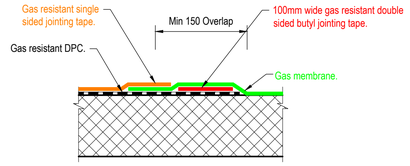
NOTE: ALL SERVICE ENTRIES REQUIRE A GAS PROOF SEAL ONCE THE SERVICES HAVE BEEN INSTALLED.



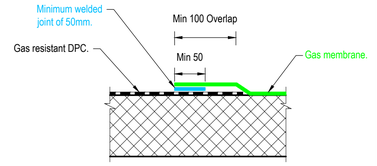
Detail 8
Pipe Penetration With Self Adhesive Gas Membrane
(Scale 1:5)



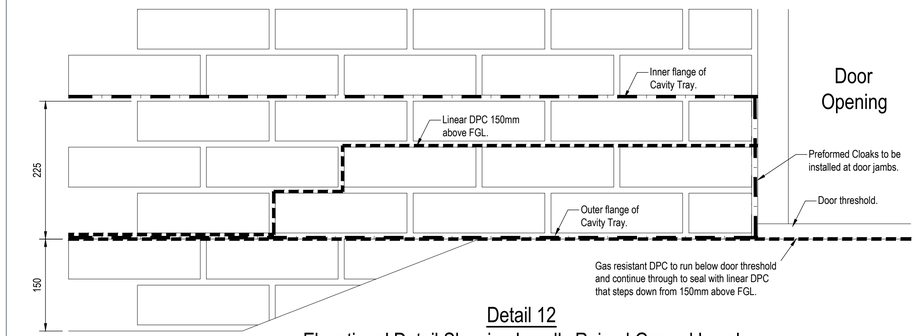
Detail 9
Detail Of Cavity Tray Sealed To DPC In External Leaf
(Scale 1:5)



Detail 10
Detail Of Overlap Between DPC And Membrane
(Scale 1:5)



Detail 11
Welded Joint Detail
(Scale 1:5)



Detail 12
Elevational Detail Showing Locally Raised Ground Level
(Scale 1:5)

1. The details shown on this drawing for construction of precast concrete ground floors with a ventilated void and gas membrane are to be used in conjunction with Eastwood Consulting Engineer's documents prefixed 50064.

2. Lithos' Gas Risk Assessment (report number 3043/5A, July 2023) notes the gas measures in Area A need to be 'hydrocarbon resistant'.

Ventilation

3. The client is to provide mark ups of each house type showing where air bricks are to be positioned, and where vent spaces are to be positioned on internal substructure walls.

4. Through-wall ventilation to be achieved using telescopic ventilators and air bricks; their spacing should conform to relevant statutory and mandatory requirements. In accordance with NHBC Standards Chapter 5.2, void ventilation should be provided to whichever gives the greater opening area i.e. 1500mm^2/ per metre run of external wall, or 500mm^2/ per m^2/ of floor area. All internal substructure walls parallel to ventilated external walls are to be vented using cavity sleeve ventilators.

5. Sleeve ventilators must not be located directly under bearing of a precast floor beam.

6. As part of the Verification Plan, the amount of ventilation will need to be calculated and the positions of air bricks and vent spaces approved by the regulators.

7. Wall cavity to be ventilated with perpend weepholes at 900c/c above cavity trays at DPC level and all lintels, to Architect's details.

8. Void heights to be minimum 150mm and may need to be increased to suit site specific volume change potential. See Foundation Schedule for foundation sections and void heights.

Gas Membrane

9. It is recommended that all gas membranes are fitted by qualified installers. Strata Homes has informed ECE that UK Membranes Ltd are installing the gas membranes.

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13. All horizontal DPCs must be bedded on both sides with fresh mortar and must extend the full width of the wall including any rendering and project 5mm beyond external face.

14. Preformed cloaks can be used at corners and change in levels exceeding 75mm in height to suit cavity tray profiles.

15. DPC where FGL is level with FFL must be suitable for tanking/water proofing as well as being gas proof. Tanking details to be designed by a CSSW certified specialist.

Verification

16. Verification of gas measures (ie. of ventilated void and membrane installation) should be carried out in accordance with C735 and the site specific Verification Plan.

Legend:

FGL	-	Finished Ground Level
FFL	-	Finished Floor Level
DPC	-	Damp Proof Course

REV	DESCRIPTION	SIG	CHK	DATE
P01	First issue.	JL	KE	30.01.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREA A

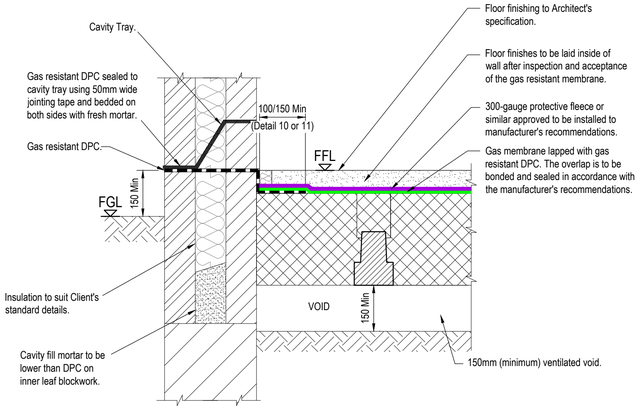
STANDARD DETAILS FOR GAS MEMBRANE WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 2 OF 2

Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

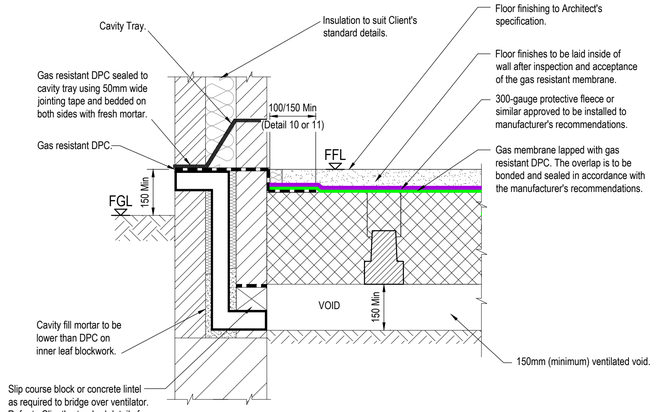
ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

DRAWING NUMBER

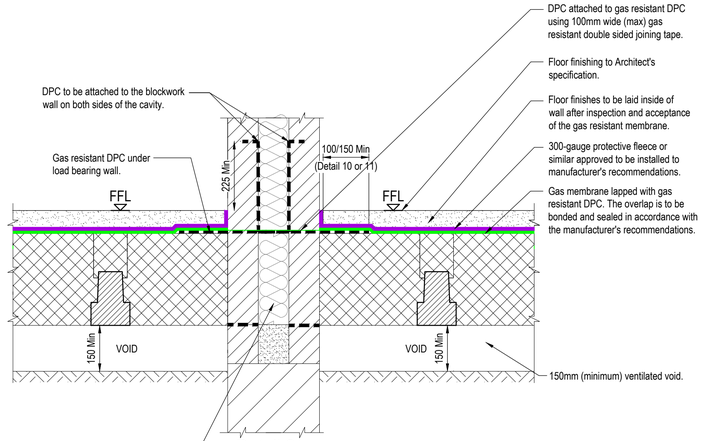
Project	Originator	Zone	Level	Type	Role	Number	REV
50064	ECE	XX	XX	DR	C	0002	C01



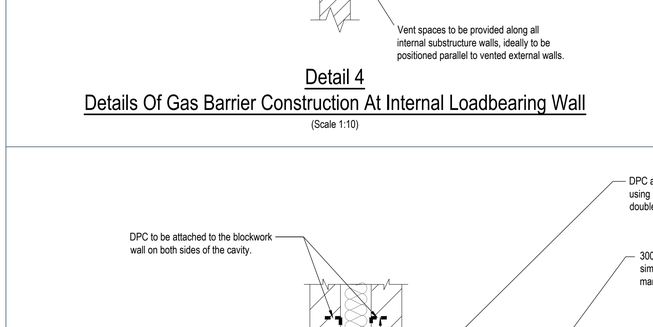
Detail 1
External Wall Detail Where DPC Is At FFL (Away From Ventilator Position)
(Scale 1:10)



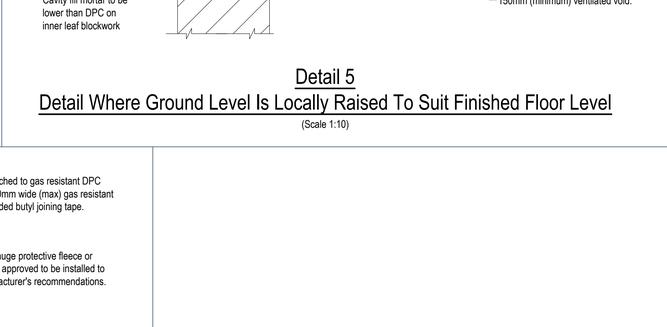
Detail 2
Typical Perimeter Detail Where D.P.C. Is At Finished Floor Level (With Ventilator)
(Scale 1:10)



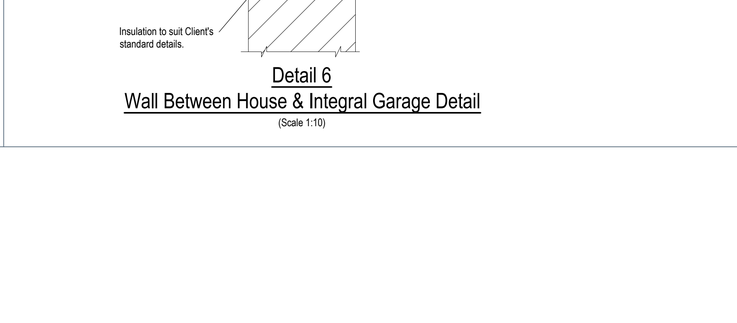
Detail 3
Party Wall Detail
(Scale 1:10)



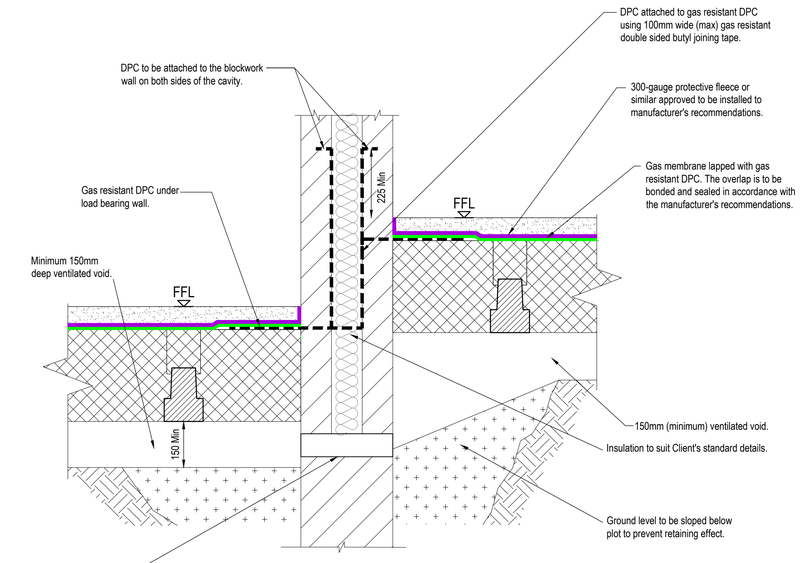
Detail 4
Details Of Gas Barrier Construction At Internal Loadbearing Wall
(Scale 1:10)



Detail 5
Detail Where Ground Level Is Locally Raised To Suit Finished Floor Level
(Scale 1:10)



Detail 6
Wall Between House & Integral Garage Detail
(Scale 1:10)



Detail 7
Typical Section Through a Stepped Party Wall
(Scale 1:10)

1. The details shown on this drawing for construction of precast concrete ground floors with a ventilated void and gas membrane are to be used in conjunction with Eastwood Consulting Engineer's documents prefixed 50064.
2. Lithos' Gas Risk Assessment (report number 3043/5A, July 2023) notes the gas measures in Areas B, C and D's gassing regime is classified as 'Amber 1'.

Ventilation

3. The client is to provide mark ups of each house type showing where air bricks are to be positioned, and where vent spaces are to be positioned on internal substructure walls.
4. Through-wall ventilation to be achieved using telescopic ventilators and air bricks; their spacing should conform to relevant statutory and mandatory requirements. In accordance with NHBC Standards Chapter 5.2, void ventilation should be provided to whichever gives the greater opening area i.e. 1500mm^2/ per metre run of external wall, or 500mm^2/ per m^2/ of floor area. All internal substructure walls parallel to ventilated external walls are to be vented using cavity sleeve ventilators.
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6. As part of the Verification Plan, the amount of ventilation will need to be calculated and the positions of air bricks and vent spaces approved by the regulators.
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8. Void heights to be minimum 150mm and may need to be increased to suit site specific volume change potential. See Foundation Schedule for foundation sections and void heights.

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11. The gas membranes to be used include Juta GP1 with associated products GP SAM (or equivalent) for Areas B, C & D.
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Legend:

FGL	-	Finished Ground Level
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REV	DESCRIPTION	SIG	CHK	DATE
C02	Title updated to include (Juta GP1).	JL	KE	10.02.2026
C01	First issue.	JL	KE	30.01.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREAS B, C & D

STANDARD DETAILS FOR GAS MEMBRANE (JUTA GP1) WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 1 OF 2

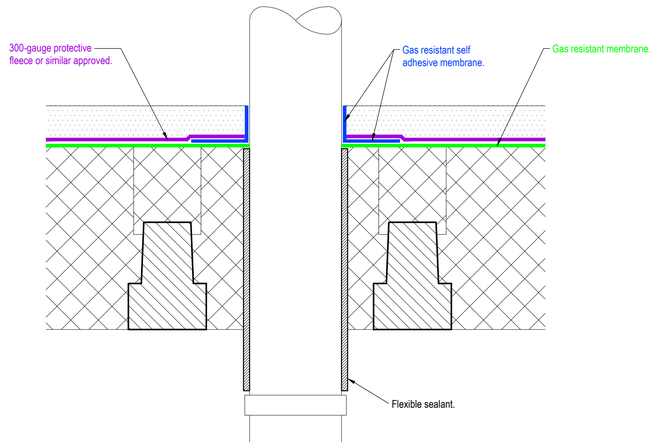
Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

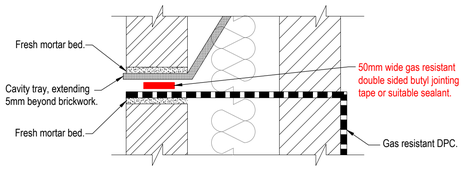
DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
50064	ECE	XX	XX	DR	C	0003	C02

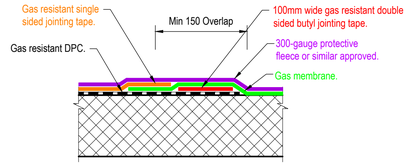
NOTE: ALL SERVICE ENTRIES REQUIRE A GAS PROOF SEAL ONCE THE SERVICES HAVE BEEN INSTALLED.



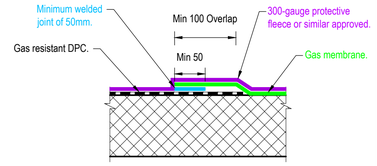
Detail 8
Pipe Penetration With Self Adhesive Gas Membrane
(Scale 1:5)



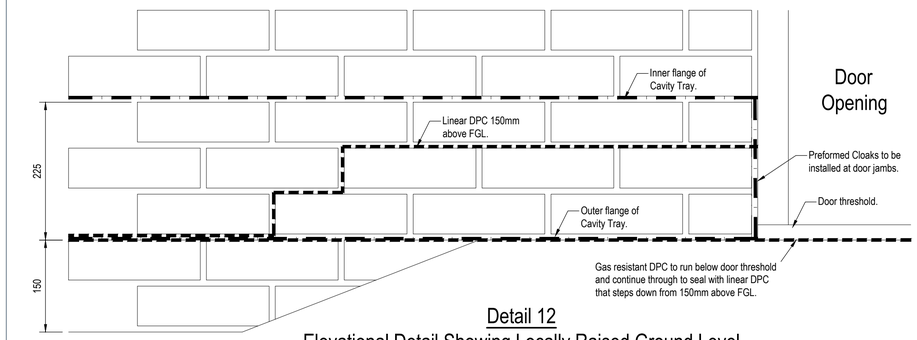
Detail 9
Detail Of Cavity Tray Sealed To DPC In External Leaf
(Scale 1:5)



Detail 10
Detail Of Overlap Between DPC And Membrane
(Scale 1:5)



Detail 11
Welded Joint Detail
(Scale 1:5)



Detail 12
Elevational Detail Showing Locally Raised Ground Level
(Scale 1:5)

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REV	DESCRIPTION	SIG	CHK	DATE
C02	Title updated to include (Juta GP1).	JL	KE	10.02.2026
C01	First issue.	JL	KE	30.01.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREAS B, C & D

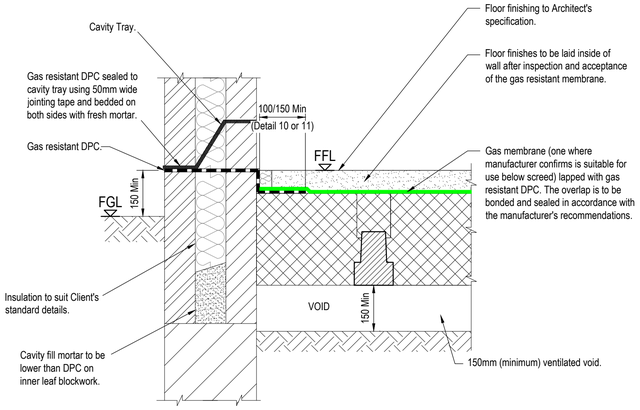
STANDARD DETAILS FOR GAS MEMBRANE (JUTA GP1) WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 2 OF 2

Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

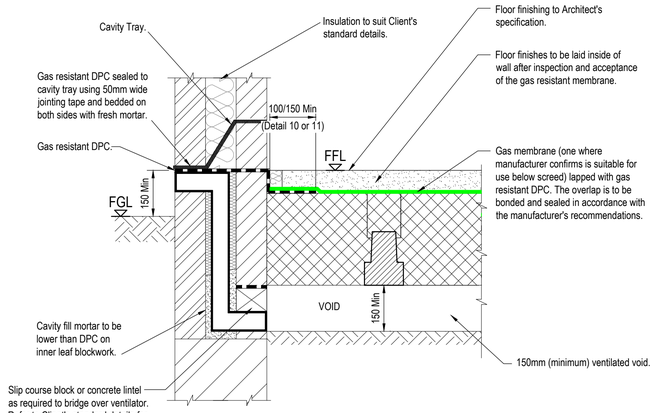
ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

DRAWING NUMBER

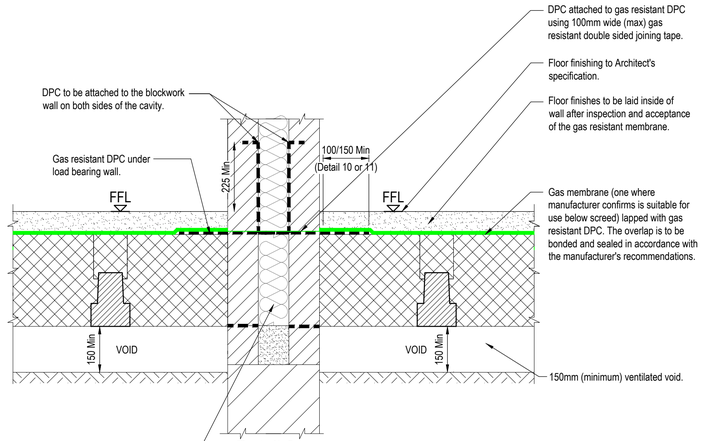
Project	Originator	Zone	Level	Type	Role	Number	REV
50064	- ECE -	XX -	XX -	DR -	C -	0004	C02



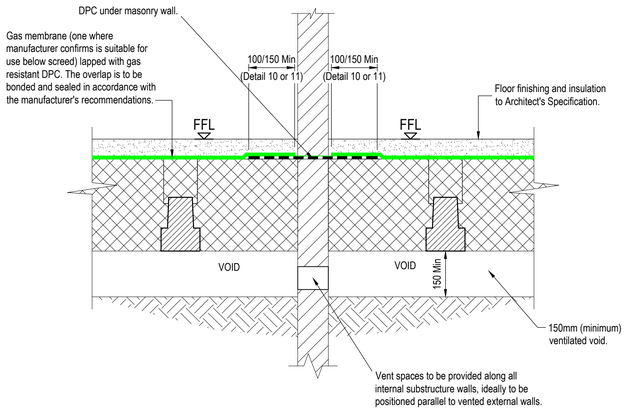
Detail 1
External Wall Detail Where DPC Is At FFL (Away From Ventilator Position)
(Scale 1:10)



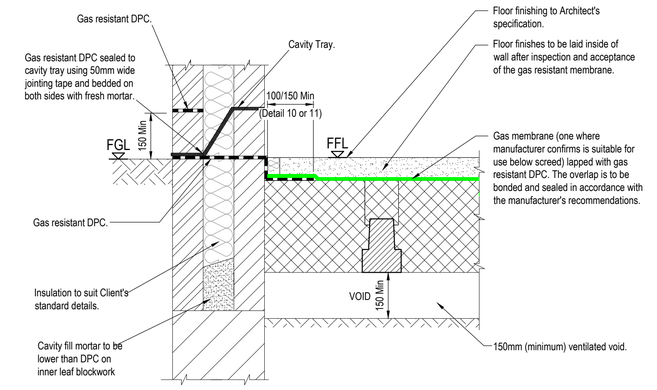
Detail 2
Typical Perimeter Detail Where D.P.C. Is At Finished Floor Level (With Ventilator)
(Scale 1:10)



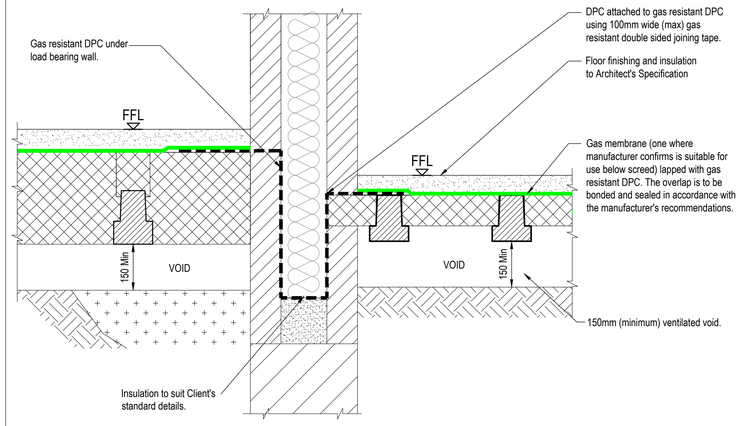
Detail 3
Party Wall Detail
(Scale 1:10)



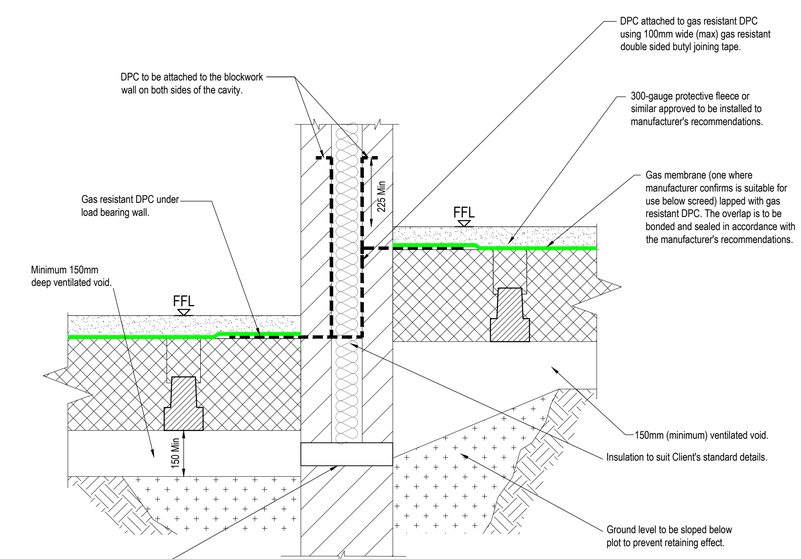
Detail 4
Details Of Gas Barrier Construction At Internal Loadbearing Wall
(Scale 1:10)



Detail 5
Detail Where Ground Level Is Locally Raised To Suit Finished Floor Level
(Scale 1:10)



Detail 6
Wall Between House & Integral Garage Detail
(Scale 1:10)



Detail 7
Typical Section Through a Stepped Party Wall
(Scale 1:10)

1. The details shown on this drawing for construction of precast concrete ground floors with a ventilated void and gas membrane are to be used in conjunction with Eastwood Consulting Engineer's documents prefixed 50064.
2. Lithos' Gas Risk Assessment (report number 3043/5A, July 2023) notes the gas measures in Areas B, C and D's gassing regime is classified as 'Amber 1'.

Ventilation

3. The client is to provide mark ups of each house type showing where air bricks are to be positioned, and where vent spaces are to be positioned on internal substructure walls.
4. Through-wall ventilation to be achieved using telescopic ventilators and air bricks; their spacing should conform to relevant statutory and mandatory requirements. In accordance with NHBC Standards Chapter 5.2, void ventilation should be provided to whichever gives the greater opening area i.e. 1500mm^2/ per metre run of external wall, or 500mm^2/ per m^2/ of floor area. All internal substructure walls parallel to ventilated external walls are to be vented using cavity sleeve ventilators.
5. Sleeve ventilators must not be located directly under bearing of a precast floor beam.
6. As part of the Verification Plan, the amount of ventilation will need to be calculated and the positions of air bricks and vent spaces approved by the regulators.
7. Wall cavity to be ventilated with perpend weepholes at 900c/c above cavity trays at DPC level and all lintels, to Architect's details.
8. Void heights to be minimum 150mm and may need to be increased to suit site specific volume change potential. See Foundation Schedule for foundation sections and void heights.

Gas Membrane

9. It is recommended that all gas membranes are fitted by qualified installers. Strata Homes has informed ECE that UK Membranes Ltd are installing the gas membranes.
10. All gas membranes and ancillary products must be installed in accordance with the manufacturer's recommendations and the requirements of BRE 414 Protective Measures for Housing on Gas Contaminated Land, CIRIA Documents C665 & C735, BR8485:2015 and AI:2019.
11. The gas membranes to be used include Juta GP5 with associated products GP SAM (or equivalent) for Areas B, C & D.
12. All overlaps in the gas membrane to be at least 150mm and bonded with gas resistant double sided butyl Tape. The joint should then be sealed with gas resistant single sided tape. Prior to sealing, all surfaces are to be cleaned to ensure a good bond. Seals can also be welded, should the membrane specification indicate welding is appropriate.
13. All horizontal DPCs must be bedded on both sides with fresh mortar and must extend the full width of the wall including any rendering and project 5mm beyond external face.
14. Preformed cloaks can be used at corners and change in levels exceeding 75mm in height to suit cavity tray profiles.
15. DPC where FGL is level with FFL must be suitable for tanking/water proofing as well as being gas proof. Tanking details to be designed by a CSSW certified specialist.

Verification

16. Verification of gas measures (ie. of ventilated void and membrane installation) should be carried out in accordance with C735 and the site specific Verification Plan.

Legend:

FGL	-	Finished Ground Level
FFL	-	Finished Floor Level
DPC	-	Damp Proof Course

REV	DESCRIPTION	SIG	CHK	DATE
C01	First issue.	JL	KE	10.02.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREAS B, C & D

STANDARD DETAILS FOR GAS MEMBRANE (JUTA GP5) WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 1 OF 2

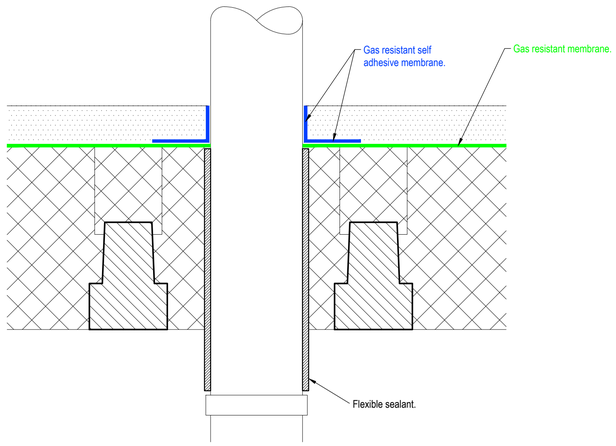
Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

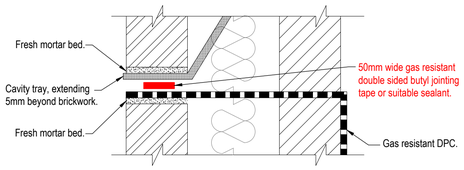
DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
50064	ECE	XX	XX	DR	C	0005	C01

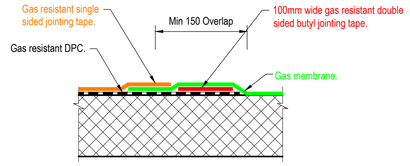
NOTE: ALL SERVICE ENTRIES REQUIRE A GAS PROOF SEAL ONCE THE SERVICES HAVE BEEN INSTALLED.



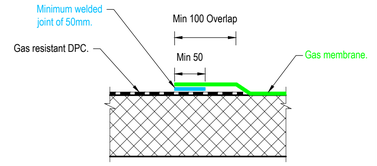
Detail 8
Pipe Penetration With Self Adhesive Gas Membrane
(Scale 1:5)



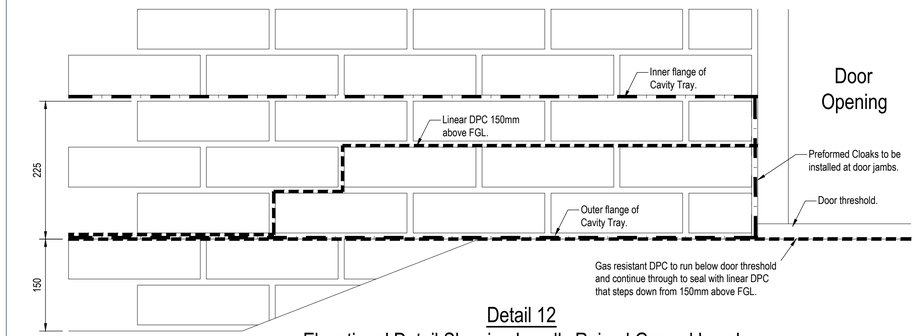
Detail 9
Detail Of Cavity Tray Sealed To DPC In External Leaf
(Scale 1:5)



Detail 10
Detail Of Overlap Between DPC And Membrane
(Scale 1:5)



Detail 11
Welded Joint Detail
(Scale 1:5)



Detail 12
Elevational Detail Showing Locally Raised Ground Level
(Scale 1:5)

1. The details shown on this drawing for construction of precast concrete ground floors with a ventilated void and gas membrane are to be used in conjunction with Eastwood Consulting Engineer's documents prefixed 50064.

2. Lithos' Gas Risk Assessment (report number 3043/5A, July 2023) notes the gas measures in Areas B, C and D's gassing regime is classified as 'Amber 1'.

Ventilation

3. The client is to provide mark ups of each house type showing where air bricks are to be positioned, and where vent spaces are to be positioned on internal substructure walls.

4. Through-wall ventilation to be achieved using telescopic ventilators and air bricks; their spacing should conform to relevant statutory and mandatory requirements. In accordance with NHBC Standards Chapter 5.2, void ventilation should be provided to whichever gives the greater opening area i.e. 1500mm^2/ per metre run of external wall, or 500mm^2/ per m^2/ of floor area. All internal substructure walls parallel to ventilated external walls are to be vented using cavity sleeve ventilators.

5. Sleeve ventilators must not be located directly under bearing of a precast floor beam.

6. As part of the Verification Plan, the amount of ventilation will need to be calculated and the positions of air bricks and vent spaces approved by the regulators.

7. Wall cavity to be ventilated with perpend weepholes at 900c/c above cavity trays at DPC level and all lintels, to Architect's details.

8. Void heights to be minimum 150mm and may need to be increased to suit site specific volume change potential. See Foundation Schedule for foundation sections and void heights.

Gas Membrane

9. It is recommended that all gas membranes are fitted by qualified installers. Strata Homes has informed ECE that UK Membranes Ltd are installing the gas membranes.

10. All gas membranes and ancillary products must be installed in accordance with the manufacturer's recommendations and the requirements of BRE 414 Protective Measures for Housing on Gas Contaminated Land, CIRIA Documents C665 & C735, BR8485:2015 and AI:2019.

11. The gas membranes to be used include Juta GP5 with associated products GP SAM (or equivalent) for Areas B, C & D.

12. All overlaps in the gas membrane to be at least 150mm and bonded with gas resistant double sided butyl Tape. The joint should then be sealed with gas resistant single sided tape. Prior to sealing, all surfaces are to be cleaned to ensure a good bond. Seals can also be welded, should the membrane specification indicate welding is appropriate.

13. All horizontal DPCs must be bedded on both sides with fresh mortar and must extend the full width of the wall including any rendering and project 5mm beyond external face.

14. Preformed cloaks can be used at corners and change in levels exceeding 75mm in height to suit cavity tray profiles.

15. DPC where FGL is level with FFL must be suitable for tanking/water proofing as well as being gas proof. Tanking details to be designed by a CSSW certified specialist.

Verification

16. Verification of gas measures (ie. of ventilated void and membrane installation) should be carried out in accordance with C735 and the site specific Verification Plan.

Legend:

FGL	-	Finished Ground Level
FFL	-	Finished Floor Level
DPC	-	Damp Proof Course

REV	DESCRIPTION	SIG	CHK	DATE
C01	First issue.	JL	KE	10.02.2026

STRATA HOMES

WESTGATE, CLECKHEATON - AREAS B, C & D

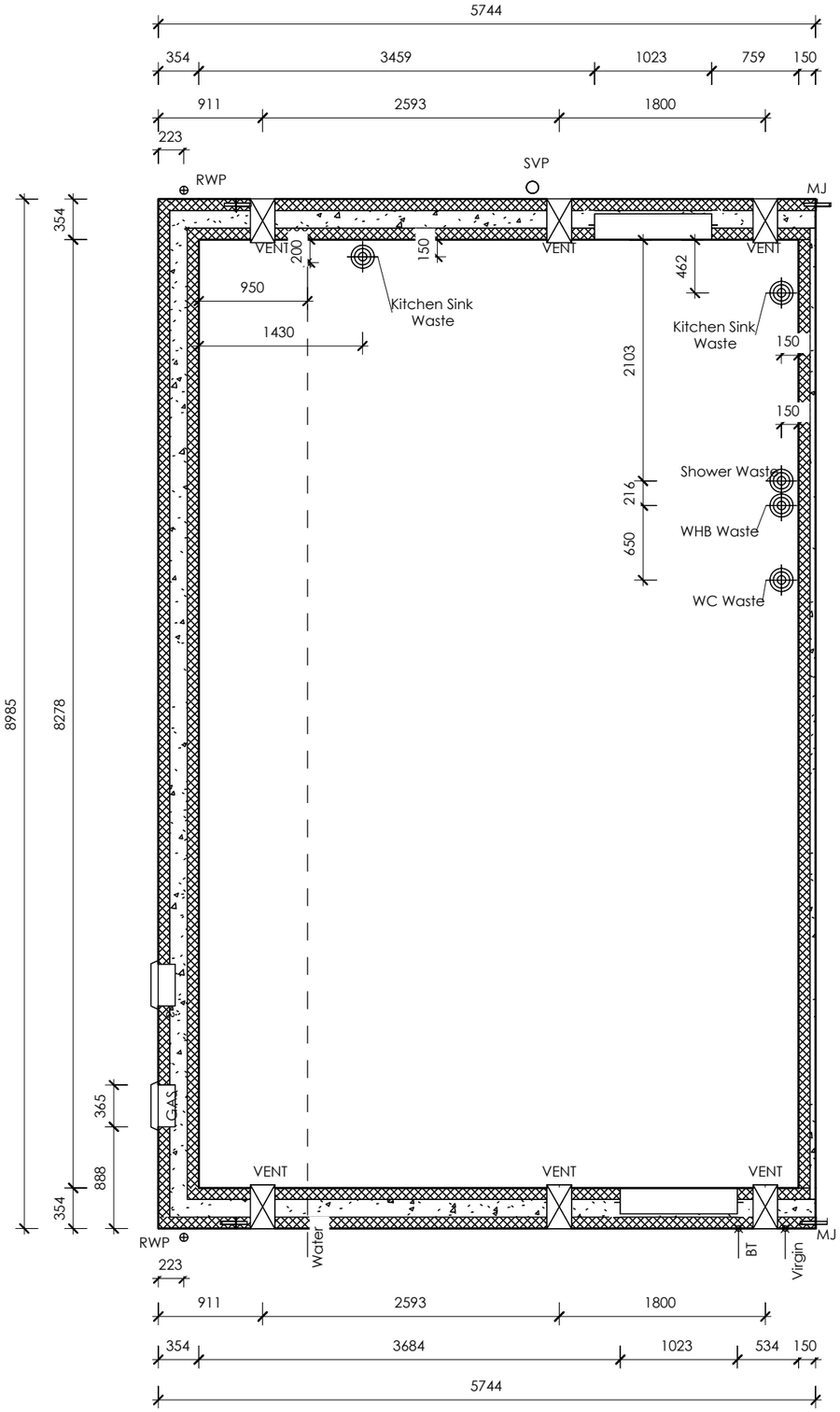
STANDARD DETAILS FOR GAS MEMBRANE (JUTA GP5) WITH PRECAST CONCRETE FLOOR & VENTILATED VOID SHEET 2 OF 2

Eastwood
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS
T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
50064	As Shown	A1	Construction

DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
50064	ECE	XX	XX	DR	C	0006	C01



FOUNDATION

1 : 50

BELOW GROUND WALLS

B1 — 100mm 7.3N Blockwork - 156mm In Situ Concrete - 100mm 7.3N Blockwork

MP4 — 100mm 7.3N Blockwork - 100mm In Situ Concrete

MJ (MOVEMENT JOINT)

WASTE — DENOTES: **FLOOR WASTE**

RWP — DENOTES: **RAIN WATER PIPE**

SVP — DENOTES: **SOIL & VENT PIPE**

ELEC — DENOTES: **WALL MOUNTED ELECTRIC METER**

GAS — DENOTES: **WALL MOUNTED GAS METER**

DENOTES: **FLOOR FINISH THRESHOLD**

DENOTES: **INCOMING WATER & MAIN**

DENOTES: **INCOMING B.T.**

DENOTES: **INCOMING VIRGIN**

FOUNDATION WIDTHS:

FOUNDATION WIDTHS TO BE DESIGNED BY STRUCTURAL ENGINEERS BASED ON SITE CONDITIONS & GROUND INVESTIGATION REPORT.

AIR VENTS: **AIR BRICK:**

TELESCOPIC AIR VENTS TO BE PROVIDED AT MAX. 1.8M CTRS. AND WITHIN 900MM OF EXTERNAL CORNERS TO PROVIDE 1500MM² UNDERFLOOR VENTILATION PER M RUN.

SUB STRUCTURE NOTES :

- DRAWING TO BE READ IN CONJUNCTION WITH ELEVATIONS
- DRAWING TO BE READ IN CONJUNCTION WITH FOUNDATION SCHEDULES
- DRAWING TO BE READ IN CONJUNCTION WITH STRUCTURAL CALCULATIONS
- MOVEMENT JOINTS LOCATED IN ACCORDANCE WITH STRUCTURAL CALCULATIONS; MOVEMENT JOINTS ARE INDICATED IN RED ON ALL DRAWINGS
- LOCATIONS OF METER BOXES TO BE INDICATED ON SITE LAYOUT

Rev	Description	Date
A	Service penetrations amended	23/10/25

Strata Homes Limited, Quay Point, Lakeside, Doncaster, DN4 5PL

T 01302 308508 www.stratahomes.co.uk

scale @A3- 1 : 50 | drawn- LS | date: 11/10/2023

Project: M3-301 AS END

Drawing: FOUNDATION (AS)

DWG No: 02 | Rev: A

MJ (MOVEMENT JOINT)

WASTE DENOTES: **FLOOR WASTE**

RWP DENOTES: **RAIN WATER PIPE**

SVP DENOTES: **SOIL & VENT PIPE**

elec DENOTES: **WALL MOUNTED ELECTRIC METER**

Rytons AC7 HP CWL Lookryt wall vents as standard in lieu of standard trickle vents
Rytons AAC125 HP CWL Lookryt acoustic wall vents (45-50db) wall vents where required refer to acoustic report

EXTERNAL WALLS

103mm FACING BRICKWORK

100mm BLOCKWORK - 7.3N/mm² PLASMOR AGLITE (600-800kg/m³, 0.11W/mk).

INTERNAL WALLS

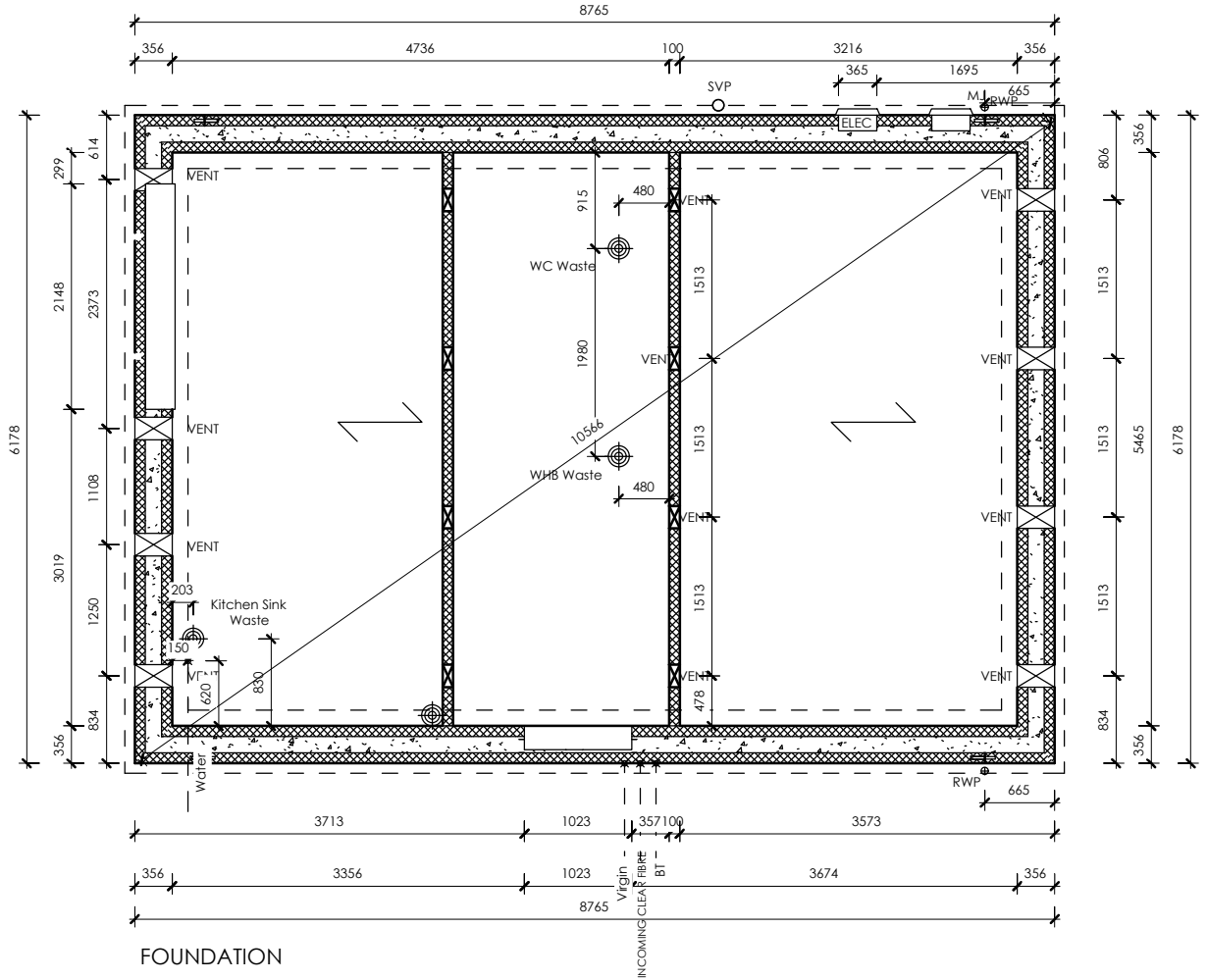
PARTY WALLS

100MM BLOCKWORK - - 7.3N/mm² - LIGHTWEIGHT AGGREGATE BLOCKS DENSITY 1350 -1600KG/ m³

STUD WALL LEGEND

STUD PARTITION - 88MM OVERALL THICKNESS COMPRISING 63x38MM TIMBER STUD WITH 12.5MM PLASTERBOARD EITHER SIDE

ACOUSTIC STUD PARTITION



FOUNDATION

1 : 50

DENOTES: **INCOMING CLEAR FIBRE**

DENOTES: **INCOMING WATER & MAIN**

DENOTES: **INCOMING B.T.**

DENOTES: **INCOMING VIRGIN**

FOUNDATION WIDTHS:

FOUNDATION WIDTHS TO BE DESIGNED BY STRUCTURAL ENGINEERS BASED ON SITE CONDITIONS & GROUND INVESTIGATION REPORT.

AIR VENTS: **AIR BRICK:**

TELESCOPIC AIR VENTS TO BE PROVIDED AT MAX. 1.8M CTRS. AND WITHIN 900MM OF EXTERNAL CORNERS TO PROVIDE 1500MM² UNDERFLOOR VENTILATION PER M RUN.

SUB STRUCTURE NOTES :

- DRAWING TO BE READ IN CONJUNCTION WITH ELEVATIONS
- DRAWING TO BE READ IN CONJUNCTION WITH FOUNDATION SCHEDULES
- DRAWING TO BE READ IN CONJUNCTION WITH STRUCTURAL CALCULATIONS
- MOVEMENT JOINTS LOCATED IN ACCORDANCE WITH STRUCTURAL CALCULATIONS; MOVEMENT JOINTS ARE INDICATED IN RED ON ALL DRAWINGS
- LOCATIONS OF METER BOXES TO BE INDICATED ON SITE LAYOUT

Rev	Description	Date
A	Gas meter box shown. Boiler added	23/10/25

strata

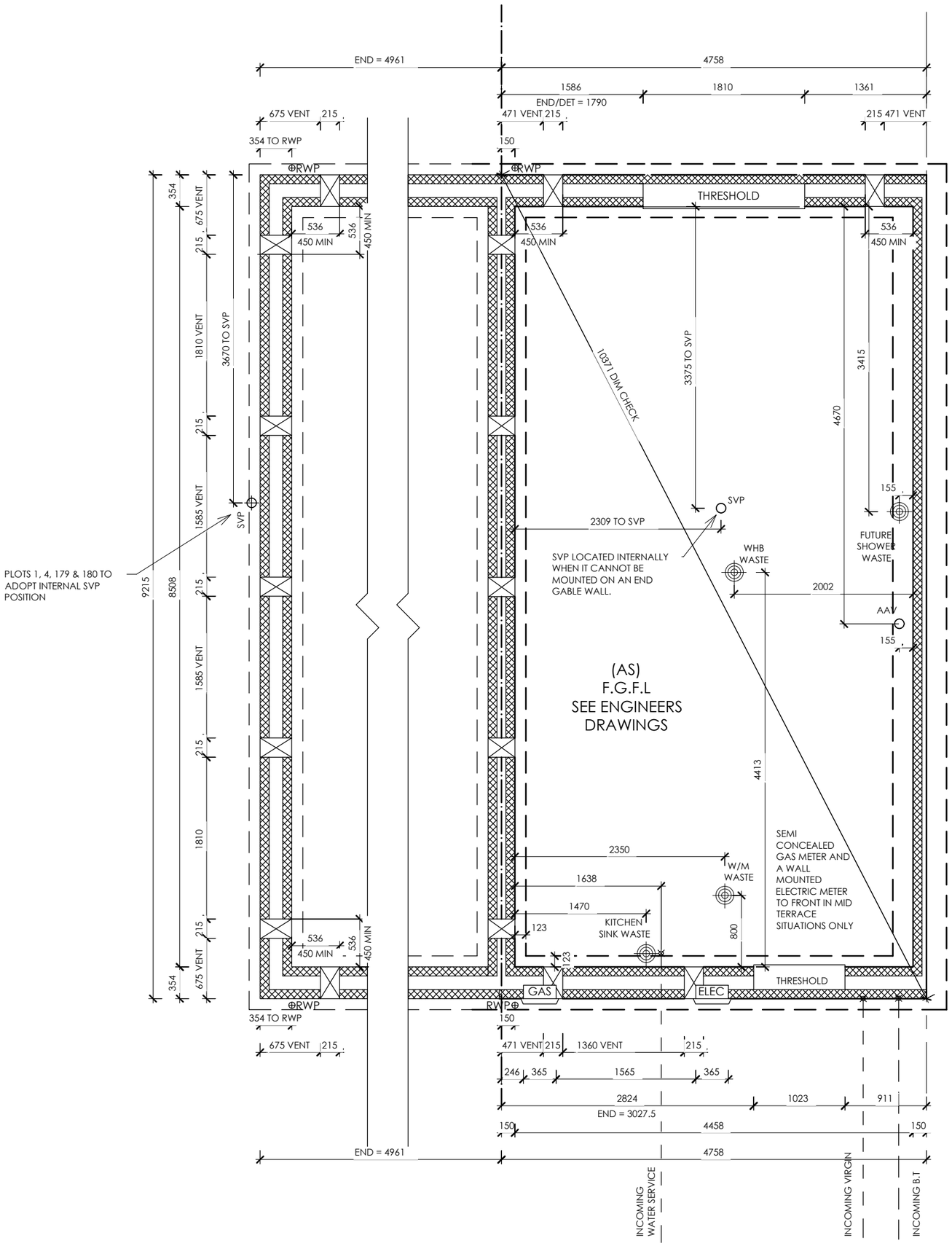
Strata Homes Limited, Quay Point, Lakeside, Doncaster, DN4 5PL
T 01302 308508 www.stratahomes.co.uk

scale @A3- 1 : 50 | drawn- MM | date: July '23

Project: M3-604

Drawing: FOUNDATION (AS)

DWG No: 02 | Rev: A



SUB STRUCTURE NOTES :

- DRAWING TO BE READ IN CONJUNCTION WITH ELEVATIONS
- DRAWING TO BE READ IN CONJUNCTION WITH FOUNDATION SCHEDULES
- DRAWING TO BE READ IN CONJUNCTION WITH STRUCTURAL CALCULATIONS
- MOVEMENT JOINTS LOCATED IN ACCORDANCE WITH STRUCTURAL CALCULATIONS; MOVEMENT JOINTS ARE INDICATED IN RED ON ALL DRAWINGS
- LOCATIONS OF METER BOXES TO BE INDICATED ON SITE LAYOUT

WASTE — DENOTES: **SEALED FLOOR GULLEY**

RWP — DENOTES: **RAIN WATER PIPE**

SVP — DENOTES: **SOIL & VENT PIPE**

elec — DENOTES: **WALL MOUNTED ELECTRIC METER**

gas — DENOTES: **WALL MOUNTED GAS METER**

DENOTES: **INCOMING WATER & MAIN**

DENOTES: **INCOMING B.T.**

DENOTES: **INCOMING VIRGIN**

FOUNDATION WIDTHS:

FOUNDATION WIDTHS TO BE DESIGNED BY STRUCTURAL ENGINEERS BASED ON SITE CONDITIONS & GROUND INVESTIGATION REPORT.

AIR VENTS:

EXTERNAL WALLS

103mm FACING BRICKWORK

100mm BLOCKWORK - 7.3N/mm² PLASMOR AGLITE (600-800kg/m³, 0.11W/mk).

NOTE:

MOVEMENT JOINTS REQUIRED FOR RECONSTITUTED STONE AND RENDERED BLOCKWORK PLOTS ONLY

PLEASE NOTE EXTRACT FANS AND METER BOXES TO BE LOCATED ON SIDE ELEVATIONS AS STANDARD; FRONT ELEVATION TERMINATION POINTS ONLY ACCEPTABLE WHEN HANDING **DOES NOT** PERMIT SIDE ELEVATION TERMINATION POINTS.

Rev	Description	Date
A	SVP moved internal for plots 1, 4, 179 & 180	02/10/25

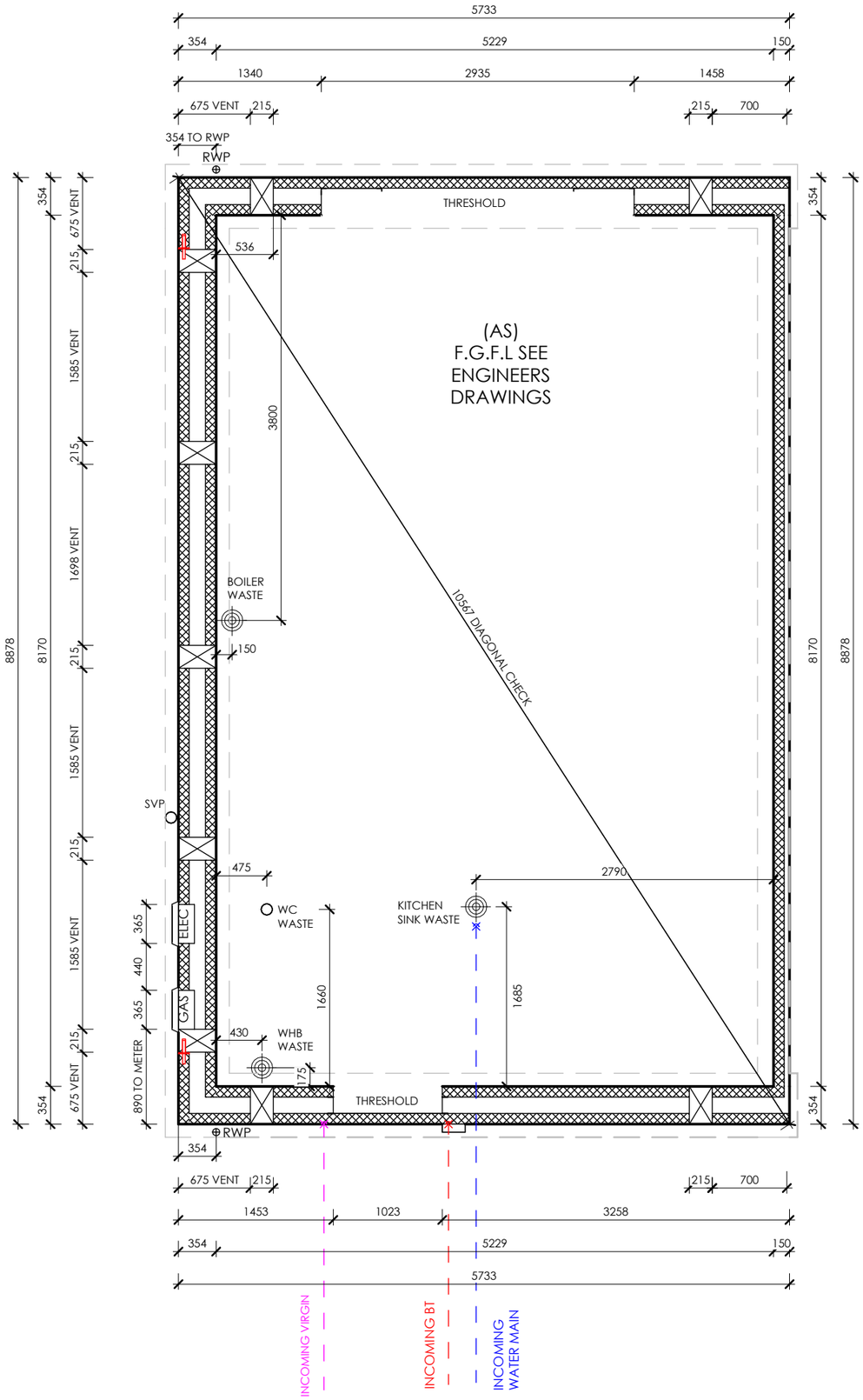
Strata Homes Limited, Quay Point, Lakeside, Doncaster, DN4 5PL
T 01302 308508 www.stratahomes.co.uk

scale @A3- 1 : 50 | drawn- LS | date: MAY 23'

Project: MY AL - 251

Drawing: FOUNDATION (AS)

DWG No: 02 | Rev: A



SUB STRUCTURE NOTES :

- DRAWING TO BE READ IN CONJUNCTION WITH ELEVATIONS
- DRAWING TO BE READ IN CONJUNCTION WITH FOUNDATION SCHEDULES
- DRAWING TO BE READ IN CONJUNCTION WITH STRUCTURAL CALCULATIONS
- MOVEMENT JOINTS LOCATED IN ACCORDANCE WITH STRUCTURAL CALCULATIONS; MOVEMENT JOINTS ARE INDICATED IN RED ON ALL DRAWINGS
- LOCATIONS OF METER BOXES TO BE INDICATED ON SITE LAYOUT

WASTE — DENOTES: **SEALED FLOOR GULLEY**

RWP — DENOTES: **RAIN WATER PIPE**

SVP — DENOTES: **SOIL & VENT PIPE**

elec — DENOTES: **WALL MOUNTED ELECTRIC METER**

gas — DENOTES: **WALL MOUNTED GAS METER**

DENOTES: **INCOMING WATER & MAIN**

DENOTES: **INCOMING B.T.**

DENOTES: **INCOMING VIRGIN**

FOUNDATION WIDTHS:

FOUNDATION WIDTHS TO BE DESIGNED BY STRUCTURAL ENGINEERS BASED ON SITE CONDITIONS & GROUND INVESTIGATION REPORT.

EXTERNAL WALLS

103mm FACING BRICKWORK

100mm BLOCKWORK - 7.3N/mm² PLASMOR AGLITE (600-800kg/m³, 0.11W/mk).

NOTE:

MOVEMENT JOINTS REQUIRED FOR RECONSTITUTED STONE AND RENDERED BLOCKWORK PLOTS ONLY

Rev	Description	Date
B	Additional air vent added	07.01.26
A	GF WC POP UP ADDED	21.02.25

strata

Strata Homes Limited, Quay Point, Lakeside, Doncaster, DN4 5PL
T 01302 308508 www.stratahomes.co.uk

scale @A3- 1 : 50 | drawn- TM | date: DEC 18'

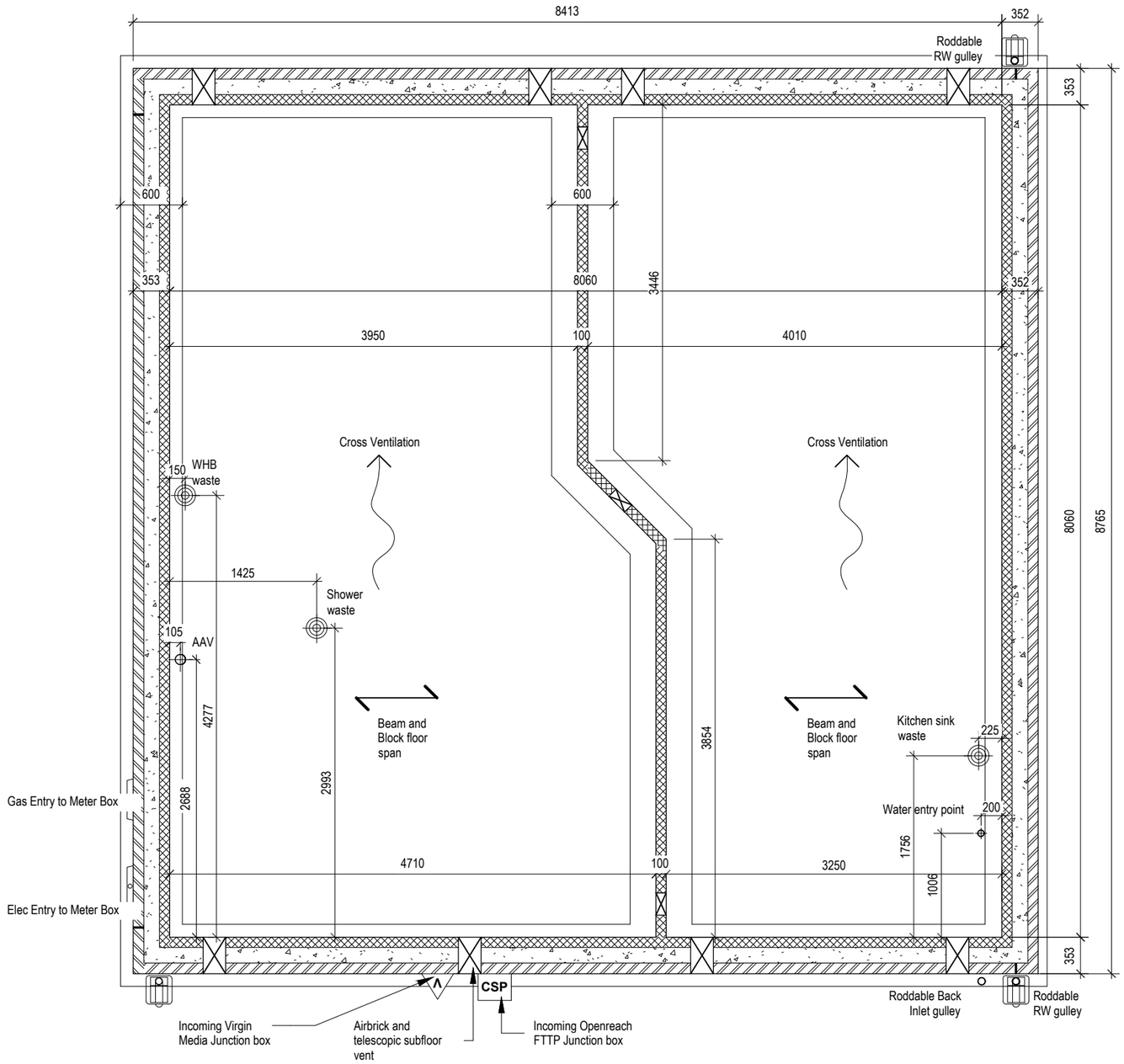
Project: MY AL-451

Drawing: FOUNDATION - AS

DWG No: 02 | Rev: B

SUBSTRUCTURE SETING OUT

1 : 50



Arrangement shown for semi arrangement to House Type 1, 2 and 2A.

See Typical Details for further information.

NOTES:

Foundations are shown as nominal 600mm wide strip foundations.

Width and type of foundation may vary dependant upon ground conditions. For plot specific foundation design, refer to Structural Engineers information. Depth of foundation to satisfy LABC requirements and to agreed on site with Local Authority Building Control officer.

Telescopic under floor vents to provide cross ventilation of at least 1500mm2 per meter run of external wall.

Floor gullies, SVP and service floor penetrations to be co-ordinated with Beam and Block manufacturers layout.

All RWP gullies to be roddable.

All service connections TBC by specialist M&E design consultant, and may be subject to variation depending on site conditions.

BELOW GROUND WALLS

100mm 7.3N Blockwork - 150mm In Situ Concrete - 100mm 7.3N Blockwork

FOUNDATION WIDTHS:

FOUNDATION WIDTHS TO BE DESIGNED BY STRUCTURAL ENGINEERS BASED ON SITE CONDITIONS & GROUND INVESTIGATION REPORT.

AIR VENTS: ☒ **AIR BRICK:** ⊠

TELESCOPIC AIR VENTS TO BE PROVIDED AT MAX. 1.8M CTRS. AND WITHIN 900MM OF EXTERNAL CORNERS TO PROVIDE 1500MM² UNDERFLOOR VENTILATION PER M RUN.

Rev	Description	Date

Strata Homes Limited, Quay Point, Lakeside, Doncaster, DN4 5PL
T 01302 308508 www.stratahomes.co.uk

scale @A3- 1 : 50 | drawn- DF | date: 21/07/25

Project: Westgate, Cleckheaton

Drawing: HT2A
SUB FLOOR PLAN

DWG No: BY00099 - HT2A-01 | Rev: -

APPENDIX B

GAS BARRIER DATASHEET

GROUND GAS PROTECTION
GP® TITANFLEX®
TECHNICAL DATA SHEET

JUTA | TITANTECH®

GP® TITANFLEX®

GP® TITANFLEX® gas and hydrocarbon barrier is a multi-layer, polyethylene membrane. GP® TITANFLEX® is specifically designed, manufactured, tested and certified to perform as a methane, carbon dioxide, radon ground gas, VOC, Air moisture and hydrocarbon protection system.

Thickness	0.5 mm
Width	2 m
Length	50 m
Weight	500 g/m²

TITANTECH®

For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

GP® TITANFLEX® complies with the latest codes of practice as published by BRE, CIRIA (C748) and BSI (BS8485:2015). Suitable for use as ground gas/hydrocarbon protection for NHBC, Green, Amber 1, Amber 2 and Red site characterisations.

Handling

Roll weights can be in excess of 20kg and hence appropriate care and equipment is required for unloading and handling.

Storage

Rolls of GP® TITANFLEX® should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged, but should be protected from exposure to UV.

Installation

GP® TITANFLEX® should be installed in accordance with the product installation guidelines, and in accordance with best practice.

BBA

CE UKCA

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
	Resistance to Chemicals	EN 1296/EN 1928	Pass
Compliance and Certification	CE Mark - EN13967:2012		
	NHBC Standards Compliant		
	CIRIA C748 Compliant		
	BS 8485:2015 Compliant		
Vapour Permeability 100% Concentration	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
	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
Gas Permeability	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

GROUND GAS PROTECTION
GP® TITANFLEX®
TECHNICAL DATA SHEET

GP® TITANFLEX®

Feature	Characteristics	Test Method	GP® TITANFLEX®
Durability and Chemical Resistance	Chemical Resistance - Sulfuric ACID (10% Solution of Sulfuric Acid (H_2SO_4)) 50° For 56 Days	EN 14414-A	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - BASIC (Calcium Hydroxide Saturated Suspension) 50° For 56 Days	EN 14414-B	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - SOLVENTS (35% Diesel, 35% Paraffin, 30% Oil Hd3O (Vol)) 50° For 56 Days	EN 14414-C	TENSILE STRENGTH RETAINED >80% RESULT - PASS
	Chemical Resistance - SYNTHETIC LEACHATE (Mixture of 14 Acids, Chlorides, Sulphates & Phosphates) 50° For 56 Days	EN 14414-D	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to Leaching - HOT WATER (Deionised Water) 50° For 56 Days	EN 14415-A	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to leaching - AQUEOUS ALKALINE (Saturated Calcium Hydroxide) 50° For 56 Days	EN 14415-B	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to Leaching - ORGANIC ALCOHOL (30% Methanol, 30% Isopropanol, 40% Glycol) 50° For 56 Days	EN 14415-C	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - BENZENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 95% (MD), 102% (CMD) RESULT - PASS
	Chemical Resistance - TOLUENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 94% (MD), 91% (CMD) RESULT - PASS
	Chemical Resistance - ETHYL BENZENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 97% (CMD) RESULT - PASS
	Chemical Resistance - XYLENES - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 91% (MD), 106% (CMD) RESULT - PASS
	Chemical Resistance - TCE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - PCE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 93% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - NAPTHALENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 101% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - HEXANE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 104% (CMD) RESULT - PASS

GROUND GAS PROTECTION
GP® TITANFLEX®
TECHNICAL DATA SHEET

GP® TITANFLEX®

JUTA UK

Please contact JUTA UK Directly for more information on GP® TITANFLEX®

Jointing and Sealing

GP® TITANFLEX® can be heat welded or taped, with jointing carried out by competent personnel with suitable qualifications in accordance with best practice. GP® TITANFLEX® should be overlapped by at least 100mm. If taping joints, only suitable tape must be used, ensuring application with a silicone roller to remove trapped air. JUTA pre-formed details, or self adhesive gas membrane are available for sealing around protuberances.

Accessory Products

- GP® DPC
- GP® Tape
- GP® Self Adhesive Membrane (SAM)
- GP® Primer
- GP® Top Hats and Preformed Corners
- GP® Protection Fleece
- GP® Void Vent (24/40mm)

GROUND GAS PROTECTION
GP®5 TECHNICAL DATA SHEET

JUTA | TITANTECH®

GP® 5

GP®5 gas barrier is a multi-layer composite of virgin polyethylene (PE) giving exceptional resistance to the passage of ground gas and organic vapours. It also acts as a high performance DPM.

Thickness	0.4 mm
Width	Various m
Length	Various m
Weight	400 g/m²

TITANTECH®
For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

GP®5 is suitable for the following applications:

- Carbon dioxide and methane affected sites in accordance with BS 8485:2015 + A1:2019 & NHBC
- Radon affected sites in accordance with BRE211:2015
- Damp protection in accordance with Building Regulations Part C
- Low level VOC contaminated sites (site specific assessment required)

Handling

Roll weights can be in excess of 20kg and hence appropriate care and equipment is required for unloading and handling.

Installation

GP®5 should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015.

Certifications

BBA Approval Inspection Testing Certification

Please Scan

CE UK CA UK NI

Rev 2024

GROUND GAS PROTECTION
GP®5 TECHNICAL DATA SHEET

GP®5

Feature	Characteristics	Test Method	GP®5
Physical Properties	Thickness	EN 1849-2	0.4 mm
	Width	EN 1849-2	Various m
	Length	EN 1849-2	Various m
	Weight	EN 1849-2	400 g/m^2
Hydraulic Press	Resistance to Water Penetration	EN 1928 (A)	Pass
Mechanical Properties	Resistance to Static Load	EN 12730	> 20 kg
	Tensile Strength (MD)	EN 12311-2 (A)	> 300 N/50mm
	Tensile Strength (CMD)	EN 12311-2 (A)	> 300 N/50mm
	Resistance to Tearing (Nail Shank) MD	EN 12310-1	> 230 N
	Resistance to Tearing (Nail Shank) CMD	EN 12310-1	> 230 N
	Impact Resistance	EN 12691-B	500 mm
	Puncture Resistance	ASTM D 4833	> 160 N
	Puncture Resistance	EN 12236	1.60 kN
	Reaction to Fire	EN 13501-1	E
Vapour Permeability	Methane Permeability	BS EN ISO 15105-1	0.12 ml/m^2/day/atm
	Carbon Dioxide Permeability	BS EN ISO 15105-1	1.53 ml/m^2/day/atm
	Hydrogen Permeability	BS EN ISO 15105-1	68.7 ml/m^2/day/atm
	Benzene Permeability	BS EN ISO 15105-2	0.41 ml/m^2/day
	Oxygen Permeability	BS EN ISO 15105-2	<3 ml/m^2/day
	Radon Permeability	K124/02/95	1.0 x 10^{-12} m^2/s
	Hydrogen Sulphide Permeability	BS EN ISO 15105-1	<0.68 ml/m^2/day/atm
Fuel Vapour Permeability	Petrol	BS EN ISO 15105-2	(ave.) 3.4 x 10^{-13} /mol/(m^2.s.Pa)
	Diesel	BS EN ISO 15105-2	(ave.) 3.4 x 10^{-13} /mol/(m^2.s.Pa)
Durability	Durability Watertightness After Artificial Ageing	EN 1928	Pass
	Durability Watertightness Against Chemicals	EN 1928	Pass
Compliance and Certification	CE Mark - EN 13967:2012		
	NHBC Standards Compliant		
	BS 8485:2015 + A1 2019 Accordant		

JUTA UK

Please contact JUTA UK Directly for more information on GP®5

Storage

Rolls of GP®5 should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged, but should be protected from exposure to UV.

GROUND GAS PROTECTION
GP®5 TECHNICAL DATA SHEET

GP® 5

JUTA UK

Please contact JUTA UK Directly for more information on GP®5

Jointing and Sealing

It is recommended GP®5 can be heat welded where possible, with welding carried out by competent personnel with suitable qualifications in accordance with best practice, and guidance contained within BS 8485:2015. GP®5 should be overlapped by at least 100mm. If taping joints, only suitable tape must be used, ensuring application with a silicone roller to remove trapped air. JUTA pre-formed details, or self adhesive gas membrane are available for sealing around protuberances.

Accessory Products

- GP® DPC
- GP® Tape
- GP® Self Adhesive Membrane (SAM)
- GP® Primer
- GP® Top Hats and Preformed Corners
- GP® Protection Fleece
- GP® Void Vent (24/40mm)

GROUND GAS PROTECTION
GP®1 TECHNICAL DATA SHEET

JUTA | TITANTECH®

GP®1

GP®1 proprietary gas resistant damp proof membrane (DPM) is a multi-layer, low density polyethylene membrane, reinforced with a polypropylene reinforcing grid with an integral aluminium foil. GP®1 is specifically designed and manufactured to perform as a methane, carbon dioxide, radon, ground gas, air & moisture protection system.

Thickness	0.6 mm
Width	Various m
Length	Various m
Weight	370 g/m²

TITANTECH®
For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

Handling
Roll weights can be in excess of 20 kg and hence appropriate care and equipment is required for unloading and handling.

Storage
Rolls of GP®1 should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged, but should be protected from exposure to UV.

Installation
GP®1 should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015.

Certifications

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 20/5705

Please Scan

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Rev 2024

GROUND GAS PROTECTION
GP®1 TECHNICAL DATA SHEET

GP®1

Feature	Characteristics	Test Method	GP®1
Physical Properties	Thickness	EN 1849-2	0.6 mm
	Thickness - between Scrim	BS EN ISO 9863-1:2016	0.4 mm
	Width	EN 1849-2	Various m
	Length	EN 1849-2	Various m
	Weight	EN 1849-2	370 g/m^2
Hydraulic Press	Water Column	EN 20811	> 300
	Resistance to Water Penetration	EN 13967, EN 1928	Pass
	Water Tightness	EN 11296, EN 1367, EN 1928	Pass
Mechanical Properties	Resistance to Static Load	EN 12730-B	20 kg
	Tensile Strength (MD)	EN 12311-1	600 N/50mm
	Tensile Strength (CMD)	EN 12311-1	480 N/50mm
	Tensile Elongation (MD)	EN 12310-1	20%
	Tensile Elongation (CMD)	EN 12310-1	20%
	Puncture Resistance	EN 12236	1.25 kN
	Resistance to Tearing (Nail Shank) MD	EN 12310-1	330 N
	Resistance to Tearing (Nail Shank) CMD	EN 12310-1	400 N
Durability and Chemical Resistance	Transmission Rate of Volatile Liquids - Diesel	ISO 6179:2010 (B)	0.246 g/m^2/h
	Transmission Rate of Volatile Liquids - Xylene	ISO 6179:2010 (B)	0.571 g/m^2/h
	Transmission Rate of Volatile Liquids - Toluene	ISO 6179:2010 (B)	0.583 g/m^2/h
	Transmission Rate of Volatile Liquids - Petrol	ISO 6179:2010 (B)	0.135 g/m^2/h
Gas Permeability	Methane Permeability	BS EN ISO 15105-1	< 0.09 ml/m^2/day/atm
	Carbon Dioxide Permeability	BS EN ISO 15105-1	< 0.09 ml/m^2/day/atm
	Radon Permeability	K124/02/95	8.0 x 10^{-15} m^2/s
	Hydrogen Sulphide Permeability	BS EN ISO 15105-1	< 0.1 ml/m^2/day/atm
Compliance and Certification	CE Mark - EN13967:2012 (A1 2017)		
	NHBC Standards Compliant		
	Conforms to BS 8485:2015 + A1 2019		
	BBA Certified - Certificate No. 20/5728		

JUTA UK

Please contact JUTA UK Directly for more information on GP®1

Jointing and Sealing

It is recommended GP®1 be heat welded where possible, with welding carried out by competent personnel with suitable qualifications in accordance with best practice, and guidance contained within BS 8485:2015.

Accessory Products

- GP®1 Starter Band
- GP® Tape
- GP® Self Adhesive Membrane
- GP® Primer
- GP® Top Hats and Preformed Corners
- GP® Protection Fleece
- GP® Void Vent (24/40mm)

GROUND GAS PROTECTION
GP®1 SAM
TECHNICAL DATA SHEET

JUTA | TITANTECH®

GP®1 SAM

GP®1 SAM, gas protection self adhesive membrane, is a bituminous gas proof and water proof sheet, composed of self-adhesive SBS polymer modified bitumen incorporating GP®1 with an upper surface finish of black reinforced LDPE, and a lower surface finish of siliconized release film. GP®1 SAM is used for the gas/ waterproofing of underground structures where harmful ground gasses are anticipated, and as a self adhesive accessory to GP®1.

Thickness	1.2 mm
Width	0.9 m or 0.3 m
Length	20 m
Weight	1100 g/m²

TITANTECH®
For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

Handling
Roll weights can be in excess of 20 kg (approx 33 kg/roll) and hence appropriate care and equipment is required for unloading and handling. This product is non-toxic nor flammable.

Storage
Rolls of GP®1 SAM should be stored on in a cool, dry place, and be protected from exposure to rain, sun, heat and cold temperatures prior to installation. Exposure to sunlight for extended period of time could cause difficulty with removal of the release film.

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GROUND GAS PROTECTION
GP®1 SAM
TECHNICAL DATA SHEET

GP®1 SAM

Feature	Characteristics	Test Method	GP®1 SAM
Physical Properties	Thickness	EN 1849-2	1.2 mm
	Width	EN 1849-2	0.9 or 0.3 m
	Length	EN 1849-2	20 m
	Weight	EN 1849-2	1100 g/m^2
Hydraulic Press	Water Tightness	EN 1928	Pass
	Water Vapour Transmission	EN 1931	0.013 g/m^2/day
Mechanical Properties	Tensile Strength (MD/CMD)	EN 12311-2 (A)	500 N/50mm
	Elongation (MD/CMD)	EN 12311-2 (A)	> 12 %
	Resistance to Static Load	EN 12370	20 kg
	Joint Strength	EN 12317-2	> 30 N
	Durability and Water Tightness (Ageing and Chemicals) 60 kPa	EN 1847	Pass
	Resistance to Nail Tear (MD/CMD)	EN 12310-1	> 300 N
	Resistance to Fire	EN 13501	F Euro Class
Gas Permeability	Methane Permeability	EN ISO 15105-1	< 0.68 ml/m^2/day/atm
	Carbon Dioxide Permeability	EN ISO 15105-1	< 2.81 ml/m^2/day/atm
	Radon Permeability	K124/02/95	8.0 x 10^{-15} m^2/S
Compliance and Certification	CE Mark - EN13967:2012 + A1:2017 Type (A/T)		
	BS 8485:2015 Compliant (Methane and Carbon Dioxide Barrier)		

JUTA UK

Please contact JUTA UK Directly for more information on GP®1 SAM

Installation

GP®1 SAM should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015, and/or BS 8102:2009.

It is recommended that GP®1 SAM is not applied in temperatures below 10°C, in colder weather the material can be warmed slightly to aid adhesion.

Accessory Products

- GP® Primer
- GP® Protection Board
- GP® Protection Fleece

APPENDIX C
GAS COMPETENCY CV's

PART OF nocn GROUP

This is to certify that

Bradley Reynolds

has achieved the following Qualification

NOCN Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification No: 603/1279/8
ULN: 7198858685
Award Date: 21/01/2025
Certificate No: 48504472

G Hasting-Evans

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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PART OF nocn GROUP

Bradley Reynolds

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification No: 603/1279/8
ULN: 7198858685
Award Date: 21/01/2025
Certificate No: 48504472

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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This is to certify that

Christopher Egan

has achieved the following Qualification

L2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification No: 600/3747/7
ULN: 8073902531
Award Date: 10/12/2013
Certificate No: 1785836

Graham Hasting-Evans
Chief Executive
NOCN Group

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Christopher Egan

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Preparing to Install Gas Membranes in the Workplace	R/601/6653	13	L2
Installing Gas Membranes in the Workplace	L/601/6666	18	L2
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2

Qualification No: 600/3747/7
ULN: 8073902531
Award Date: 10/12/2013
Certificate No: 1785836

Graham Hasting-Evans
Chief Executive
NOCN Group

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This is to certify that

Connor Sharman

has achieved the following Qualification

NOCN_Cskills Awards Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification Approval No: 603/1279/8
ULN: 2461440076
Award Date: 24/10/2023
Certificate No: 48182334

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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Connor Sharman

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification Approval No: 603/1279/8
ULN: 2461440076
Award Date: 24/10/2023
Certificate No: 48182334

Graham Hasting-Evans
Chief Executive
NOCN Group

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This is to certify that

Garry Taylor

has achieved the following Qualification

NOCN_Cskills Awards Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification Approval No: 603/1279/8
ULN: 5593390451
Award Date: 25/03/2021
Certificate No: 47459056

Graham Hasting-Evans
Group Managing Director
NOCN Group

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Garry Taylor

Credit/s Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification Approval No: 603/1279/8
ULN: 5593390451
Award Date: 25/03/2021
Certificate No: 47459056

Graham Hasting-Evans
Group Managing Director
NOCN Group

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Cskills Awards

This

Cskills Awards

Level 2 NVQ Diploma

in

Sub-structure Work Occupations (Construction) - Installation of Gas Membranes (QCF)

(600/7811/X)

is awarded to

Jay Parsons

Carl Rhymer
Delivery and Customer Engagement Director

Regulated by

Ofqual

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CYMWYSTERAU CYMRU QUALIFICATIONS WALES
Recognised awarding body

Issued Date: 11-04-2016

2130085

Registration No: 4467828

Construction Awards Alliance is an alliance between Cskills Awards and City & Guilds

Construction Awards Alliance

Cskills awards

City & Guilds

This

Cskills Awards

Level 2 NVQ Diploma

in

Sub-structure Work Occupations (Construction) - Installation of Gas Membranes (QCF)

(600/3747/7)

is awarded to

Kevan Shotter

Adrian Beckingham
Head of Cskills Awards

Chris Jones
Director General
The City & Guilds of London Institute

Regulated by Ofqual

For more information see http://register.ofqual.gov.uk

Issued Date: 13-11-2012

1571503

Registration No: 1877825

Construction Awards Alliance is an alliance between Cskills Awards and City & Guilds

Construction Awards Alliance

Cskills awards

City & Guilds

This

Credit Certificate

is awarded to

Kevan Shotter

Level 1	Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2 credits
Level 2	Conforming to Productive Working Practices in the Workplace	J/503/1169	3 credits
Level 2	Installing Gas Membranes in the Workplace	L/601/6666	18 credits
Level 2	Moving, Handling and Storing Resources in the Workplace	F/503/1171	5 credits
Level 2	Preparing to Install Gas Membranes in the Workplace	R/601/6653	13 credits

Adrian Beckingham
Head of Cskills Awards

Chris Jones
Director General
The City & Guilds of London Institute

Regulated by Ofqual

For more information see http://register.ofqual.gov.uk

Issued Date: 13-11-2012

1571502

Registration No: 1877825

PART OF nocn GROUP

This is to certify that

Lucas Morton

has achieved the following Qualification

NOCN_Cskills Awards Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification Approval No: 603/1279/8
ULN: 7490795396
Award Date: 10/03/2023
Certificate No: 48008337

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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This is to certify that

Nathan George

has achieved the following Qualification

NOCN_Cskills Awards Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification Approval No: 603/1279/8
ULN: 8517584308
Award Date: 10/03/2023
Certificate No: 48008335

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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This is to certify that

Tate Butterworth

has achieved the following Qualification

NOCN Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification No: 603/1279/8
ULN: 1740192507
Award Date: 21/01/2025
Certificate No: 48504473

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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Tate Butterworth

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification No: 603/1279/8
ULN: 1740192507
Award Date: 21/01/2025
Certificate No: 48504473

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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This is to certify that

Timothy King

has achieved the following Qualification

NOCN_Cskills Awards Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification Approval No: 603/1279/8
ULN: 9458355558
Award Date: 24/03/2022
Certificate No: 47725315

HOLOGRAM

Graham Hasting-Evans
Chief Executive Officer
NOCN Group

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Regulation

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Timothy King

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification Approval No: 603/1279/8
ULN: 9458355558
Award Date: 24/03/2022
Certificate No: 47725315

HOLOGRAM

Graham Hasting-Evans
Chief Executive Officer
NOCN Group

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This is to certify that

Tristan Andrew Luke Adams

has achieved the following Qualification

NOCN Level 2 NVQ Diploma in Sub-structure Work Occupations (Construction) - Installation of Gas Membranes

Qualification No: 603/1279/8
ULN: 1565824058
Award Date: 12/03/2025
Certificate No: 48542486

Graham Hasting-Evans
Chief Executive
NOCN Group

Regulation

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Tristan Andrew Luke Adams

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification No: 603/1279/8
ULN: 1565824058
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Lithos Consulting
[Gas Competency Curriculum vitae]

Personal details

Name: **Adam Everson**

Qualifications: BSc (Hons) Environmental Science, University of Wales (Bangor), 2004
Member of the Institution of Environmental Sciences (IES)

Outline of experience

Name of employer: **Lithos Consulting Limited**
January 2015 - Present
Current position: Senior Engineer

Details/duties:
Site/office based Engineer, undertaking Geo-Environmental consultancy work on a variety of earthworks, ground improvement, remediation projects and construction sites.

Name of employer: **Stratus Environmental Limited**
November 2009 – December 2014
Positions held: Senior Engineer (Jan 2012 – Dec 2014)
Construction Quality Assurance (CQA) Engineer (Nov 2009 – Dec 2011)

Details/duties:

- Supervision and monitoring/testing of capping and cell construction works;
- Site investigation;
- Preparation of CQA Method Statements and Specifications;
- Preparation of Health & Safety Risk Assessments;
- Preparation of final CQA Validation reports;
- Supervision of earthworks and bulk earth moving for capping and lining;
- Supervision of deployment of HDPE/LLDPE geomembranes, geotextiles and geocomposite;
- Infrastructure and drainage works;
- Attendance at site meetings;
- Management of other CQA Engineers on several projects simultaneously;
- Liaising with the Environment Agency.

Name of employer: **Encia Environmental Limited**
August 2008 – November 2009
Position held: Construction Quality Assurance (CQA) Engineer

Details/duties:

- Supervision and monitoring/testing of capping and cell construction works;
- Site investigation;
- Preparation of final CQA report;
- Supervision of earthworks and bulk earth moving for capping and lining;
- Supervision of deployment of HDPE/LLDPE geomembranes, geotextiles and geocomposite;
- Infrastructure and drainage works;
- Liaising with the Environment Agency.

Lithos Consulting
[Gas Competency Curriculum vitae]

Ground gas verification training

Course 1: A-Z of Ground Gas
Name of organisation: PAGeotechnical Ltd and Ground Gas Solutions Ltd
Date: 29th April 2015

Course 2: Verification of Gas Protection Systems
Name of organisation: CL:AIRE
Date: 30th November 2017

Course 3: 1 Day Gas Verification Training
Name of organisation: Neil Salvidge Training
Date: 14th March 2024

Ground gas verification – on site experience

Year: **2023 & 2024**

Sites:

- Inspection of sub floor void, air bricks, cross ventilation & membranes of various plots at Manor 12 (Ref. 3057)
- Inspection of sub floor void, air bricks, cross ventilation & membranes of various plots at Pennine Village (Ref. 3059)
- Inspection of subfloor, air bricks & cross ventilation of plot 12 at Wentworth Drive, Emley (Ref. 3253)
- Inspection of subfloor, air bricks & cross ventilation of plot 10 at Selby Road, Garforth (Ref. 1702)
- Inspection of various membranes at City Fields 4B (Ref. 3715), Flanshaw Way, Wakefield (Ref. 2299), Pullman Green, Hexthorpe (Ref. 1172), Limekiln Lane, Cayton (Ref. 3255), Main Street, Carlton (Ref. 1796), Park Lane, Shirland (Ref. 3318) and Radial Park, Leeds (Ref. 1225)

Total Hours: **22**

Year: **2025**

Sites:

- Inspection of sub floor void, air bricks, cross ventilation & membranes of various plots at Hipperholme (Ref. 4607), including integrity testing via air-lancing of two plots
- Inspection of sub floor void, air bricks, cross ventilation & membranes of various plots at Rossington R7 (Ref. 5286)
- Inspection of sub floor void, air bricks, cross ventilation & membranes of various plots at Radial Park, Leeds (Ref. 1225)

Total Hours: **24**

Lithos Consulting
[Gas Competency Curriculum Vitae]

Personal details

Name: **Kelvin Eady**

Qualifications: BEng (Hons) – Geology, University of Leicester, 2002

Outline of experience

Name of employer: **Lithos Consulting Limited**
November 2016 - Present
Current position: Freelance Remediation Engineer

Details/duties:
Generally, as a site-based engineer undertaking:

- Engineering supervision / Resident Engineer for various Geotechnical / Geo-Environmental earthworks, contamination and mine treatment works projects including compliance testing.
- Validation inspections of gas protection measures / clean capping at residential developments.

Name of employer: **EKS Geo-Science Ltd**
March 2009 – October 2016
Position held: Freelance Geotechnical / Geo-Environmental

Details/duties:
Working for various Geotechnical / Geo-environmental consultancies and contractors. Roles included Resident Engineer supervising earthworks, contamination and mine treatment works projects; Validation inspections of gas protection measures / clean capping at residential developments; Inspections of embankments & cuttings etc. on motorway grade infrastructure; Grading rock for rock armour suitability in a quarry; Desk studies, ground investigation design, interpretative report writing including RAMS; Ground investigation site supervision, logging of soils & rock core samples to BS5930:1999 +A2:2010 and chalk logging in accordance with Ciria C574, trial pitting, groundwater / ground gas monitoring and permeability testing; Rail work – Supervising Engineer, ballast logging and operating a window sampler rig.

Name of employer: **Ground Sense Limited**
April 2006 – March 2009
Position held: Senior Engineer

Details/duties:
Working for a small, busy Geotechnical / Geo-Environmental consultancy with responsibility for 4 junior staff. Duties included Preparing project proposals, invoicing and marketing; Desk studies & site walkovers and liaising with various regulators; Design, procurement and undertaking of Geotechnical / Geo-Environmental ground investigations; Factual & interpretive report writing, ground gas assessments and RAMS; Resident Engineer on remediation and coal mine investigation projects

Name of Employer: **Freelance Geologist / Engineering Geologist**
January 2005 – April 2006
Position Held: Geologist / Engineering Geologist

Details / Duties:

Roles included the Data-basing of the Geodiversity of Leicestershire for the British Geological Survey from

various collections and site-based contracts undertaking general site investigation works.

Name of Employer: **Ian Farmer Associates**
September 2002 – January 2005

Position Held: Engineering Geologist

Details / Duties:

Field and office-based Engineer working for a Geotechnical / Geo-Environmental ground investigation Contractor. Duties included project preparation, proposals and procurement for ground investigations; factual report writing, desk studies & site walkovers; Preparation of Risk Assessments & Method Statements; Site supervision of multiple contractors i.e. cable percussion, rotary & window sampler drill crews, excavators & other specialist services, Technicians and other Engineers; Logging trial pits and boreholes (including core samples); Performing permeability testing in boreholes & trial pits; in-situ CBR testing, water sampling, landfill / ground gas & groundwater monitoring; down borehole geo-physical logging.

Ground gas verification training

Course 1: 1 Day Gas Verification Training
Name of organisation: Neil Salvidge Training
Date: 14th March 2024

Ground gas verification – on site experience

Year: **2023 & 2024**

Sites	Visits
Inspection of air bricks and radon membrane of plot 94 at Marlpit Lane, Bolsover (Ref. 1575)	1
Inspection of sub floor void, air bricks, cross ventilation, membranes, water anulus seals and membrane repairs of various plots at Hexthorpe (Ref. 1172)	5
Inspection of sub floor void, air bricks, cross ventilation, membranes and water anulus seals of various plots at Radial Park, Leeds (Ref. 1225)	6
Inspection of sub floor void, air bricks, cross ventilation, membranes and water anulus seals of various plots at Flanshaw Way, Wakefield (Ref. 2299)	10
Inspection of sub floor void, air bricks, cross ventilation and membranes of various plots at Selby Road, Howden (Ref. 2572)	1
Inspection of sub floor void, air bricks, cross ventilation and membranes of various plots at Station Road, Howden (Ref. 2592)	3
Inspection of sub floor void, air bricks, cross ventilation and membranes of various plots at Manor 12, Sheffield (Ref. 3057)	6
Inspection of sub floor void, air bricks, cross ventilation, membranes and water anulus seals of various plots at Wentworth Drive, Emley (Ref. 3253)	10
Inspection of sub floor void, air bricks, cross ventilation and membranes of various plots at Limekiln Lane, Cayton (Ref. 3255)	3
Inspection of sub floor void, air bricks, cross ventilation and membranes of various plots at Park Lane, Shirland (Ref. 3318)	4
Inspection of sub floor void, air bricks, cross ventilation, membranes, water anulus seals, cavity tray details and weep holes of various plots at Shipley Lakeside, Derbyshire (Ref. 4336)	26

Total Hours: **150**

Lithos Consulting
[Gas Competency Curriculum Vitae]

Personal details

Name: **David Jackson**

Qualifications: BEng (Hons) – Environmental Engineering & Mineral Industry, Leeds University, 1999
Chartered Scientist (CSci) Geological Society
NVQ Level 3 (Independent Gas Validation)

Outline of experience

Name of employer: **Lithos Consulting Limited**
September 2023 - Present
Current position: Principal Engineer – Remediation

Details/duties:
Specific responsibility for management of an effective and high performing remediation team including the provision of briefings, writing and reviewing technical reports, coaching, giving support and feedback to junior staff. The role requires the monitoring and tracking of team performance, quality, and job profitability through relevant KPIs. A key aspect of the role is liaising with regulators, developers and contractors in a pragmatic and proactive manner. The role requires a commitment to business development, supporting team targets whilst minimising business risk; most notably issues associated with H&S.

Name of employer: **Delta Simons Limited**
February 2018 – June 2023
Position held: Associate

Details/duties:
Responsibility for the management of multiple projects relating to ground investigation and remediation works for a range of clients for sites across the UK. These projects were predominantly for the redevelopment of land, environmental permitting and due diligence land transaction. The main client base were commercial warehouse developers who were looking to develop both greenfield and brownfield land with both environmental and/or geotechnical constraints. The role also required the mentoring and development of junior staff, delivery of training, development of systems of work, health & safety and business development.

Name of employer: **Wakefield Council**
March 2005 – February 2018
Position held: Land Quality Officer

Details/duties:
Responsible for the regulation of land contamination through the planning regime and implementation of the Councils Contaminated Land Strategy under Part 2a of the Environmental Protection Act 1990.

Name of employer: **Selby Council**
March 2003 - March 2005
Position held: Contaminated Land Officer

Details/duties:

As Wakefield Council

Ground gas verification training

Course 1: 1 Day Gas Verification Training
Name of organisation: Neil Salvidge Training
Date: 14th March 2024

Course 2: NOCN Level 3 NVQ Diploma in Substructure Work Occupations (Construction) Protection System Independent Verification
Name of organisation: NOCN
Date: 11th February 2025

Ground gas verification – on site experience

Year: 2024

Sites:

- February 2024 – Inspection of sub floor void, air bricks and cross ventilation of plot 7 at Main Street Carlton (Ref. 1796)
- March 2024 – Inspection of membrane of plot 7 & 8 at Wentworth Drive, Emley (Ref. 3253)
- March 2024 – Inspection of sub floor void, air bricks and cross ventilation (visit 1) and membrane (visit 2) of plots 105 to 108 at Station Road, Howden (Ref. 2792)
- March 2024 – Inspection of radon membrane of plot 61 at Middle Deepdale (Ref. 4251)
- April 2024 – Inspection of membrane installation of plot 22 at Main Street, Carlton (Ref. 1796)
- April 2024 – Inspection of sub floor voids and membrane installation of plots 17&18 at Radial Park, Leeds (Ref. 1225R)
- May 2024 – Inspection of radon membrane installation of plots 2-5 at Royd Edge Mill, Meltham (Ref. 5039)
- May 2024 – Inspection of gas membranes of plots 334/335, 347 & 348/349 at Hexthorpe, Doncaster (Ref. 1172)
- June 2024 – Inspection of water seals at plots 23-27 and membrane install in plot 10 at Radial Park, Leeds (Ref. 1225)
- September 2024 - Inspection of sub floor voids in plot 52 and membrane installs in plots 48 to 51 at Main Street, Carlton (Ref. 1796)
- September 2024 - Inspection of membrane install in the extension at Dancing House, Gomersal (Ref. 5050)
- September 2024 - Inspection of membrane installs in plot 61 to 64 at Radial Park, Leeds (Ref. 1225)
- November 2024 – Inspection of sub floor void in plots 39 to 42 and membrane install in plot 39 to 43 at Radial Park, Leeds (Ref. 1225)
- November 2024 – Inspection of sub floor void in plots 1 to 4 & 83 and membrane install in plots 1 to 4 at Brompton on Swale (Ref. 1284)

Total Hours: 41

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[Gas Competency Curriculum Vitae]

Year: 2025

Sites:

- January 2025 – Inspection of sub floor voids of plots 42 to 46 at Darton Lane, Barnsley (Ref. 4386)
- April 2025 – Inspection of sub floor voids (plots 123-125) and water seals of plots 1 at City Fields, (Phase 1), Wakefield (Ref. 4232)
- April 2025 – Inspection of sub floor void and gas membranes in plots 16 to 17 at Brompton on Swale (Ref. 1284)
- April 2025 – Inspection of radon membranes in plots 80 & 81 at Bell Street, Upton (Ref. 4236)
- May 2025 – Inspection of sub floor void of plot 2 at Smithy Wood, Dodworth (Ref. 1979)
- May 2025 – Inspection of water seal of plots 4 & 5 at City Fields, (Phase 1), Wakefield (Ref. 4232)
- May 2025 – Inspection of membrane installs in plot 141 to 142 at Radial Park, Leeds (Ref. 1225)
- May 2025 - Inspection of radon membranes in plots 1 & 2 at Station Road, Altofts (Ref. 4092)
- June 2025 – Inspection of membrane of plots 1 & 2 at Smithy Wood, Dodworth (Ref. 1979)
- June 2025 - Inspection of sub floor void of plots 75, 76, 114 & 115 at City Fields, (Phase 1), Wakefield (Ref. 4232)
- August 2025 – Inspection of membrane of plot 80 at Main Street Carlton (Ref. 1796)
- August 2025 – Inspection of radon membrane of plots 15 to 18 at Royd Edge Mill, Meltham (Ref. 5039)
- September 2025 - Inspection of sub floor void of plots 63 & 64 at Fenay Bridge (Ref. 2770)
- September 2025 - Inspection of sub floor void (plots 135 to 138) and membrane install in plots 52 & 53 64 at Radial Park, Leeds (Ref. 1225)
- October 2025 – Inspection of sub floor void (plots 36 & 37) and gas membranes in plots 36 to 40 at Brompton on Swale (Ref. 1284)
- October 2025 - Inspection of membrane installs in plots 54, 55, 131 to 133 and water seals in plots 52, 53 & 136 to 138 at Radial Park, Leeds (Ref. 1225)
- December 2025 - Inspection of gas membranes of plots 9 to 12 & 60 to 61 at Fenay Bridge (Ref. 2770)

Total Hours: 31

Lithos Consulting
[Gas Competency Curriculum vitae]

Personal details

Name: **Emily Tweed**

Date of Birth: 12th October 1998

Qualifications: BSc – Geological Sciences, Leeds University, 2021
Fellow of the Geological Society (FGS)
NVQ Level 3 (Gas Validation)

Outline of experience

Name of employer: **Lithos Consulting Limited**
August 2021 - Present
Current position: Engineer – Remediation

Details/duties:
Predominately supervising remediation projects (including drilling & grouting, earthworks, treatment/ removal of grossly contaminated soil/fill, CBR or plate load testing etc) in accordance with our (or other third party) Remediation Strategy and Earthworks. Validating protection measures are installed as specified in Remediation Strategy &/or Gas Protection Validation Strategy.

Ground gas verification training

Course 1: 1 Day Gas Verification Training
Name of organisation: CL:AIRE Training (Via MEC Environmental)
Date: 23rd May 2023

Course 2: 1 Day Gas Verification Training
Name of organisation: Neil Salvidge Training
Date: 14th March 2024

NOCN Level 3 NVQ Diploma: Substructure Work Occupations (Construction) – Protection System Independent Verification
Date: August 2025

Ground gas verification – on site experience

Year: **2023**

Sites:

- May & June 2023 - Inspection of sub-floor voids & membrane of Plots 224 to 231 at Hawthorne Avenue (Ref. 3976)
- July & November 2023 - Inspection of membrane of Plots 82 to 84 & 79 at Limekiln Lane, Cayton (Ref. 3255).
- June & July 2023 - Inspection of subfloor void & membrane of Plots 38 to 41 at Lockwood Farm, Bierley (Ref. 3493).
- October 2023 - Inspection of sub-floor voids of Plot 31 at Main Street, Carlton

Total Hours: **7**

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[Gas Competency Curriculum vitae]

Year: **2024**

Sites:

- January 2024 – Inspection of sub-floor voids of Plots 158 & 159 at Station Road, Howden (Ref. 2792)
- January 2024 – Inspection of sub-floor voids of Plots 16 & 19 to 21 at Main Street, Carlton (Ref. 1796)
- March & May 2024 – Inspection of sub-floors & water seals of Plots 48 &146 to 149 at Manor 12, Sheffield (Ref. 3057)
- March 2024 – Inspection of Radon membrane of Plots 28 & 29 at Middle Deepdale (Ref. 4251).
- May 2024 – Inspection of membrane with stanchions of Plot 12 at Green Acres Close, Emley (Ref. 3253)
- June to August 2024 – Inspection of sub-floor void & membranes of Plot 83 to 86 & 80 to 82 at Selby Road, Howden (Ref. 2572)
- June 2024 — Inspection of membrane of Plots 459 to 463 at Navigation Point, Castleford (Ref. 1057)
- July 2024 – Inspection of sub-floor void & membrane of Plot 69 at Main Street, Carlton (Ref. 1796)
- July 2024 – Inspection of sub-floor voids of Plot 123 at Station Road, Howden (Ref. 2792)
- July & November 2024 – Inspection of membrane and water annulus seal of Plots 30 to 31 at Green Acres Close, Emley (Ref. 3253)
- October 2024 – Inspection of Radon membrane of Plots 1 & 2 at Bell Street, Upton (Ref. 4236)
- November 2024 – Inspection of subfloors and membranes of Plots 610 to 613 at Navigation Point, Castleford (Ref. 1057)
- November 2024 – Inspection of membranes on split-level plots 140/141, 177/178 & 180/181 at Manor 12, Sheffield (Ref. 3057)

Total Hours: **21**

Year: **2025**

Sites:

- January & October 2025 – Inspection of membranes of Plots 36-37 & 81-85 at Gatherley Road, Brompton on Swale (Ref. 1284)
- January 2025 – Inspection of membranes of Plots 182-183 at Manor 12, Sheffield (Ref. 3057)
- January & June 2025 - Inspection of radon membranes of Plots 21-26 & 45-46 at Bell Street, Upton (Ref. 4236)
- January, February & July 2025 – Inspection of membrane of Plots 23-26, 37-43 & 45-46 at Dalton Lane, Barnsley (Ref. 4386)
- January & February 2025 – Inspection of membrane with air lancing of Plots 1-5 at City Fields, Wakefield (Ref. 4232)
- February & July 2025 – Inspecting membrane perimeter detail of Plots 15-20, apartments and Interior of Plots 7-8 at Royd Edge, Meltham
- February, March & December 2025 – Inspection of subfloor, membranes & water seals of Plots 29-32, 37-38, 50, 56 &124-125. at Manston Lane, Leeds (Ref. 1225R)
- March 2025 – Inspection of membrane and repairs of Plots 58 & 77 at Main Street, Carlton (Ref. 1796)
- June & August 2025 – Inspection of membrane infill of Plots 5-8 & 23-26 at Kings Drive, Wrose (Ref. 5076)
- July & September 2025 – Inspection of subfloor voids, membranes and water seals for Plots 4, 105, 144 & 178-179 at Smithy Wood Lane, Dodsworth (Ref. 1979)
- July 2025 – Inspection of membrane for Plots 15-18 at Station Road, Altofts (Ref. 4092)
- July, September & December 2025 – Inspection of membrane of Plots 2-5, 10-11 & 25-30 at Rossington (Ref. 5286)
- September & November 2025 – Inspection of subfloor void and membranes for Apartments B2 and Plots 61-64, 112-113 & 126 at Yew Tree Lane, Harrogate (Ref. 1752)
- November 2025 – Inspection of membranes of Plots 1-6 at Whitwell Green, Lane, Elland (Ref. 3933)

Total Hours: **40**

APPENDIX D
SUB FLOOR VENTILATION CALCULATIONS

Sub floor void ventilation calculations

Site name	Westgate, Cleckheaton
Project no.	3043
Date	16/01/2026
Assessor	E Tweed
Checked by	D Jackson

Property summary		
Property name[5]	3-301	
Property type[5]	Semi/Terrace	
Cross ventilation check[5]	N/A	
Hazardous gas type		
	CO_2	**CH_4**
Wind		
Wind speed (mph)[1]	2.7	
U_m Design corrected wind speed being exceeded 80% of the time (m/s)	0.7	0.0
K Value from Table 8 of BS5925:1991[2]	0.35	0.35
α Value from Table 8 of BS5925:1991[2]	0.25	0.25
z Value for ventilator height (m)[3]	0.15	0.15
$U_r = U_m \times K \times z^{\alpha}$ Corrected wind speed (m/s)	**0.15**	**0.00**
Building specifics		
Conservative void height (m)[4]	0.15	
Building longest side (m)[5]	8.3	
Building shortest side (m)[5]	5.2	
Air brick size (m^2)[6]	0.0061	
Total no. of air bricks (all sides of the building)[5]	6	
Total no. of air bricks (shortest sides of both opposite ventilated walls)[5]	6	
Least no. of air bricks (shortest side)[5]	3	
Ventilation of two opposite walls (m^2/m)	0.003	#DIV/0!
Ventilation of two opposite walls (mm^2/m)	**3,492**	**#DIV/0!**
Ventilation of the entire floor area (mm^2/m^2)	**844**	**#DIV/0!**
Fresh air flow into void		
A_w Total vent area for all air bricks on the shortest side of the building (m^2)	0.018	0.000
C_d Discharge coefficient of a narrow opening[7]	0.61	0.61
ΔCp Worst case coefficient from CIEH LA Guide (2008)	0.4	0.4
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (m^3/h)	4	0
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (cm^3/s)	**1,039**	**0**
Diffusion of gas into the void		
Max steady state non-flooded borehole flow rate (l/hr)[8]	16.00	
Max steady state gas conc (% v/v)[8]	0.1	
Pecksen Zone of Influence (m^2)	10	10
Surface emission rate by diffusion (l/hr/m^2) by Pecksen Method[9]	0.00	0.00
Surface emission rate by diffusion ($m^3/hr/m^2$) by Pecksen Method[9]	0.00000	0.00000
Density of specific gas (kg/m^3)	1.980	0.657
q Total surface emission rate of gas into void by diffusion (m^3/h)	0.000	0.000
Q_{Entry} Total surface emission rate of gas into the void by diffusion (g/s)	**0.0000**	**0.0000**
Theoretical equilibrium concentration of gas into the void		
Molecular weight of specific gas (g/mol)	44.00	16.04
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (mg/m^3)	37	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (ppm)	20	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (%)	**0.002**	**#DIV/0!**
Required ventilation		
C_e Maximum design concentration for gas (%)[10]	1.0	1.0
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/h)[11]	0.01	0.00
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/s)	0.00000	0.00000
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (m^2)	0.00003	#DIV/0!
$Aw = Q_{Required} / Ur \times Cd \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2)	34	#DIV/0!
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2/m)[12]	1	#DIV/0!
Building Regs min vent area for run of external wall (mm^2/m)[13]	1,500	1,500
Building Regs min vent area for floor area (mm^2/m^2)[13]	500	500
Ventilation of two opposite walls (mm^2/m)[14]	3,492	#DIV/0!
Ventilation of the entire floor area (mm^2/m^2)[14]	844	#DIV/0!
TFill Time to fill void to maximum design concentration if no wind[15] (hrs)	**938**	**#DIV/0!**

1 http://www.solarinsiders.co.uk/cWindspeed/lookup

2 Choose values from Table 8 in Background Info tab Ref. BS5925:1991 Code of practice for ventilation principles and designing for natural ventilation

3 Building regs min. 0.15m from surface level to top of air brick so use 0.15 unless site specific data

4 Most buildings have design for 0.225m however more conservative value of 0.15 should normally be used but could be increased to 0.225 if justified (i.e. actually measures/confirmed this post construction)

5 Buildings dimensions, air brick positions/no. and cross ventilation checks will be on the house type foundation plans

6 If no other site specific data use value 0.0061

7 CL:AIRE Technical Bulletin (TB16) Complete Continuous Monitoring in Underfloor Voids. December 2017

8 Obtain this data from either the Gas Risk Assessment of Site Investigation (which ever is the most current)

9 Local Authority Guide to Ground Gas (2008) CIEH - Box 4.6. Assumes gas data is from a 50mm pipe. If data from different pipe diameter see a director as this will need to be amended.

10 Max design concentration referenced in NHBC NP94 guidance as 1%. PIT 1997 states 1.5% for carbon dioxide and 1% for methane

11 Local Authority Guide to Ground Gas (2008) CIEH - Box 8.4

12 Where the area required for the whole building (mm2/m) is greater than min building regs 1,500mm2/m this cell will highlight in red

13 Buildings Regulations Approved Document C (2010)

14 Where the ventilation area of two opposite walls (mm2/m) is less than min building regs 1,500mm2/m or 500mm2/m2 this cell will highlight in red

15 Maximum period of still wind in the UK is 10 hours based on DETR and Partners in Technology (1997) Passive venting of soil gases beneath buildings, guide for design. Research Report, Volume I, Ove Arup and Partners.

Sub floor void ventilation calculations

Site name	Westgate, Cleckheaton
Project no.	3043
Date	16/01/2026
Assessor	E Tweed
Checked by	D Jackson

Property summary		
Property name[5]	3-604	
Property type[5]	Detached	
Cross ventilation check[5]	Yes	
Hazardous gas type		
	CO_2	**CH_4**
Wind		
Wind speed (mph)[1]	2.7	
U_m Design corrected wind speed being exceeded 80% of the time (m/s)	0.7	0.0
K Value from Table 8 of BS5925:1991[2]	0.35	0.35
α Value from Table 8 of BS5925:1991[2]	0.25	0.25
z Value for ventilator height (m)[3]	0.15	0.15
$U_r = U_m \times K \times z^{\alpha}$ Corrected wind speed (m/s)	**0.15**	**0.00**
Building specifics		
Conservative void height (m)[4]	0.15	
Building longest side (m)[5]	8.1	
Building shortest side (m)[5]	5.5	
Air brick size (m^2)[6]	0.0061	
Total no. of air bricks (all sides of the building)[5]	8	
Total no. of air bricks (shortest sides of both opposite ventilated walls)[5]	8	
Least no. of air bricks (shortest side)[5]	4	
Ventilation of two opposite walls (m^2/m)	0.004	#DIV/0!
Ventilation of two opposite walls (mm^2/m)	**4,465**	**#DIV/0!**
Ventilation of the entire floor area (mm^2/m^2)	**1,109**	**#DIV/0!**
Fresh air flow into void		
A_w Total vent area for all air bricks on the shortest side of the building (m^2)	0.024	0.000
C_d Discharge coefficient of a narrow opening[7]	0.61	0.61
ΔCp Worst case coefficient from CIEH LA Guide (2008)	0.4	0.4
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (m^3/h)	5	0
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (cm^3/s)	**1,386**	**0**
Diffusion of gas into the void		
Max steady state non-flooded borehole flow rate (l/hr)[8]	16.00	
Max steady state gas conc (% v/v)[8]	0.1	
Pecksen Zone of Influence (m^2)	10	10
Surface emission rate by diffusion (l/hr/m^2) by Pecksen Method[9]	0.00	0.00
Surface emission rate by diffusion ($m^3/hr/m^2$) by Pecksen Method[9]	0.00000	0.00000
Density of specific gas (kg/m^3)	1.980	0.657
q Total surface emission rate of gas into void by diffusion (m^3/h)	0.000	0.000
Q_{Entry} Total surface emission rate of gas into the void by diffusion (g/s)	**0.0000**	**0.0000**
Theoretical equilibrium concentration of gas into the void		
Molecular weight of specific gas (g/mol)	44.00	16.04
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (mg/m^3)	28	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (ppm)	16	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (%)	**0.002**	**#DIV/0!**
Required ventilation		
C_e Maximum design concentration for gas (%)[10]	1.0	1.0
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/h)[11]	0.01	0.00
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/s)	0.00000	0.00000
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (m^2)	0.00003	#DIV/0!
$Aw = Q_{Required} / Ur \times Cd \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2)	34	#DIV/0!
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2/m)[12]	1	#DIV/0!
Building Regs min vent area for run of external wall (mm^2/m)[13]	1,500	1,500
Building Regs min vent area for floor area (mm^2/m^2)[13]	500	500
Ventilation of two opposite walls (mm^2/m)[14]	4,465	#DIV/0!
Ventilation of the entire floor area (mm^2/m^2)[14]	1,109	#DIV/0!
TFill Time to fill void to maximum design concentration if no wind[15] (hrs)	**938**	**#DIV/0!**

1 http://www.solarinsiders.co.uk/cWindspeed/lookup

2 Choose values from Table 8 in Background Info tab Ref. BS5925:1991 Code of practice for ventilation principles and designing for natural ventilation

3 Building regs min. 0.15m from surface level to top of air brick so use 0.15 unless site specific data

4 Most buildings have design for 0.225m however more conservative value of 0.15 should normally be used but could be increased to 0.225 if justified (i.e. actually measures/confirmed this post construction)

5 Buildings dimensions, air brick positions/no. and cross ventilation checks will be on the house type foundation plans

6 If no other site specific data use value 0.0061

7 CL:AIRE Technical Bulletin (TB16) Complete Continuous Monitoring in Underfloor Voids. December 2017

8 Obtain this data from either the Gas Risk Assessment of Site Investigation (which ever is the most current)

9 Local Authority Guide to Ground Gas (2008) CIEH - Box 4.6. Assumes gas data is from a 50mm pipe. If data from different pipe diameter see a director as this will need to be amended.

10 Max design concentration referenced in NHBC NP94 guidance as 1%. PIT 1997 states 1.5% for carbon dioxide and 1% for methane

11 Local Authority Guide to Ground Gas (2008) CIEH - Box 8.4

12 Where the area required for the whole building (mm2/m) is greater than min building regs 1,500mm2/m this cell will highlight in red

13 Buildings Regulations Approved Document C (2010)

14 Where the ventilation area of two opposite walls (mm2/m) is less than min building regs 1,500mm2/m or 500mm2/m2 this cell will highlight in red

15 Maximum period of still wind in the UK is 10 hours based on DETR and Partners in Technology (1997) Passive venting of soil gases beneath buildings, guide for design. Research Report, Volume I, Ove Arup and Partners.

Sub floor void ventilation calculations

Site name	Westgate, Cleckheaton
Project no.	3043
Date	16/01/2026
Assessor	E Tweed
Checked by	D Jackson

Property summary		
Property name[5]	AL-251	
Property type[5]	Semi/Terrace	
Cross ventilation check[5]	Yes	
Hazardous gas type		
	CO_2	**CH_4**
Wind		
Wind speed (mph)[1]	2.7	
U_m Design corrected wind speed being exceeded 80% of the time (m/s)	0.7	0.0
K Value from Table 8 of BS5925:1991[2]	0.35	0.35
α Value from Table 8 of BS5925:1991[2]	0.25	0.25
z Value for ventilator height (m)[3]	0.15	0.15
$U_r = U_m \times K \times z^{\alpha}$ Corrected wind speed (m/s)	**0.15**	**0.00**
Building specifics		
Conservative void height (m)[4]	0.15	
Building longest side (m)[5]	8.5	
Building shortest side (m)[5]	4.5	
Air brick size (m^2)[6]	0.0061	
Total no. of air bricks (all sides of the building)[5]	4	
Total no. of air bricks (shortest sides of both opposite ventilated walls)[5]	4	
Least no. of air bricks (shortest side)[5]	2	
Ventilation of two opposite walls (m^2/m)	0.003	#DIV/0!
Ventilation of two opposite walls (mm^2/m)	**2,737**	**#DIV/0!**
Ventilation of the entire floor area (mm^2/m^2)	**643**	**#DIV/0!**
Fresh air flow into void		
A_w Total vent area for all air bricks on the shortest side of the building (m^2)	0.012	0.000
C_d Discharge coefficient of a narrow opening[7]	0.61	0.61
ΔCp Worst case coefficient from CIEH LA Guide (2008)	0.4	0.4
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (m^3/h)	2	0
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (cm^3/s)	**693**	**0**
Diffusion of gas into the void		
Max steady state non-flooded borehole flow rate (l/hr)[8]	16.00	
Max steady state gas conc (% v/v)[8]	0.1	
Pecksen Zone of Influence (m^2)	10	10
Surface emission rate by diffusion (l/hr/m^2) by Pecksen Method[9]	0.00	0.00
Surface emission rate by diffusion ($m^3/hr/m^2$) by Pecksen Method[9]	0.00000	0.00000
Density of specific gas (kg/m^3)	1.980	0.657
q Total surface emission rate of gas into void by diffusion (m^3/h)	0.000	0.000
Q_{Entry} Total surface emission rate of gas into the void by diffusion (g/s)	**0.0000**	**0.0000**
Theoretical equilibrium concentration of gas into the void		
Molecular weight of specific gas (g/mol)	44.00	16.04
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (mg/m^3)	48	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (ppm)	27	#DIV/0!
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (%)	**0.003**	**#DIV/0!**
Required ventilation		
C_e Maximum design concentration for gas (%)[10]	1.0	1.0
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/h)[11]	0.01	0.00
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/s)	0.00000	0.00000
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (m^2)	0.00003	#DIV/0!
$Aw = Q_{Required} / Ur \times Cd \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2)	29	#DIV/0!
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2/m)[12]	1	#DIV/0!
Building Regs min vent area for run of external wall (mm^2/m)[13]	1,500	1,500
Building Regs min vent area for floor area (mm^2/m^2)[13]	500	500
Ventilation of two opposite walls (mm^2/m)[14]	2,737	#DIV/0!
Ventilation of the entire floor area (mm^2/m^2)[14]	643	#DIV/0!
TFill Time to fill void to maximum design concentration if no wind[15] (hrs)	**938**	**#DIV/0!**

1 http://www.solarinsiders.co.uk/cWindspeed/lookup

2 Choose values from Table 8 in Background Info tab Ref. BS5925:1991 Code of practice for ventilation principles and designing for natural ventilation

3 Building regs min. 0.15m from surface level to top of air brick so use 0.15 unless site specific data

4 Most buildings have design for 0.225m however more conservative value of 0.15 should normally be used but could be increased to 0.225 if justified (i.e. actually measures/confirmed this post construction)

5 Buildings dimensions, air brick positions/no. and cross ventilation checks will be on the house type foundation plans

6 If no other site specific data use value 0.0061

7 CL:AIRE Technical Bulletin (TB16) Complete Continuous Monitoring in Underfloor Voids. December 2017

8 Obtain this data from either the Gas Risk Assessment of Site Investigation (which ever is the most current)

9 Local Authority Guide to Ground Gas (2008) CIEH - Box 4.6. Assumes gas data is from a 50mm pipe. If data from different pipe diameter see a director as this will need to be amended.

10 Max design concentration referenced in NHBC NP94 guidance as 1%. PIT 1997 states 1.5% for carbon dioxide and 1% for methane

11 Local Authority Guide to Ground Gas (2008) CIEH - Box 8.4

12 Where the area required for the whole building (mm2/m) is greater than min building regs 1,500mm2/m this cell will highlight in red

13 Buildings Regulations Approved Document C (2010)

14 Where the ventilation area of two opposite walls (mm2/m) is less than min building regs 1,500mm2/m or 500mm2/m2 this cell will highlight in red

15 Maximum period of still wind in the UK is 10 hours based on DETR and Partners in Technology (1997) Passive venting of soil gases beneath buildings, guide for design. Research Report, Volume I, Ove Arup and Partners.

Sub floor void ventilation calculations

Site name	Westgate, Cleckheaton
Project no.	3043
Date	16/01/2026
Assessor	E Tweed
Checked by	

Property summary		
Property name[5]	AL-451	
Property type[5]	Detached	
Cross ventilation check[5]	N/A	
Hazardous gas type		
	CO_2	**CH_4**
Wind		
Wind speed (mph)[1]	2.7	2.7
U_m Design corrected wind speed being exceeded 80% of the time (m/s)	0.7	0.7
K Value from Table 8 of BS5925:1991[2]	0.35	0.35
α Value from Table 8 of BS5925:1991[2]	0.25	0.25
z Value for ventilator height (m)[3]	0.15	0.15
$U_r = U_m \times K \times z^{\alpha}$ Corrected wind speed (m/s)	**0.15**	**0.15**
Building specifics		
Conservative void height (m)[4]	0.15	0.15
Building longest side (m)[5]	8.2	8.2
Building shortest side (m)[5]	5.2	5.2
Air brick size (m^2)[6]	0.0061	0.0061
Total no. of air bricks (all sides of the building)[5]	4	9
Total no. of air bricks (shortest sides of both opposite ventilated walls)[5]	4	4
Least no. of air bricks (shortest side)[5]	2	2
Ventilation of two opposite walls (m^2/m)	0.002	0.002
Ventilation of two opposite walls (mm^2/m)	**2,333**	**2,333**
Ventilation of the entire floor area (mm^2/m^2)	**571**	**1,285**
Fresh air flow into void		
A_w Total vent area for all air bricks on the shortest side of the building (m^2)	0.012	0.012
C_d Discharge coefficient of a narrow opening[7]	0.61	0.61
ΔCp Worst case coefficient from CIEH LA Guide (2008)	0.4	0.4
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (m^3/h)	2	2
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (cm^3/s)	**693**	**693**
Diffusion of gas into the void		
Max steady state non-flooded borehole flow rate (l/hr)[8]	16.00	2.00
Max steady state gas conc (% v/v)[8]	0.1	0.1
Pecksen Zone of Influence (m^2)	10	10
Surface emission rate by diffusion (l/hr/m^2) by Pecksen Method[9]	0.00	0.00
Surface emission rate by diffusion ($m^3/hr/m^2$) by Pecksen Method[9]	0.00000	0.00000
Density of specific gas (kg/m^3)	1.980	0.657
q Total surface emission rate of gas into void by diffusion (m^3/h)	0.000	0.000
Q_{Entry} Total surface emission rate of gas into the void by diffusion (g/s)	**0.0000**	**0.0000**
Theoretical equilibrium concentration of gas into the void		
Molecular weight of specific gas (g/mol)	44.00	16.04
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (mg/m^3)	54	2
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (ppm)	30	3
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (%)	**0.003**	**0.000**
Required ventilation		
C_e Maximum design concentration for gas (%)[10]	1.0	1.0
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/h)[11]	0.01	0.00
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/s)	0.00000	0.00000
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (m^2)	0.00003	0.00000
$Aw = Q_{Required} / Ur \times Cd \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2)	33	4
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2/m)[12]	1	0
Building Regs min vent area for run of external wall (mm^2/m)[13]	1,500	1,500
Building Regs min vent area for floor area (mm^2/m^2)[13]	500	500
Ventilation of two opposite walls (mm^2/m)[14]	2,333	2,333
Ventilation of the entire floor area (mm^2/m^2)[14]	571	1,285
TFill Time to fill void to maximum design concentration if no wind[15] (hrs)	**938**	**7500**

1 http://www.solarinsiders.co.uk/cWindspeed/lookup

2 Choose values from Table 8 in Background Info tab Ref. BS5925:1991 Code of practice for ventilation principles and designing for natural ventilation

3 Building regs min. 0.15m from surface level to top of air brick so use 0.15 unless site specific data

4 Most buildings have design for 0.225m however more conservative value of 0.15 should normally be used but could be increased to 0.225 if justified (i.e. actually measures/confirmed this post construction)

5 Buildings dimensions, air brick positions/no. and cross ventilation checks will be on the house type foundation plans

6 If no other site specific data use value 0.0061

7 CL:AIRE Technical Bulletin (TB16) Complete Continuous Monitoring in Underfloor Voids. December 2017

8 Obtain this data from either the Gas Risk Assessment of Site Investigation (which ever is the most current)

9 Local Authority Guide to Ground Gas (2008) CIEH - Box 4.6. Assumes gas data is from a 50mm pipe. If data from different pipe diameter see a director as this will need to be amended.

10 Max design concentration referenced in NHBC NP94 guidance as 1%. PIT 1997 states 1.5% for carbon dioxide and 1% for methane

11 Local Authority Guide to Ground Gas (2008) CIEH - Box 8.4

12 Where the area required for the whole building (mm2/m) is greater than min building regs 1,500mm2/m this cell will highlight in red

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14 Where the ventilation area of two opposite walls (mm2/m) is less than min building regs 1,500mm2/m or 500mm2/m2 this cell will highlight in red

15 Maximum period of still wind in the UK is 10 hours based on DETR and Partners in Technology (1997) Passive venting of soil gases beneath buildings, guide for design. Research Report, Volume I, Ove Arup and Partners.

Sub floor void ventilation calculations

Site name	Westgate, Cleckheaton
Project no.	3043
Date	16/01/2026
Assessor	E Tweed
Checked by	D Jackson

Property summary		
Property name[5]	HT2A	
Property type[5]	Detached	
Cross ventilation check[5]	Yes	
Hazardous gas type		
	CO_2	**CH_4**
Wind		
Wind speed (mph)[1]	2.7	2.7
U_m Design corrected wind speed being exceeded 80% of the time (m/s)	0.7	0.7
K Value from Table 8 of BS5925:1991[2]	0.35	0.35
α Value from Table 8 of BS5925:1991[2]	0.25	0.25
z Value for ventilator height (m)[3]	0.15	0.15
$U_r = U_m \times K \times z^{\alpha}$ Corrected wind speed (m/s)	**0.15**	**0.15**
Building specifics		
Conservative void height (m)[4]	0.15	0.15
Building longest side (m)[5]	8.4	8.4
Building shortest side (m)[5]	8.1	8.1
Air brick size (m^2)[6]	0.0061	0.0061
Total no. of air bricks (all sides of the building)[5]	8	8
Total no. of air bricks (shortest sides of both opposite ventilated walls)[5]	8	8
Least no. of air bricks (shortest side)[5]	4	4
Ventilation of two opposite walls (m^2/m)	0.003	0.003
Ventilation of two opposite walls (mm^2/m)	**3,027**	**3,027**
Ventilation of the entire floor area (mm^2/m^2)	**720**	**720**
Fresh air flow into void		
A_w Total vent area for all air bricks on the shortest side of the building (m^2)	0.024	0.024
C_d Discharge coefficient of a narrow opening[7]	0.61	0.61
ΔCp Worst case coefficient from CIEH LA Guide (2008)	0.4	0.4
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (m^3/h)	5	5
$Q_{Building} = A_w \times U_r \times C_d \times \sqrt{\Delta C_p}$ Fresh Air flow into void (cm^3/s)	**1,386**	**1,386**
Diffusion of gas into the void		
Max steady state non-flooded borehole flow rate (l/hr)[8]	16.00	2.00
Max steady state gas conc (% v/v)[8]	0.1	0.1
Pecksen Zone of Influence (m^2)	10	10
Surface emission rate by diffusion (l/hr/m^2) by Pecksen Method[9]	0.00	0.00
Surface emission rate by diffusion ($m^3/hr/m^2$) by Pecksen Method[9]	0.00000	0.00000
Density of specific gas (kg/m^3)	1.980	0.657
q Total surface emission rate of gas into void by diffusion (m^3/h)	0.000	0.000
Q_{Entry} Total surface emission rate of gas into the void by diffusion (g/s)	**0.0001**	**0.0000**
Theoretical equilibrium concentration of gas into the void		
Molecular weight of specific gas (g/mol)	44.00	16.04
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (mg/m^3)	43	2
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (ppm)	24	3
$C_{Building} = Q_{Entry}/Q_{Building}$ Equilibrium conc of gas in ventilation layer (%)	**0.002**	**0.000**
Required ventilation		
C_e Maximum design concentration for gas (%)[10]	1.0	1.0
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/h)[11]	0.01	0.00
$Q_{Required} = q \times [(100 - C_e)/C_e]$ Design fresh air flow rate required (m^3/s)	0.00000	0.00000
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (m^2)	0.00005	0.00001
$Aw = Q_{Required} / Ur \times Cd \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2)	53	7
$Aw = Q_{Required} / U_r \times C_d \times \sqrt{\Delta C_p}$ Area of ventilation required for whole building (mm^2/m)[12]	2	0
Building Regs min vent area for run of external wall (mm^2/m)[13]	1,500	1,500
Building Regs min vent area for floor area (mm^2/m^2)[13]	500	500
Ventilation of two opposite walls (mm^2/m)[14]	3,027	3,027
Ventilation of the entire floor area (mm^2/m^2)[14]	720	720
TFill Time to fill void to maximum design concentration if no wind[15] (hrs)	**938**	**7500**

1 http://www.solarinsiders.co.uk/cWindspeed/lookup

2 Choose values from Table 8 in Background Info tab Ref. BS5925:1991 Code of practice for ventilation principles and designing for natural ventilation

3 Building regs min. 0.15m from surface level to top of air brick so use 0.15 unless site specific data

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5 Buildings dimensions, air brick positions/no. and cross ventilation checks will be on the house type foundation plans

6 If no other site specific data use value 0.0061

7 CL:AIRE Technical Bulletin (TB16) Complete Continuous Monitoring in Underfloor Voids. December 2017

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9 Local Authority Guide to Ground Gas (2008) CIEH - Box 4.6. Assumes gas data is from a 50mm pipe. If data from different pipe diameter see a director as this will need to be amended.

10 Max design concentration referenced in NHBC NP94 guidance as 1%. PIT 1997 states 1.5% for carbon dioxide and 1% for methane

11 Local Authority Guide to Ground Gas (2008) CIEH - Box 8.4

12 Where the area required for the whole building (mm2/m) is greater than min building regs 1,500mm2/m this cell will highlight in red

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14 Where the ventilation area of two opposite walls (mm2/m) is less than min building regs 1,500mm2/m or 500mm2/m2 this cell will highlight in red

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APPENDIX E
VERIFICATION PROFORMA

VALIDATION OF GAS PROTECTION MEASURES

PLOT

Project Data

Site Name:		Lithos Job No:	
Developer:		Planning Ref:	
Gas Risk Assessment Ref:		NHBC Ref:	
Verification Report Ref:		Gas Classification:	Radon only / CS2 / CS3 or above

Gas Protection Requirements

Sub-floor ventilation:	Clear void		Void former		Granular layer		Floor construction:	Beam & block	Reinforced ground bearing	Reinforced suspended
Ventilation:	Passive		Active				Membrane installer:			
Weather conditions at time of membrane inspection:										

Inspection Data

Sub-floor ventilation:							Date:	
External airbricks:		Front		Rear		Left / Right	Date:	
Internal sleeper walls:							Date:	
Underside of gas membrane:							Date:	
Gas membrane type:							Date:	
Gas membrane condition:							Date:	
Lapping design:							Date:	
Jointing product:							Date:	
Laps, welds & joints seal:							Date:	
Service entries seal:							Date:	
Water supply pipe seal							Date:	
Remarks								

We confirm that the gas protection measures inspected have been installed in accordance with the specification and to an acceptable level of workmanship. However, it is the main contractor's responsibility to ensure that following trades to not damage the gas membrane. Final inspection to be carried out by the main contractor prior to pour to repair any damage.

Signed on behalf of Lithos Consulting

Date:

PLOT

PLOT XX SUB-FLOOR VOID

PLOT XX MEMBRANE

PLOT XX SERVICE ENTRY SEALS AND CORNER DETAIL

PLOT XX SEAL BETWEEN WATER PIPE AND SERVICE DUCT

CONSTRUCTION QUALITY ASSURANCE (CQA) CHECKLIST
GAS PROTECITON MEASURES

Site Information					
Site Name					
Developer					
Groundworker/installer details					
Plot No		**Foundation Type**			
Gas Protection Checklist					
	Confirmed	**n/a**	**Action Required**	**Comments**	**Date**
Granular venting layer present?					
Void former present?					
>150mm sub floor void?					
No visible blockages that would restrict air movement?					
Cross ventilation provided in party/sleeper walls?					
Air bricks on at least 2 opposite sides connect to sub floor void?					
Floor free of debris/clean prior to placement of membrane?					
Membrane type, manufacturer and products used?	List:				
Joining method	Heat bonding ☐ Weld ☐ Tape ☐				
Joints properly sealed?					
Condition of membrane good?					
Seals at penetrations present and good standard?					
Corner detail to a good standard?					
Water supply pipe sealed?					
Design					
Membrane spec as approved in design?					
Is the above in accordance with the approved design?					
Photographs					
Taken of passive venting system?					
Taken of membrane?					
Taken of water pipe seal?					
Sign off					
Name of person inspecting				**Date of final sign off**	
Company					
Signature					