Report Title:

Ground Gas Verification Plan

Project Name:

Public Open Space, Wygate Park, Spalding



Report Reference: **BRD241183-OR11-A**

Date: **September 2019**

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REPORT CONTROL SHEET

REPORT TITLE	**GROUND GAS VERIFICATION PLAN**
PROJECT	**PUBLIC OPEN SPACE, WYGATE PARK, SPALDING**
CLIENT	**KIER LIVING**

REPORT REFERENCE	ISSUE DETAIL	DATE	PREPARED BY	CHECKED BY
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BRD Environmental Limited

Geotechnical and Environmental Services

- Ground Investigation
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REPORT LAYOUT

This report is divided into the following four sections: Summary Report, Technical Report, Supporting Information and Appendices.

SUMMARY REPORT

This expanded executive summary provides the main findings of the work undertaken in brief non-technical language. This section provides an overview of the key outcomes for the benefit of non-specialists and concludes with the main recommendations. This section should only be relied upon in the context of the whole report and the Technical Report should be referred to with respect to any design decisions.

TECHNICAL REPORT

The main report section is intended to provide the technical detail of the investigation and is intended to provide the level of information required by current guidance documents and practice. The Technical Report is written in a language that, in part, assumes knowledge of subject matter so that it can be written in as concise a form as possible. Its intended audience is peers, regulators and other professionals in related disciplines.

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REFERENCES

SUPPORTING INFORMATION

This section of the report provides background details of a generic nature together with specific technical approaches adopted by BRD and details of the guidance documents that are commonly referenced in the report. The section also includes explanations of technical terms to assist non-specialist readers in understanding the Technical Report. It should be noted that not all the information within this section is necessarily applicable to this specific report.

APPENDICES

The final section of the report presents the factual data collected and employed as part of the investigation.

APPENDIX 1 SITE PLANS

Site Location Plan	Ref. BRD241183-OP6-A
Revised Conceptual Site Model	Ref. BRD241183-OP8-B
Proposed Development Layout	'Site Plan', Robert Doughty Consultancy, dwg no. 520-247_PL_SP01, dated 22/10/18
Plans of Floor Details	'Amber 1 Protection - Floor Construction Option 1' Kier Living, dwg no. STD-SUB-01op1 rev c, and 'Amber 1 Protection - Floor Construction Option 2' Kier Living, dwg no. STD-SUB-01op2 rev c, both dated 29-05-2019.

APPENDIX 2 PROPOSED MEMBRANE DETAILS

Visqueen Low Permeability Gas Membrane Datasheet	4 x A4 pages
Installation / System Components	6 x A4 pages

APPENDIX 3 INSPECTION VISIT TEMPLATE

Template	2 x A4 pages

SUMMARY REPORT – GROUND GAS ISSUES

SUBJECT	COMMENTS
CURRENT SITE CONDITION	The site currently comprises an area of public open space within the larger Wygate Park residential development. A pumping station and electricity substation are present along the southern site boundary.
PROPOSED DEVELOPMENT	It is proposed that part of the site will be developed with residential houses in keeping with the surrounding housing estate. This report does not discuss the construction of the Community Hall.
PUBLISHED GEOLOGY	The site is underlain by superficial deposits of the Terrington Beds and Barroway Drove Beds. At the base of these a thin band of Glacio-lacustrine deposits were sporadically encountered. Beneath, clays comprising of Glacial Till are present. The underlying bedrock geology comprises of Oxford Clay Formation.
GAS RISK	The soils underlying the site contain high organic content that can give rise to elevated concentrations of methane and carbon dioxide which present a low risk to future residents. This risk is easily managed through the use of appropriate basic gas protection measures known as NHBC Amber 1 gas protection measures.
GAS PROTECTION MEASURES	The houses are to be built with a suspended floor with a ventilated sub-floor void. The floor construction is to incorporate a continuous Visqueen Low Permeability Gas Membrane. The gas protection measures are to be fitted by the non-specialist groundwork contractor.
GROUND GAS VERIFICATION PLAN	To ensure the gas protection measures are correctly installed the independent verification procedure shall be thorough visual examination by the BRD Consultant. The verification inspections of the membrane are to be at a minimum rate of 1 in 5 plots (i.e. 20% of plots). The groundwork contractor is to provide statements and photographic evidence of successful fitting of membranes in remaining plots that are not inspected by the Consultant. When the development is completed, all the verification information is to be compiled into a single verification report.

1. INTRODUCTION TO TECHNICAL REPORT

1.1. CONTRACT DETAILS

CLIENT	Kier Living Ltd trading as Kier Living.
SITE	Land situated at Wygate Park in the town of Spalding, Lincolnshire.
CLIENT'S ADVISORS	BRD Environmental Limited (BRD) has been commissioned directly by the Client.
REPORT CONTEXT	It is understood that the Client currently owns the site and is in the process of developing it for residential housing.
REPORT TYPE	Ground Gas Verification Plan.
REPORT OBJECTIVES	The site has received planning permission from South Holland District Council, referenced H16-1117-18 and dated 20th March 2019. This report is designed to address Condition 3 of this planning permission: "*Before the commencement of the development hereby permitted, a scheme to prevent the ingress of hazardous ground gasses to the buildings shall be submitted to and approved by the local planning authority. This should include detailed design, specification and proposed verification schedule. No deviation shall be made from this scheme without the express written agreement of the local planning authority*". It should be noted that the planning application was of a hybrid form with a full planning application for 34 dwellings and an outline application for a Community Hall. The scope of this report only considers the 34 residential properties. The verification plan for the Community Hall cannot be developed at this time as the detailed design of this structure has not been completed. A separate ground gas verification plan will need to developed for this structure at an appropriate point in the future.

1.2. SCOPE OF WORKS

The agreed scope of works related to the ground gas protection was:

- Prepare a Ground Gas Verification Plan including a ground gas risk assessment confirming the design of the gas protection measures. Report to be supplied in an electronic Adobe pdf format.
- Attendance by Geo-Environmental Consultant to verify correct fitting of gas protection measures to the new buildings through thorough visual inspection and mechanical point stress tests. Issue inspection report after each visit.
- Provision of equipment for performing air lance tests on membrane joints.
- Provision of a Remediation Verification Report on completion of fitting all the gas protection measures. Report to be supplied in an electronic Adobe pdf format.

This report addresses the first bullet point.

1.3. REPORT LIMITATIONS

Any site boundary lines depicted on plans included within this report are approximate only and do not imply legal ownership of land. Any observations of tree species, asbestos containing materials within structures or invasive weeds, does not constitute a formal survey of such features. The identification of such features is therefore tentative only. In the case of Japanese Knotweed, BRD can undertake separate surveys for this plant undertaken by a Property Care Association qualified surveyor.

The assessment and interpretation of contamination risks is based on the scope of works agreed with the Client together with the budgetary and programme constraints imposed. Further investigation, analysis and assessment of contamination may be required by regulators or other third parties with an interest in the site.

2. GROUND GAS RISK ASSESSMENT

2.1. SITE SETTING

SITE ADDRESS AND POST CODE	Land north of Witham Road, Wygate Park, Spalding, Lincolnshire, PE11 3WT.
NATIONAL GRID REFERENCE	523552E, 323056N.

2.2. SITE DESCRIPTION

SUBJECT	COMMENTS
CURRENT SITE DESCRIPTION	The site currently comprises a former area of public open space within the larger Wygate Park residential development that is currently undergoing preparatory work for the forthcoming redevelopment. A pumping station and electricity substation are present along the southern site boundary.
SURROUNDING LAND USE	The surrounding land use is predominantly residential with the exception of a school which is immediately adjacent to the western site boundary.
PROPOSED DEVELOPMENT	It is proposed that the site will be developed with 34No. residential houses with associated garages and private gardens.
HISTORICAL SUMMARY	The site has remained relatively un-developed throughout its history. From the 1960's until 2000, moveable greenhouses were evident in the north eastern corner of the site. A construction site compound is identified along the western site boundary in aerial imagery from 2016, however, this was not present at the time of the 2018 site works and the area had been reinstated.
PUBLISHED GEOLOGY	The site is underlain by superficial deposits of the Terrington Beds and Barroway Drove Beds. At the base of these a thin band of Glacio-lacustrine deposits were sporadically encountered. Beneath, clays comprising of Glacial Till are present. The underlying bedrock geology comprises of Oxford Clay.
RADON	Radon gas protection measures are not required.

2.3. PREVIOUS INVESTIGATIONS

The wider residential estate has been the subject of several phases of investigation which has included some exploratory holes being undertaken on the site. The following site investigation reports contain information that is relevant to the site:

- 'Site Investigation – Residential Area, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR1-A, dated September 2010.
- 'Site Investigation – School Site, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR2-A, dated September 2010.
- 'Site Investigation – Open Space, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR3-A, dated September 2010.
- 'Gas Risk Assessment - Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR5-A, dated March 2011.
- 'Site Investigation – Southern and Eastern Areas, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR7-A, dated August 2012.

Of particular note is the gas risk assessment undertaken within BRD report ref. BRD241183-OR7 which considered the gas monitoring results from across the Wygate Park development. This previous report identified the need for NHBC Amber 1 gas protection measures across the site on account of the elevated methane and carbon dioxide concentrations associated with the natural organic soils.

The information from these reports was reviewed and the site itself was subject to an intrusive ground investigation that was reported in:

- 'Geo-Environmental Site Investigation - Public Open Space, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR9-A, dated October 2018.

This report considered that the proposed development of the Public Open Space land is consistent with NHBC gas model and so in order to maintain continuity with the rest of the estate it was considered that NHBC Amber 1 protection measures should be applied.

The report recommended that a gas protection Verification Plan should be developed by a suitably qualified and experienced geo-environmental consultant. The Verification Plan should include details on the gas protection measures and the requirements regarding independent verification of the gas membrane installation.

2.3.1. Council Comment

At the end of August 2019, BRD were made aware of an internal email from the Council's Environmental Protection Officer and the Planning Officer for the development dated January 2019. The Environmental Protection Officer considered that, despite the mass of previous investigation data available, additional ground gas monitoring is required. The council officer focused on the boreholes actually on site rather than the data and situation as a whole. The guidance referred to by the council officer specifically allows the use of historic monitoring data in assessing whether a sufficient number of visits have been completed.

The council officer's request for three further gas monitoring visits would entail the drilling of new boreholes in order to facilitate this. Whilst the additional boreholes and monitoring would generate additional fees for BRD, it would be unethical and unsustainable to undertake additional work that in the professional opinion of BRD is not necessary. The reason we believe that this additional investigation is unnecessary as it will not change the understanding of the Conceptual

Site Model and related design of the ground gas protection measures. Further discussion of the gas regime at the site is provided in the following section to further justify our position.

2.4. GAS RISK ESTIMATION

Elevated concentrations of methane and carbon dioxide were identified across the Wygate Park area in previous ground investigations as a result of the high organic content within the underlying soils. The only contamination risk identified at the site is the potential migration of gases from the underlying soils which could impact future residents if the gases are allowed to accumulate within future residential houses. No other unacceptable risk with respect to the proposed development have been identified by the previous investigations.

The gas source identified at the site is the presence of naturally occurring organic clays of the Barroway Drove Beds. During the drilling of the previous boreholes some intact plant remains were noted as well as some amorphous peat pockets. The Barroway Drove Beds were deposited in an environment dominated by marshes and shallow water brackish lagoons cut by a complex network of tidal channels and creeks. The geological formation of these superficial deposits is therefore analogous with alluvium.

The previous BRD reports referenced BRD241183-OR5-A and BRD241183-OR7-A partly struggled to explain the extremely high methane concentrations recorded in some boreholes at the site although the risk from them was discounted through the assessment of surface emissions.

It is notable that both these aforementioned BRD reports pre-date the publication of 'RB17: A Pragmatic Approach to Ground Gas Risk Assessment' (CL:AIRE) in November 2012. The RB17 document was the first to widely publicise the fact that alluvial soils and buried peat can quite often give high concentrations of methane and carbon dioxide in monitoring wells. It notes that methane concentrations can reach up to 90% and this is certainly comparable to some of the extreme concentrations recorded at Wygate Park. This is because the gas has been generated historically and is trapped in the pores due to limited transport (at low diffusion rates). The methane accumulates at increasing depth in peat columns, but this does not indicate high rates of production. There is no, or very little, current gas generation and the carbon dioxide has dissolved out of the gas trapped in the soil pores which causes a higher percentage of methane to be recorded. The high methane concentrations previously recorded at the Wygate Park are therefore related to this phenomenon. The lack of active gas generation inherently limits the risk to future residents.

It is worth noting that across the large Kier Wygate Park development there have been a total of 14No. gas monitoring visits extending over a total period of 47 months. This is far in excess of the requirements of CIRIA C665 and whilst the data is historic, this is allowed under CIRIA C665.

The fact that many of the borehole monitoring wells are not situated within the current Public Open Space, i.e. the 'site' for this report, is irrelevant to the understanding of the ground gas regime. This is because the geology of the Wygate Park estate, the rest of Spalding and much of the surrounding area is the same. As noted above, the complex depositional environment means that these organic rich soils can be found in any location within the Barroway Drove Beds.

The RB17 guidance goes on to note that "*If gas monitoring is not undertaken it is acceptable to simply install Characteristic Situation 2 protection on sites where Alluvial soils are present. A similar approach is acceptable on sites with soils containing lignite or buried layers of peat*" and that its pragmatic approach also removes the need for additional monitoring to deal with anomalous flows, etc. It is worth noting that the protection requirements for Characteristic 2 are in effect the same as for NHBC Amber 1.

Considerable industry experience has demonstrated that when the ground gas is related to natural soils the provision of passive venting below the floor slab combined with a gas resistant membrane (installed correctly and independently verified) is sufficient to mitigate the risk.

The proposed development of the Public Open Space land is consistent with NHBC gas model and so in order to maintain continuity with the rest of the estate it is considered that NHBC Amber 1 gas protection measures should be applied.

Accordingly, it is considered that basic gas protection measures comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit ingress of gas into buildings are needed. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. In order to ensure the correct installation of such measures, independent verification is required.

3. GAS PROTECTION MEASURES

3.1. FLOOR DETAIL

The detailed design of the floor construction is shown on the drawings include in Appendix 1.

Void ventilation through air bricks and periscopic vents should be provided to whichever gives the greater opening area: 1,500mm^2 per metre run of external wall and 500mm^2 per m^2 of floor area.

The minimum design void beneath the floor is 225mm.

3.2. MEMBRANE CHOSEN

Kier Living have specified the use of Visqueen Low Permeability Gas Membrane and the fitting contractor has confirmed their intention to use this membrane. This membrane is a robust co-polymer thermoplastic membrane rated for use in NHBC Amber 1 and radon applications.

The fitting contractor has confirmed they will be sealing joints with tape rather than welding. The Visqueen Low Permeability Gas Membrane should be overlapped by at least 150mm and bonded with Visqueen Double Sided Tape. The joint should then be secured with Visqueen Gas Resistant (GR) Foil Jointing Tape.

It will be necessary that the membrane is laid in dry conditions as tape joints are difficult to successfully complete in wet weather.

When the weather is cold, all jointing tapes should be kept in a warm and dry place until needed.

Membrane installation should not proceed when the air temperature is below 5°C and/or the floor surface is in a frozen condition.

3.3. FITTERS

The contractor responsible for fitting the gas protection measures, including the gas resistant membrane, is the appointed ground works contractor for the development:

C E R Groundworks Limited
Cornfields Horseshoe Road
Spalding
PE11 3BE

This contractor's operatives have no formal training qualifications in the fitting of gas protection membranes. This groundworker has a large amount of practical experience in the fitting of gas protection measures to the satisfaction of NHBC building control inspectors.

4. VERIFICATION PLAN

4.1. RATE OF VERIFICATION INSPECTIONS

In determining the appropriate level of independent verification inspections required, the following four aspects have been considered:

- Site specific gas risk: Low risk (NHBC Amber 1 / natural soil source).
- Number of buildings: High (34 plots, i.e. >10).
- Complexity of the design and installation: Simple (typical modern houses).
- Qualifications and experience of workforce: Non-specialist (groundworker).

From consideration of these factors, it is considered that the following rate of inspections is appropriate for this site:

- Independent Consultant verification of the membrane as fitted to the first plot.
- Independent Consultant verification of the membrane after the installation of steel mesh reinforcement to the first plot. If a fibre reinforced screed concrete is used (as allowed for in the detailed design), then this requirement is not necessary as the risk of damage to the installed membrane is avoided.
- Subsequent independent Consultant verification inspections of the membrane at a minimum rate of 1 in 5 plots (i.e. 20% of plots or approximate minimum 6 plots). The rate of inspections is on a sliding scale upwards depending upon the nature and frequency of non-conformities observed.
- Groundwork contractor to provide statements and photographic evidence of successful fitting of membranes in remaining plots that are not inspected by the Consultant.

The minimum rate of independent verification inspections stated assumes that only minor occasional readily remedied defects are found during inspections. The rate of inspections is to increase, if there is insufficient confidence that the gas protection measures are being fitted correctly e.g. repeated poor fitting of membrane or damage to the membrane by follow on trades.

4.2. PERSONNEL CARRYING OUT VERIFICATION

4.2.1. Organisation

Kier Living has appointed BRD Environmental Ltd (BRD) to undertake the verification of the ground gas protection measures. BRD are therefore independent of the fitting company CER Groundworks Limited.

4.2.2. Personnel

All BRD consultants are degree level qualified, have attended third party training courses, have been mentored by more senior staff and received in house training. The BRD consultants that will be undertaking the verification process will be one of the following:

- Brian Devonshire. Over twenty-five years' experience of ground gas assessment and management. Last external gas training course attended: 'A-Z of Ground Gas' delivered by PAGeotechnical and Ground Gas Solutions, 2018.

- Matt Morgan. Over fifteen years' experience of ground gas assessment and management. Last external gas training course attended: 'A-Z of Ground Gas' delivered by PAGeotechnical and Ground Gas Solutions, 2018.

- Matt wood. Over five years' experience of ground gas assessment and management. Last external gas training course attended: 'Ground Gas Installation & Verification Training', delivered by Property Care Association, 2018.

The actual individual that attends for any given inspection visit is dependent upon prevailing workloads as inspection visits are ideally timed during or shortly after fitting so that there is not an undue delay before the membrane is covered (i.e. protected) by follow on construction. Accordingly, inspection visits can be at short notice depending upon contractor progress and weather conditions.

4.3. TOOL BOX TALK

Early during the construction programme, either BRD or groundworker management should deliver a 'Tool Box Talk' on the presence of the of the membrane and that damage to the membrane must be prevented. This talk should be delivered to the groundworkers and brick layers as the principal follow on trades that are of concern (by the time other trades are involved in typical house the membrane will have already been covered and therefore protected by concrete screed and brickwork.

4.4. CONSULTANT INSPECTION VISITS

The independent verification procedure shall be by thorough visual examination by the BRD Consultant.

The air bricks, periscopic vents, sub-floor voids and cross ventilation voids in sleeper walls will all be inspected as these are observed elsewhere on site in the course of inspections visits actually targeting membrane fitting on particular plots. It should be noted that these construction aspects are standard items that are routinely checked under independent building regulation inspections. These aspects of the gas protection measures are also less likely to be constructed with defects. Accordingly, this 'lighter touch' inspection by BRD is appropriate.

Membrane fitting will be the main focus of BRD inspections visits. The inspection shall check that the membrane is free from tears and punctures, and is lapped and sealed in accordance with good practice at joints and around service entries. Joint seam integrity shall be tested by mechanical point stress tests on randomly selected seam sections together with targeted testing of any

sections of joints that appear to be of poor quality. At the discretion of the inspecting consultant, joints may also be subject to air lance integrity tests.

Where non-conformances are recorded by inspections, these will be identified to the contractor. Ideally, remedial action is taken immediately and the attending BRD Consultant can witness the remedial action. Where this is not possible, the contractor shall provide BRD with photographic evidence that required corrective action has been taken.

Each inspection visit will be recorded as a written record including photographs. The template for such inspection records is included in Appendix 3.

4.5. CONTRACTOR PROVIDED EVIDENCE

For house plots that are not subject to inspection by BRD, the groundworks contractor shall supply a clear statement that the gas protection measures were installed in accordance with the design and manufacturer's instructions. Such plot specific statements shall include photographs showing the installed membrane.

4.6. SITE MANAGEMENT

During the initial inspection visit, BRD will emphasise the need for the site management to be vigilant that the gas protection membrane is protected from damage by follow on trades.

If non-conformances are found during a site inspection, the BRD will discuss these with site management so they are aware of issues and be vigilant for any such further occurrences.

The fitting of the gas protection measures will also be inspected by the NHBC during routine inspections under building regulations. Site management shall inform BRD if the NHBC Building Inspector raises any concerns with regard to the fitting of gas protection measures.

4.7. VERIFICATION REPORT

4.7.1. Planning Condition

Planning permission referenced H16-1117-18 from South Holland District Council contains condition four that reads: "*Prior to the first occupation of any dwelling, two copies of a full closure report shall be submitted to and approved in writing by the local planning authority. The report shall provide verification that the required works regarding ground gas ingress have been carried out in accordance with the approved scheme*".

The term 'closure report' has been interpreted as the Verification Report as required by technical guidance.

In common with many contaminated land planning conditions, this condition is poorly worded in that the 'full' verification report is expected before any occupation can occur. The full verification report cannot be issued until all the house plots have been constructed. It is simply not a reasonable requirement that none of the houses on an estate can be sold and occupied until all have been built. In this instance, there will be at least half a year between the construction of the first plot being completed and the last. As the council were forewarned, there is a need to, allow, in effect the partial discharge of this condition as individual houses are completed.

Accordingly, the verification reporting will be subject to following proposed programme:

- Upon completion of an individual house, the applicable BRD inspection record or Contractor statement (as appropriate) will be forwarded directly to the Environmental Protection Officer of the Council to demonstrate that the protection measures have been successfully completed and that occupation of this specific plot may proceed.

- Once all the houses are completed, the full Verification Report will be prepared and issued to the planning department in support of condition four.

As this programme is within a report that is to be approved under Condition 3 as the 'approved scheme', then the requirements of Condition 4 will be complied with in a workable manner.

4.7.2. Report Contents

Upon completion of the installation of the ground gas protection measures, BRD shall prepare a ground gas verification report. The report will include commentary on the following:

- Summary of ground gas risk assessment.

- Description of ground gas protection measures as installed.

- Details of the verification inspection regime actually completed.

- Consultant inspection records.

- Contractor statements for plots not inspected by Consultant.

- Any defects identified, corrective action undertaken and verification thereafter.

- Photographic records.

- Provide a revision to the Conceptual Site Model confirming the breaking of the ground gas pollutant linkage.

The verification report will conclude with a statement confirming the site is fit for its intended use in respect of ground gas issues.

REPORT SPECIFIC REFERENCES

- 'Site Investigation – Residential Area, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR1-A, dated September 2010.
- 'Site Investigation – School Site, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR2-A, dated September 2010.
- 'Site Investigation – Open Space, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR3-A, dated September 2010.
- 'Gas Risk Assessment - Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR5-A, dated March 2011.
- 'Site Investigation – Southern and Eastern Areas, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR7-A, dated August 2012.
- 'Geo-Environmental Site Investigation - Public Open Space, Wygate Park, Spalding', BRD Environmental Ltd, report ref. BRD241183-OR9-A, dated October 2018.
- 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' BS8485:2015.
- 'CIRIA C735: Good practice on the testing and verification of protection systems for buildings against ground gases' CIRIA, 2014.
- 'Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present' NHBC and RSK, Report edition No: 04, March 2007.
- 'Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants', Yorkshire and Lincolnshire Pollution Advisory Group, Version 1.1, December 2016.
- 'RB17: A Pragmatic Approach to Ground Gas Risk Assessment', Contaminated Land: Applications in the Real Environment (CL:AIRE), November 2012.

SUPPORTING INFORMATION

CONTAMINATION ASSESSMENT METHODOLOGY

UK Policy

The UK Government's policy in relation to land affected by historic contamination is based on a 'suitable for use' approach. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Contamination risks therefore need to be assessed on a site-by-site basis. The 'suitable for use' approach limits requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to either the current use or future use of the land.

The three main drivers for contamination assessment and remediation are:

- *Voluntary action.*
- *Development as part of the planning regime.*
- *Regulatory action to mitigate unacceptable risks e.g. Part 2A of the Environmental Protection Act 1990.*

Pollutant Linkages

For a contamination risk to exist there must be a 'pollutant linkage' from the contaminant (source) via a pathway (the route from contaminant to receptor) to a receptor (the entity that could be harmed). The absence of a contaminant, pathway or receptor breaks the pollutant linkage and therefore no contamination risk exists.

Contamination is typically present at a site (in the ground and/or in the underlying groundwater) as a result of a historic or current industrial use, usually as a result of leaks, spills or disposal of residues, wastes and excess raw materials from the industrial processes. Contamination may also be present due to:

- *The deliberate application of chemicals e.g. the spraying of herbicide/pesticide.*
- *Migration of pollutants from adjacent land.*
- *Naturally occurring processes e.g. elevated concentrations of particular heavy metals associated with specific geological strata.*

Conceptual Site Model

The conceptual site model can be defined as a textual or graphical representation of the identified pollutant linkages for a given site. The model forms the basis for designing the investigation as the aim will be to target all of the potential pollutant linkages to determine, through the subsequent phases of risk assessment, whether or not they pose an actual risk.

It is important that the conceptual site model is updated with new information as the various investigation, risk assessment and remediation works are completed.

Technical Guidance

The technical and legal framework for contamination assessment is complex. The process adopted through this report for assessing contamination risks is in general accordance with the following guidance, as listed below:

- *'Investigation of Potentially Contaminated Sites - Code of Practice - BS 10175:2011+A2:2017', The British Standards Institution 2017.*
- *'Model Procedures for the management of Land Contamination - CLR Document No. 11', Environment Agency, 2004.*
- *'Guidance for the safe development of housing on land affected by contamination - R&D66: 2008', NHBC/Environment Agency, 2008.*

Risk Assessment Methodology

In line with the technical guidance, the contamination risk assessment follows a series of phased stages for each particular site:

PHASE	***DESCRIPTION***	***RISK ASSESSMENT STAGE***
PHASE1	*Generally limited to desk based research and a site walkover survey to develop an initial conceptual site model and identify what risks, if any, are likely to be presented by the site.*	***Hazard Identification and Assessment*** *A preliminary stage of risk assessment concerned with identifying and characterising the hazards that may be associated with a particular site and identifying potential pollutant linkages.*
PHASE 2	*This phase is concerned with establishing whether contamination is present, usually through intrusive ground investigation, and then evaluating the degree and magnitude of the associated risks.*	***Risk Estimation*** *A stage concerned with estimating the likelihood that receptors will suffer adverse effects if they come into contact with, or are otherwise affected by, a hazardous substance or agent under defined conditions.* ***Risk Evaluation*** *A stage of risk assessment concerned with evaluating the acceptability of estimated risks, taking into account the nature and scale of the risk estimates, any uncertainties associated with the assessment and the broad costs and benefits of taking action to mitigate risks.*
PHASE 3	*The appraisal and selection of remediation techniques, their implementation and verification.*	***Risk Management*** *The process whereby decisions are made to accept a known or assessed risk and/or the implementation of action to reduce the consequences or probabilities of occurrence.*

Risk Classification

The objective of risk assessment is to identify the nature and magnitude of the potential risks and should be based on a consideration of both:

- *The likelihood/probability of an event [taking into account both the presence of the hazard and receptor and the integrity of the pathway].*
- *The severity of the potential consequence [taking into account both the potential severity of the hazard and the sensitivity of the receptor].*

There is a need for a logical, transparent and repeatable system in defining the categories of severity of consequence and likelihood as well as for the risk itself and therefore the following risk rating matrix is employed:

		SEVERITY OF CONSEQUENCE			
		SEVERE	***MEDIUM***	***MILD***	***MINOR***
PROBABILITY	***HIGH LIKELIHOOD***	*Very High Risk*	*High Risk*	*Moderate Risk*	*Moderate/Low Risk*
	LIKELY	*High Risk*	*Moderate Risk*	*Moderate/Low Risk*	*Low Risk*
	LOW LIKELIHOOD	*Moderate Risk*	*Moderate/Low Risk*	*Low Risk*	*Negligible Risk*
	UNLIKELY	*Moderate/Low Risk*	*Low Risk*	*Negligible Risk*	*Negligible Risk*

These risk classifications are defined as follows:

- *Very High Risk - There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.*
- *High Risk - Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.*
- *Moderate Risk - It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.*
- *Low Risk - It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised any effects would be mild.*
- *Negligible Risk - The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.*

This risk assessment matrix and classification system is based on guidance produced by Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency in connection with contaminated land assessment.

RISK ESTIMATION - GROUND GAS

Introduction

A variety of potentially hazardous gases occur in naturally in the ground environment. Microbial decay of organic matter under anaerobic conditions and geological processes can lead to the generation of Methane and Carbon Dioxide, but can also include traces gases such as Hydrogen sulphide and Carbon monoxide.

Methane is a colourless and odourless gas that has the hazardous properties of being flammable and, at certain air/Methane mixtures, explosive. Methane has a low toxicity, but can be a simple asphyxiant due to the displacement of oxygen.

Carbon Dioxide is a colourless, odourless and non-combustible gas that has the hazardous property of being a highly toxic chemical. At concentrations of 3% by volume, shortness of breath and headaches will occur becoming acute by 6%. At levels of above 10% by volume headache, visual distortion, tremors and rapid loss of consciousness occur. Concentrations of Carbon Dioxide above 22% by volume are likely to be fatal. The effects of Carbon Dioxide poisoning are made more severe if there is accompanying reduction in oxygen concentrations.

Hydrogen sulphide is a colourless and flammable gas that has an odour of rotten eggs. It is important to that the sense of smell is over powered at higher concentrations. The gas is toxic and can be an asphyxiant.

Carbon monoxide is a colourless, odourless and explosive gas in air mixtures that has the hazardous property of being a highly toxic chemical.

Radon is a naturally occurring colourless and odourless gas that is radioactive. It is formed by the radioactive decay of radium which in turn is derived from the radioactive decay of uranium, both of which are minerals that can be found in many soil types. Whilst it is recognised that the air inside every building contains radon, some buildings built in certain defined areas of the country might have unacceptably high concentrations and require special precautions to be taken. The maps contained within BRE211:2015 'Radon: guidance on protective measures for new buildings' identify areas where no radon protection measures are necessary or where higher concentrations are present that either basic or full radon protection measures are required to be fitted to all new buildings, extensions or refurbishments.

Basis of Gas Assessment

In order to classify the level of risk and need, if any, for gas protection measures at a site with the potential for a gas problem, consideration of each of the following is necessary:

- *The source of the gas.*
- *The generation potential of the gas.*
- *The location of the source and the geological setting.*
- *Boreholes flow rate and estimated surface emission rate.*
- *The nature of the proposed development.*
- *Confidence in the knowledge of the gas regime.*

The gas assessment is made with reference to 'C665 - Assessing risks posed by hazardous ground gases to buildings', Construction Industry Research and Information Association (CIRIA), 2007 and 'BS8485:2015 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' BSi 2015.

Gas Screening Value

The methods within CIRIA C665 and BS8485 both use the gas concentrations together with the borehole flow rates to define a characteristic situation for a site based on the limiting borehole gas volume flow for Methane and Carbon Dioxide. This limiting borehole gas volume flow is called the Gas Screening Value (GSV) and is expressed below:

Gas Screening Value (l /hr) = borehole flow rate (l/hr) x gas concentration (fraction)

The calculation of GSV is completed for both Methane and Carbon Dioxide and then the 'worse case' maximum values are used in the assessment. The assessment is to determine the gas regime at the site is dependent upon the nature of the development.

Characteristic Gas Situation

The characteristic situation for many sites is determined from evaluation of the Gas Screening Value derived against the criteria in the following table.

Characteristic situation	Hazard potential	Gas Screening Value (CH4 or CO2 l/hr)	Additional factors
CS1	Very low risk	<0.07	Typically Methane ≤1% and/or Carbon Dioxide ≤5%. Otherwise consider an increase to characteristic situation 2.
CS2	Low risk	0.07 to <0.7	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider an increase to characteristic situation 3.
CS3	Moderate risk	0.7 to <3.5	-
CS4	Moderate to high risk	3.5 to <15	-
CS5	High risk	15 to <70	-
CS6	Very high risk	>70	-

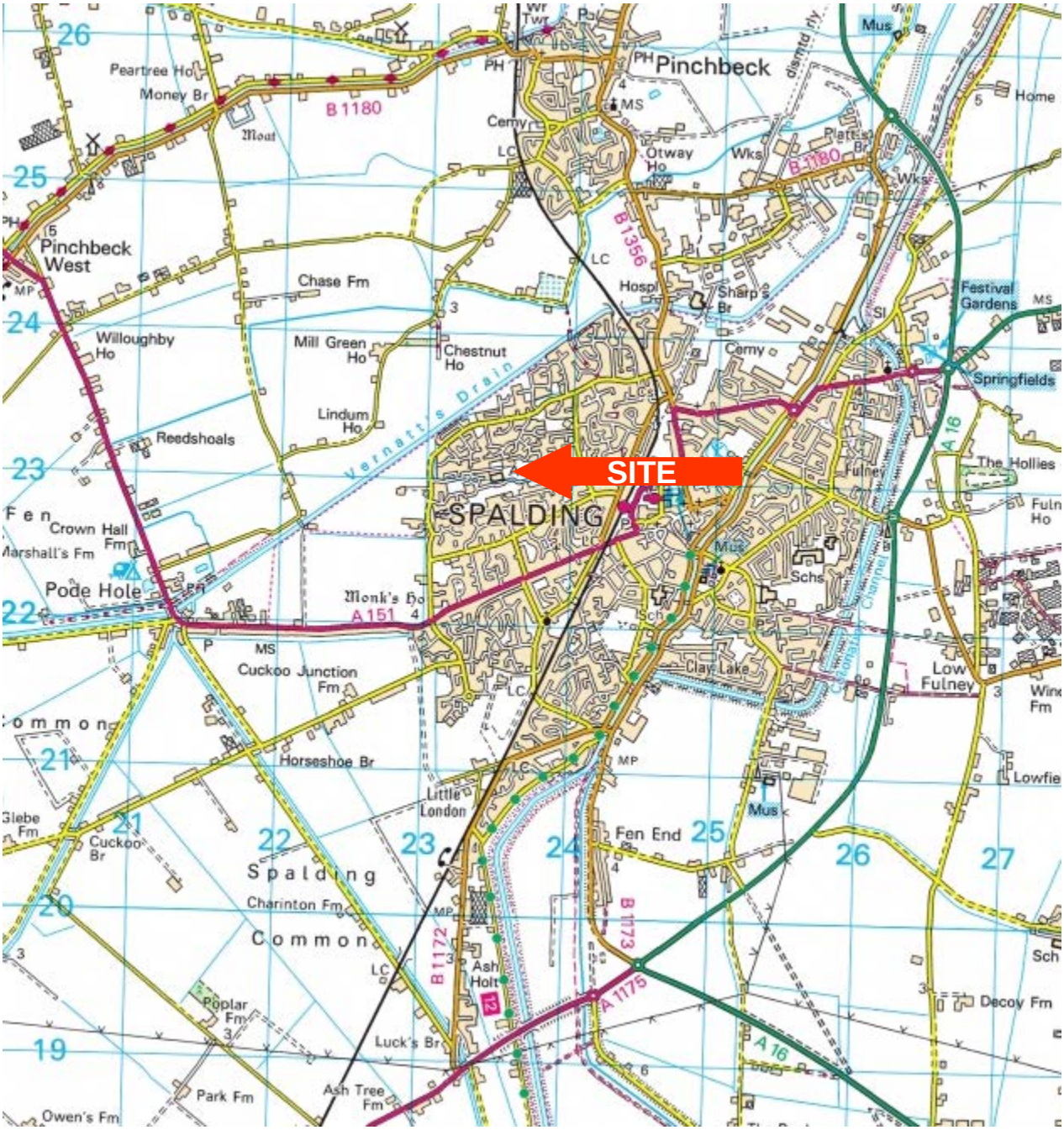
Low rise housing with gardens – NHBC 'Traffic Lights'

The NHBC model for low rise housing development considered a typical residential house with a ground floor area of 64m^2, suspended floor and ventilated sub-floor void of height 150mm. Where the proposed development of a site is consistent with this model, the NHBC traffic light situation of the site is determined from evaluation of the Gas Screening Value against the criteria in the following table.

Traffic Lights	Methane		Carbon Dioxide	
	Typical maximum concentrations (%)	Gas Screening Value (l/hr)	Typical maximum concentrations (%)	Gas Screening Value (l/hr)
Green	≤1	≤0.16	≤5	≤0.78
Amber 1	1> to ≤5	>0.16 to ≤0.63	>5 to ≤10	>0.78 to ≤1.56
Amber 2	5> to ≤20	>0.63 to ≤1.56	>10 to ≤30	>1.56 to ≤3.13
Red	>20	>1.56	>30	>3.13

APPENDIX 1

Site Location Plan



Not to scale.

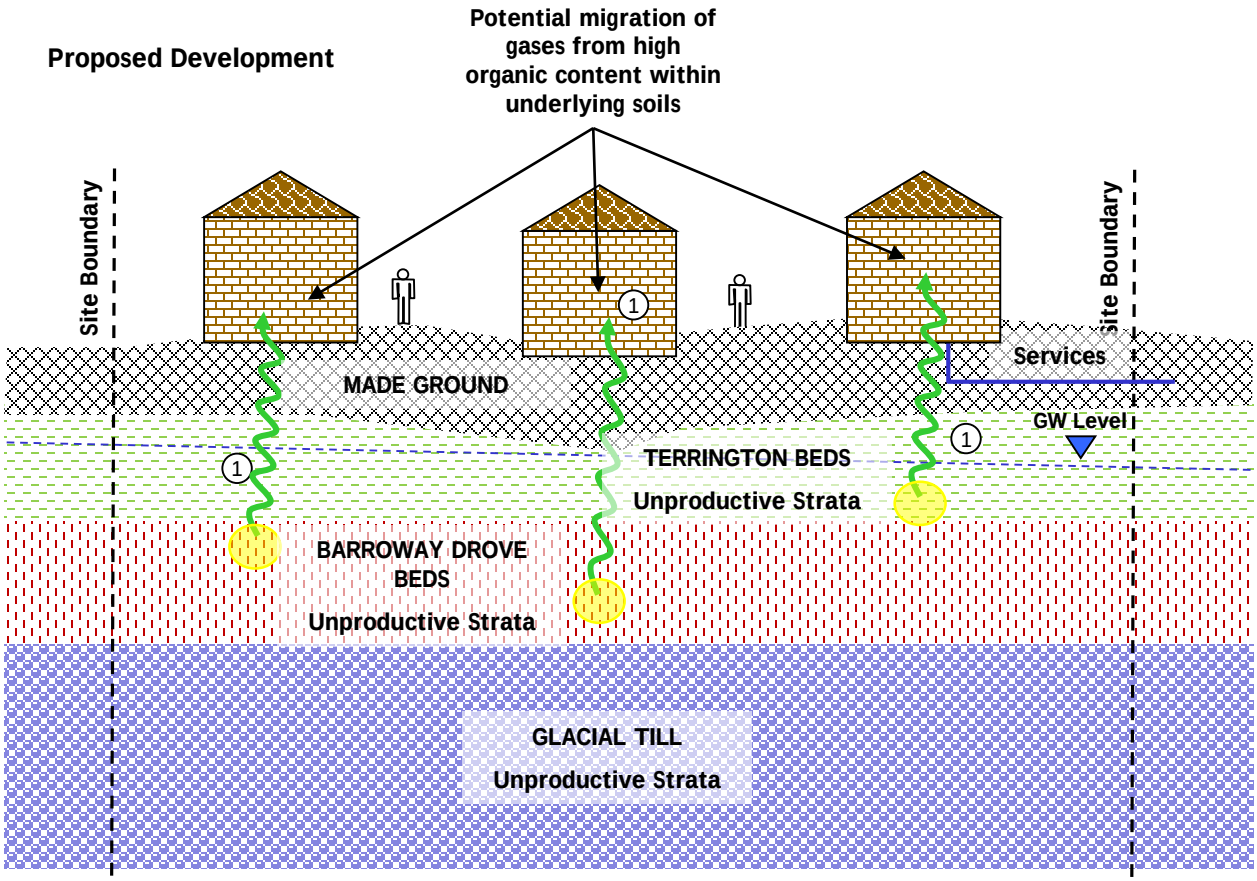
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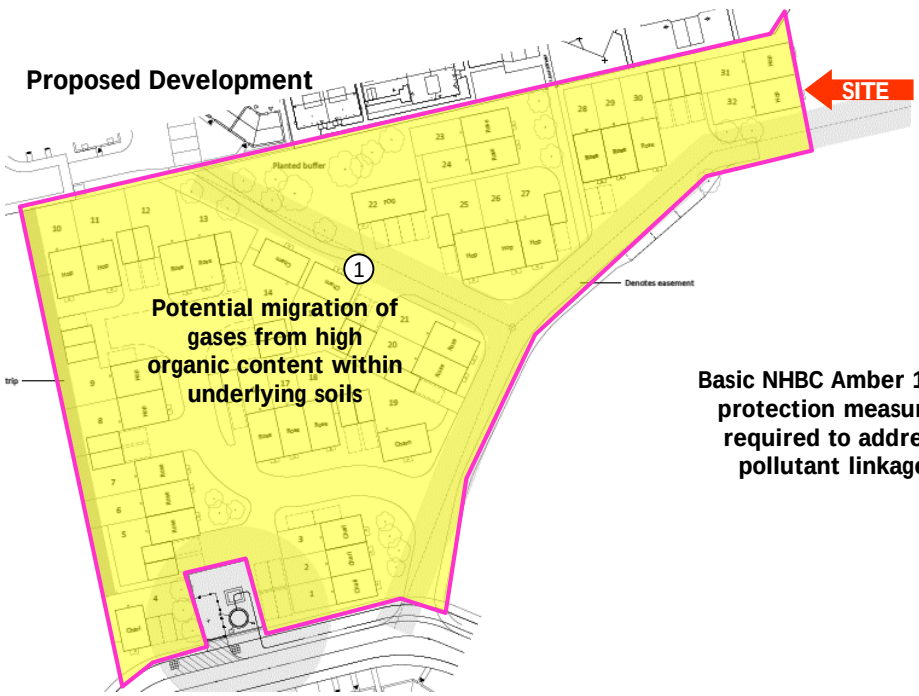
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Project Title:	Public Open Space, Wygate Park, Spalding
Client:	Kier Living
BRD Reference:	BRD241183-OP6-A
Date Issued:	October 2018

BRD
01295 272244
info@brduk.com

Revised Conceptual Site Model





N

Basic NHBC Amber 1 gas protection measures required to address pollutant linkage

Project Title:	Public Open Space, Wygate Park, Spalding
Client:	Kier Living
BRD Reference:	BRD241183-OP8-B
Date Issued:	September 2019

BRD
01295 272244
info@brduk.com

House Type	Beds	Floor area m²	No. of units	Total floor area m²
Charlton (Shelly)	2	63.9	5	319.5
Rosewood (Palmerston)	3	107.08	15	1606.2
Hopwood (Bluebell)	3	86.22	9	775.98
Charnwood (Ashingdon)	3	79.68	3	239.04
Frampton	2	65.46	2	130.92
			34	**3071.64**

Denotes underground pipe

Denotes easement

Street scene 1

Adoptable turning head 2

Adoptable turning head 1

5m road with 2m footway

Acoustic fence along western boundary

Open space area to be re graded and leveled

29 spaces

Planted bund (5m wide x 2m high)

Community Hall

Re graded swale/ pond

Line of existing swale

Kerb drop/ rise

Street scene 2

Pergola to cover parking area & dropped kerb to plot 1

Dropped kerb to plot 4

1.8m FOOTWAY

ROAD 2

DROPPED KERB

PC

HP Ch 89.421

N

0 5 10 15 20 25m

Notes

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CDM 2015
This drawing is for illustrative purposes and/or obtaining the relevant planning permission only. It should not be used for construction and accordingly, risk identification under the Construction (Design & Management) Regulations 2015 has not been undertaken.

* Denotes garage

Boundary Treatments Key

- 1.8m high close boarded fence
- 1.8m high acoustic fence
- 1.2m high post & rail fence
- 0.5m high knee rail fence
- 1.8m high garden wall
- Existing metal fence
- Existing metal fence to be replaced or retained with the addition of a 1.8m high close boarded fence

Rev	Description	Date

rdc
Robert Doughty Consultancy

32 High Street, Helpringham
Sleaford, Lincolnshire, NG34 0RA

Tel: 01529 421646
Email: admin@rdc-landplan.co.uk
Web: www.rdc-landplan.co.uk

Client
Kier Living Ltd

Project
Central Open Space
Wygate Park, Spalding

Drawing
Site Plan

Scale @ A2	Date
1: 500	22/10/18

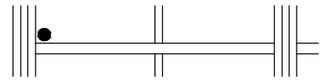
Drawn By	Checked By
WW	RJCD

Job Number	Status	Purpose of Issue
520-247	PL	Planning

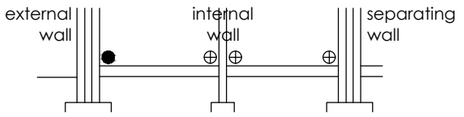
Drawing No.	Rev
520-247_PL_SP101	-

Notes

WHERE SEALANT IS NECESSARY TO MEET PART L ROBUST DETAILS



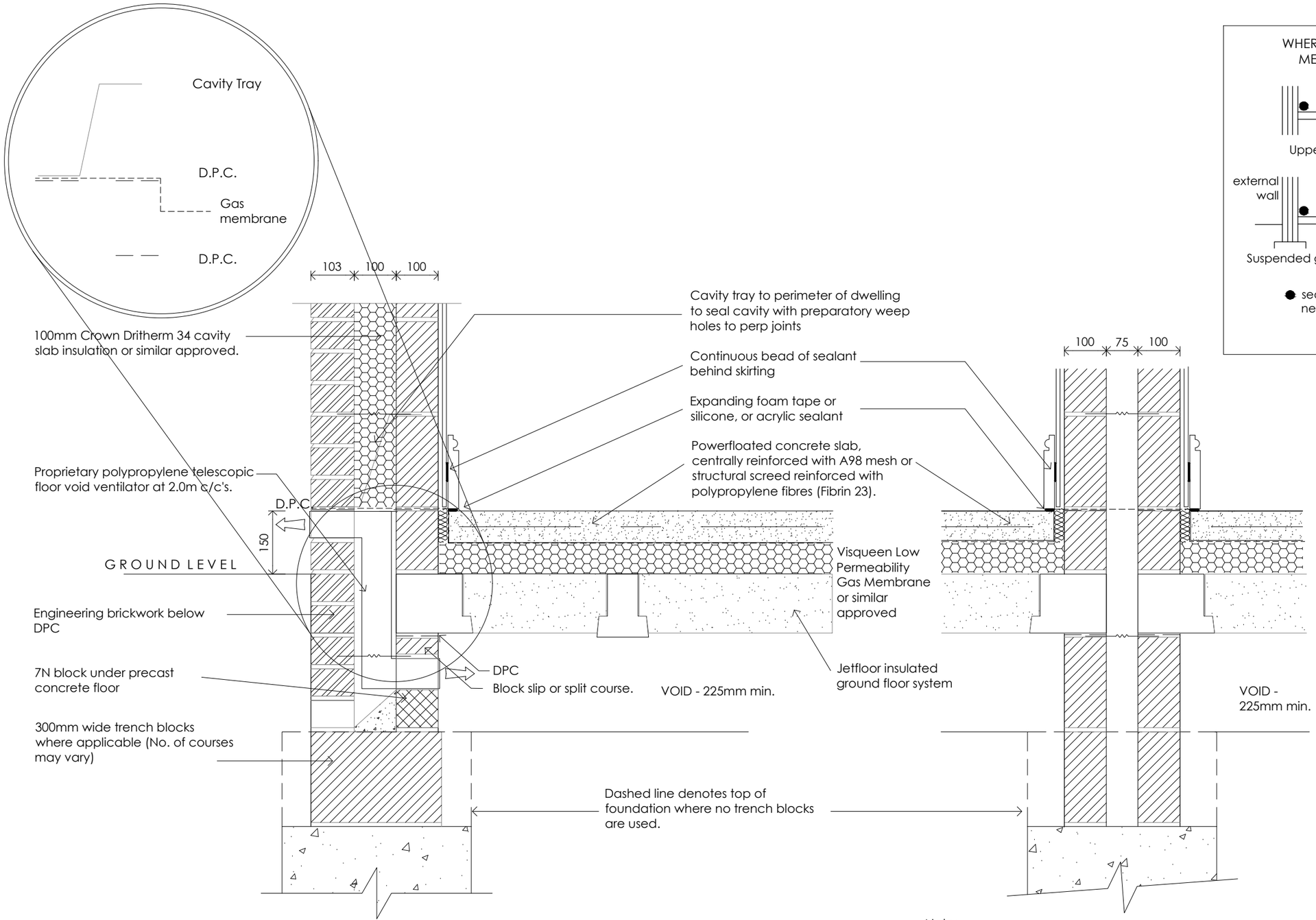
Upper floor with dry lining to walls



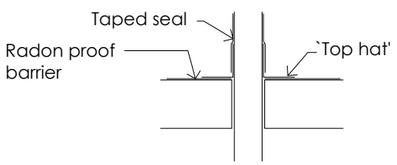
Suspended ground floor with dry lining to walls

● sealant needed

⊕ sealant needed unless the floor dpm (where provided) links with the wall dpc



Note:
Integral garage with occupied rooms above or with direct access via a doorway from the garage to the house needs the same provision as the rest of the dwelling



SERVICE ENTRIES

Note:
All service pipes, cables, ducts etc, must be sealed where they penetrate the vapour barrier see detail below

Rev	Date	By	Details

KIER

Kier Partnership Homes
Lysander House
Tempsford Hall
Sandy
Bedfordshire
SG19 2BD
Tel: 01767 642500 Fax: 01767 642628

Project: WYGATE PARK

SPALDING - WYGATE POS

Drawing:
Amber 1 Protection
Floor Construction Option 1

Drawing File Location:

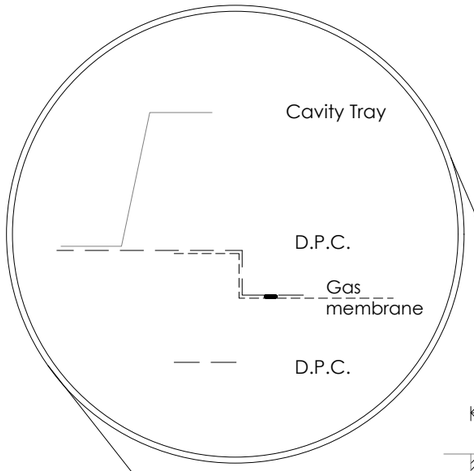
Drawn by:	Date:
C	29-05-2019
Scale:	COINS code:
1:10 @ A3	------

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All dimensions to be checked on site.
Any discrepancies to be reported to the Architect immediately.
This drawing should not be scaled.

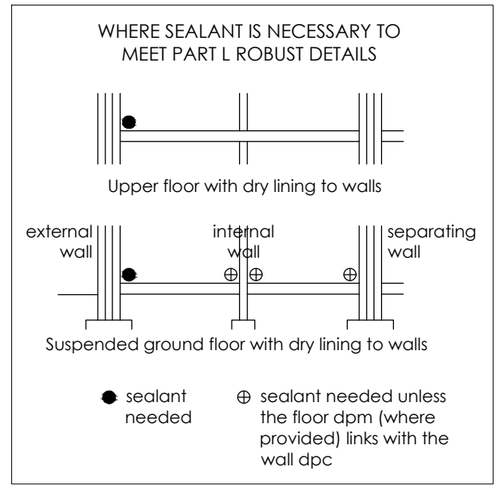
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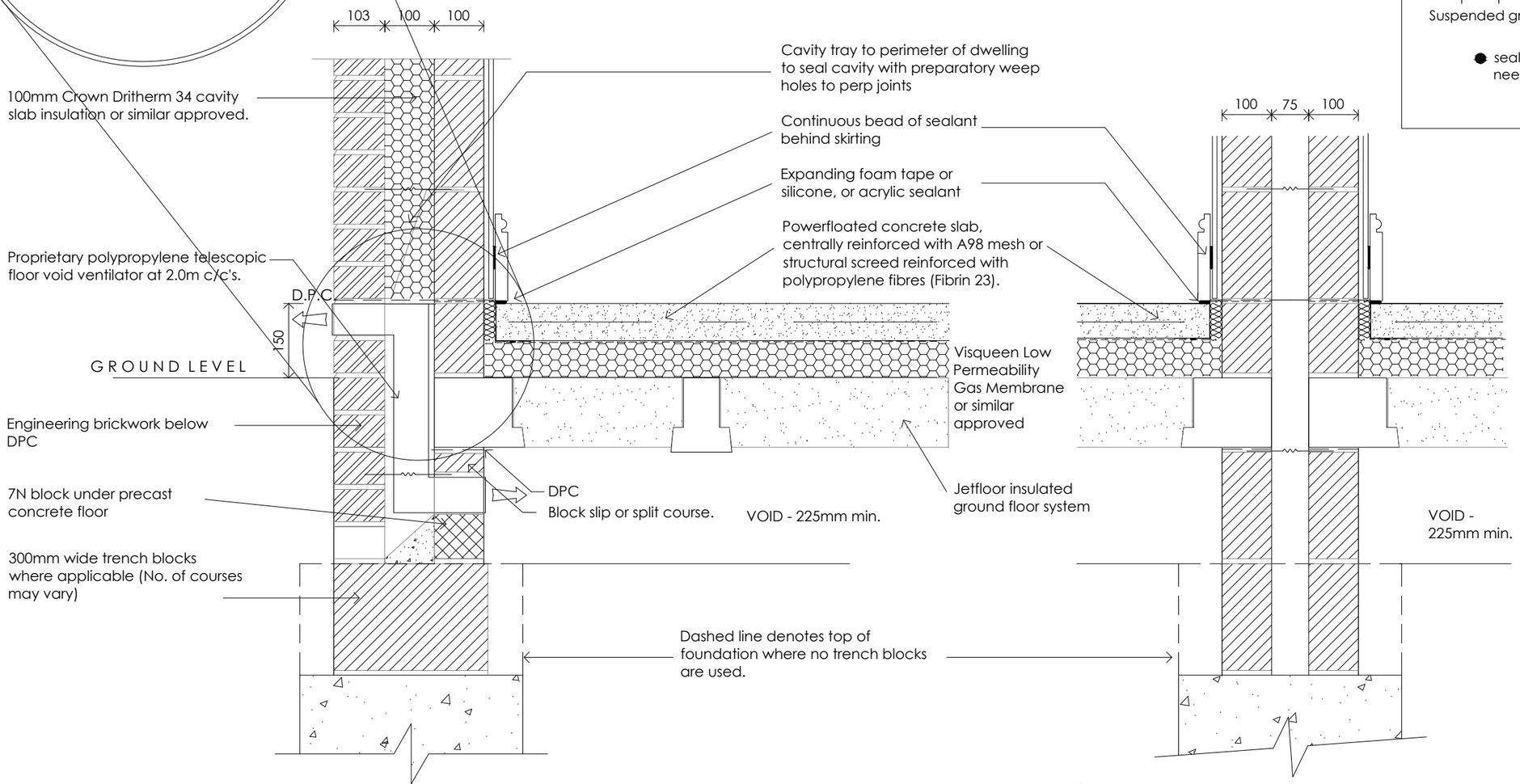
Revision: _

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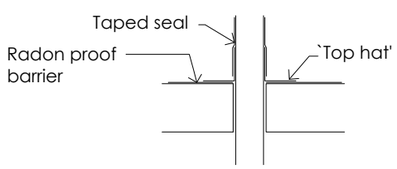


SHOULD OPTION 2 BE USED THEN VISQUEEN GAS RESISTANT DPC AND LAP TAPE MUST BE USED TO





Note:
Integral garage with occupied rooms above or with direct access via a doorway from the garage to the house needs the same provision as the rest of the dwelling



SERVICE ENTRIES

Note:
All service pipes, cables, ducts etc, must be sealed where they penetrate the vapour barrier see detail below

Rev	Date	By	Details

KIER

Kier Partnership Homes
Lysander House
Tempsford Hall
Sandy
Bedfordshire
SG19 2BD
Tel: 01767 642500 Fax: 01767 642628

Project: WYGATE PARK
SPALDING - WYGATE POS

Drawing:
Amber 1 Protection
Floor Construction Option 2

Drawing File Location:

Drawn by:	Date:
C	29-05-2019
Scale: 1:10 @ A3	COINS code: ------

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Revision: _

APPENDIX 2

DATASHEET

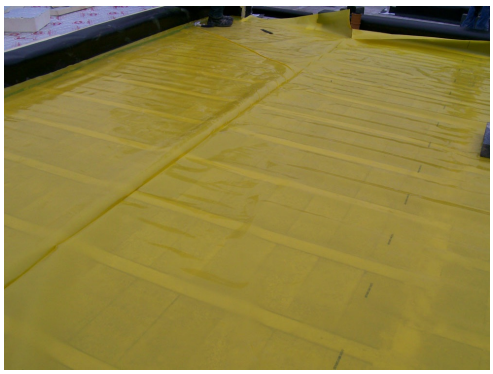
Technical Support: 0333 202 6800
LAST UPDATED: 12.11.2018

VISQUEEN LOW PERMEABILITY GAS MEMBRANE

Low Permeability Gas Membrane

CE Mark to EN 13967:2017







- **Approved for use in NHBC Amber 1**
- **High quality robust co-polymer thermoplastic membrane**
- **Supplied in centre folded sheeting which reduces the risk of cracks in screed**
- **A high performance radon membrane**
- **BBA Certificate 13/5069 and CE Mark 13967:2012**

Description

Visqueen Low Permeability Gas Membrane is a robust co-polymer thermoplastic membrane approved for use in NHBC Amber 1 and radon applications. For ease of identification on site the membrane is coloured yellow. The membrane is flexible, easy to install and supplied in a 4m x 12.5m roll.

The membrane is manufactured as a centre folded product to limit creases which aids jointing and welding applications on site. Centre Folded films can also help to reduce cracks found in structural concrete screeds where traditional multi-folded DPMs are used.

Applications

Visqueen Low Permeability Gas Membrane offers a safe solution for the protection of buildings and occupiers against, damp radon and on NHBC amber 1 site conditions. NHBC Technical Extra Document 20 contains further information on their traffic light application criteria and is available on this link.

BS8485:2015

Visqueen Low Permeability Gas Membrane does NOT meet the criteria of BS8485:2015 and should only be used on the above applications. To ensure correct specification Visqueen's new Gas Protection guide is an easy to use tool and contains a product selector - page 9 - and a gas membrane criteria check sheet on page 6.

Please click here to download Visqueen's Ultimate Gas Protection Guide.

Also, the product is not intended for use where there is risk of hydrostatic pressure.

System components

- Visqueen Double Sided Jointing Tape
- Visqueen Gas Resistant (GR) Foil Tape
- Visqueen Top Hat Units
- Visqueen TreadGUARD1500
- Visqueen Detailing Strip

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Installation

Visqueen Low Permeability Gas Membrane and ancillary components must be installed

in accordance with the recommendations of Building Research Establishment BRE 414 “Protective measures for housing on gas contaminated land”, NHBC guidelines and the Chartered Institute of Environmental Health Ground Gas Handbook.

The membrane should be installed on a smooth grouted surface allowing adequate overlap for jointing between the sheets. To avoid slip or shear planes and high compressive loadings it is not recommended to take the membrane through the wall. In order to provide a continuous barrier across the cavity Visqueen Zedex CPT DPC should be taken through the blockwork and incorporated below the damp proof course cavity tray in the outer leaf.

Laps can be joined together by either using the Visqueen Gas Barrier jointing system or welded by our specialist on-site contractors.

Radon areas
The membrane can be used as a robust solution under concrete slabs on a top of a smooth blinding layer.

Jointing and Sealing
Visqueen Low Permeability Gas Membrane should be overlapped by at least 150mm and bonded with Visqueen Double Sided Tape. The joint should then be secured with Visqueen Gas Resistant (GR) Foil Jointing Tape. Ensure that the membrane is clean and dry at the time of jointing. Airtight seals should be formed around all service entry points. Visqueen Pre-formed Top Hat Units must be used for sealing service entry pipes. The base of the top hat should be sealed using Visqueen Double Sided Tape and Visqueen GR Foil Jointing Tape should be used to secure the joint.

NB. In demanding site conditions use Visqueen Gas Lap Tape as a high performance alternative to Visqueen GR Foil Jointing Tape.

Storage and Handling
The membrane should be stored under cover in a dry environment. The material is not recommended for applications where it will be exposed to long periods of outdoor weathering as exposure to ultraviolet light will embrittle the product. Weathering will not occur when the membrane is installed in accordance with CP 102:1973. Care should be taken to avoid accidental damage when handling the membrane on site. When the weather is cold all jointing tapes should be kept in a warm and dry place until needed. Installation is not recommended below 5°C

Technical Data and CE Mark

Visqueen Low Permeability Gas Membrane complies with the requirements and clauses of EN 13967 - Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic rubber basement tanking sheet - Definitions and characteristics.

British Board of Agrement performed initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control, and issued certificate of constancy of conformity of factory production control. 0836–CPD – 13/F029 applies.

DATASHEET

Technical Support: 0333 202 6800
LAST UPDATED: 12.11.2018

VISQUEEN LOW PERMEABILITY GAS MEMBRANE

Low Permeability Gas Membrane

CE Mark to EN 13967:2017

Product Data

Product Data

Characteristic	Test method	Units	Compliance criteria	Value or Statement
Visible defects	EN 1850 -2	-	Pass/Fail	Pass
Length	EN 1848-2	m	-0%/+10%	12.5
Width	EN 1848-2	m	-2.5%/+2.5%	4
Straightness	EN 1848-2	-	Pass/Fail	Pass
Thickness	EN 1849-2	mm	-12%/+12%	0.5
Grammage	EN 1849-2		-12%/+12%	460
Tensile Strength - MD	EN EN12311		>MLV	20
Tensile Strength - TD	EN EN12311		>MLV	20
Tensile Elongation - MD	EN EN12311	%	>MLV	300
Tensile Elongation - TD	EN EN12311	%	>MLV	300
Joint Strength	EN12317-2	N	>MLV	298
Watertightness 2kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	>MLV	200
Durability (artificial ageing)	EN 1296 and EN 1928	-	Pass/Fail	Pass
Durability Chemical Resistance	EN 1847	-	Pass/Fail	Pass
Resistance to tearing (nail shank) CD	EN 12310-1	N	MDV	333
Resistance to tearing (nail shank) MD	EN 12310-1	N	MDV	335
Resistance to static loading	EN 12730	Kg	>MLV	Pass-20kgs
Water vapour transmission - resistance	EN 1931	MNs/g	MDV	2100
Water vapour transmission - permeability	EN 1931		MDV	0.08
Radon Permeability	SP Test Method		MDV	5.477x10-12
Radon Transmittance	SP Test Method	m/s	MDV	5.477x10-12
Carbon Dioxide Permeability	IS0 2782	m/s/Pa	MDV	2.8x10-17
Methane Permeability	IS0 2782	m/s/Pa	MDV	1.13x10-17
Reaction to Fire	EN 13501-1	Class	MDV	F

DATASHEET

Technical Support: 0333 202 6800
LAST UPDATED: 12.11.2018

VISQUEEN LOW PERMEABILITY GAS MEMBRANE

Low Permeability Gas Membrane

CE Mark to EN 13967:2017

Appendix A

About Visqueen

Visqueen is the market leader in the manufacture and supply of structural waterproofing and gas protection systems. Visqueen offers the complete package – a proven, reliable range backed by a technical support service that goes unmatched in the market - everything you would expect from a reputable and ethical company.

Complete Range, Complete Solution

- Structural Waterproofing
- Damp Proof Course
- Damp Proof Membranes
- Gas Protection and Gas Venting
- Vapour Control Layers
- Stormwater Protection

Download Library

- Technical Datasheet
- Standard Details
- Technical Service
- Visqueen Gas Protection Brochure
- NBS Clauses
- BBA Certificates
- Material Safety Datasheets
- Specification Guide

Find your local stockist

Search our directory of Visqueen specification Specialist Centres to locate your nearest Visqueen Partner.

Technical support throughout your project

We are specialists in our field and can help you specify the correct solutions with the necessary performance levels, in accordance with building regulations.

- Nationwide site support team
- Specification advice
- Installation guidance & project sign off
- System design including CAD details

CPD Seminars and Training Academy

Gas Protection CPD
The specification, technical design, and installation of gas protection systems, enabling the sustainable regeneration of brownfield sites.

Structural Waterproofing CPD
The specification, technical design, and installation of structural waterproofing systems for protection against water and damp ingress in both above and below ground projects.

Visqueen Training Academy
We are now able to offer exclusive in depth training opportunities on a wide variety of Visqueen products at our Training Academy.

Visqueen Special Projects
We provide high-level expertise, comprehensive support and experience in all types of waterproofing and gas protection.

VISQUEEN
Part of RPC bpi group
Heanor Gate Road, Heanor, Derbyshire, DE75 7RG
0333 202 6800 enquiries@visqueen.com www.visqueen.com

The information given in this datasheet is based on data and knowledge correct at the time of printing. Statements made are of a general nature and are not intended to apply to any use or application outside any referred to in the datasheet. As conditions of usage and installation are beyond our control we do not warrant performance obtained but strongly recommend that our installation guidelines and the relevant British Standard Codes of Practice are adhered to. Please contact us if you are in any doubt as to the suitability of application.

84 Lapping & Jointing
86 Service Pipe Penetrations
87 Sealing to Cavity Wall Constructions
88 Protecting Membranes
90 System Components

INSTALLATION/ SYSTEM COMPONENTS

LAPPING AND JOINTING

To ease the installation process we have created a step by step guide to all our system components to ensure effective jointing, continuity and protection.

GENERAL PRECAUTIONS FOR INSTALLATION

- Ensure that all surfaces to be jointed are dry, clean, and free from grease, mortar droppings, etc.
- Do not joint membranes and DPC/ cavity trays in temperatures below 5°C. In temperatures between 5 and 10°C, some warming with a hot air gun may be required.
- Use a roller to exert maximum pressure when joining sheets with Visqueen DPM Double Sided Jointing Tape.
- If the membrane is below a steel reinforced floor, concrete slab, cover with a screed or Visqueen Heavy Duty Protection Board prior to the positioning of the reinforcement.
- If the membrane is above the slab, delay installing the membrane until just before laying the screed or flooring topping (or thermal insulation where above the slab) to avoid damage from site traffic.
- Ensure that any screed laid directly on the membrane is at least 50mm thick.

IMPORTANT
The illustrations shown are for guideline installation purposes only. For the relevant system components for your application, please refer to the products "system components" table on p90

HOW TO LAP AND JOINT A MEMBRANE ABOVE A FLOOR SLAB

Visqueen Radon (red) membrane used for illustrative purposes only.



Remove loose debris from the surface of the floor slab and unroll the first sheet of membrane. The surface of the slab should be smooth and free from projections or indentations – if very rough, apply a sand blinding.



Remove the protective paper from one side of the appropriate jointing tape and apply it to the first sheet, starting about 50mm from the edge. Ensure that all surfaces are dry for maximum adhesion.



Unroll the second sheet along the joint, overlapping the first by at least 150mm. Press firmly onto the double sided tape, gradually removing the protective paper.



Seal the edge of the overlap with appropriate sealing tape.

HOW TO JOINT THE CAVITY TRAY TO THE MEMBRANE AT THE FLOOR PERIMETER

Visqueen Radon (red) membrane used for illustrative purposes only.



Install the DPC starting from the outside of the external wall, over the inner masonry leaf and finishing at least 200mm from the wall.



Just before the floor topping is applied (or floor slab is cast), clean any mortar droppings, or other debris from the DPC. Remove the protective paper from the appropriate jointing tape and apply the tape to the DPC, starting about 50mm from the edge.



Lay the membrane over the floor slab (or subfloor blinding), overlapping the DPC by at least 150mm. Press firmly onto the appropriate jointing tape, gradually removing the protective paper.



Seal the edge of the overlap with appropriate sealing tape.

HOW TO INSTALL A PRE-WELDED MEMBRANE



Ensure Visqueen Gas Barrier is laid on a level blinded surface.



Carefully unroll the pre-welded membrane.



Ensure that the membrane is not damaged during the unfolding process.



Visqueen Pre-Welded Membrane will fit exactly to the footprint dimensions.

HOW DO I REPAIR A GAS MEMBRANE IF PUNCTURED OR PERFORATED?

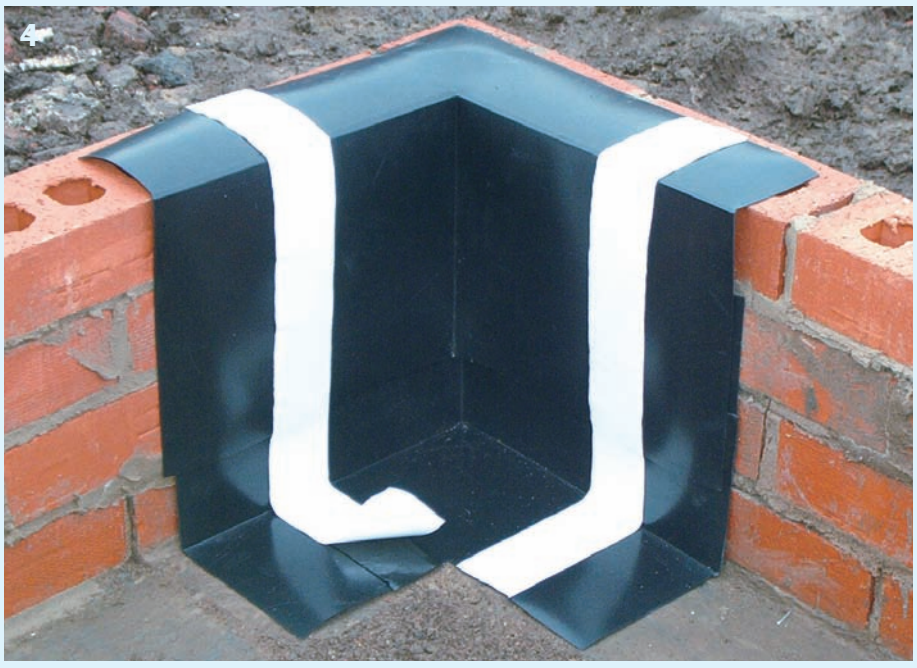
Any tears or punctures in the membrane should be patched using a piece of the same material sized to overlap at least 150mm beyond the extent of the puncture, the lap being bonded with Visqueen Double Sided Jointing Tape and sealed with Visqueen Foil Lap Tape.

HOW TO LINK PREFORMED COMPONENTS TO FORM A SEAL AT CORNERS









1) Build the masonry up to the height of the horizontal joint where the cavity tray is to be built in. Place the preformed upstand unit tight into the corner of the masonry wall.

2) Remove the protective paper from the back of the Visqueen Double Sided Jointing Tape and apply it to the upstand unit at a height that will ensure a good overlap when the downstand unit is in place. Remove the protective paper from the face of the tape.

3) Place the preformed downstand unit tight into the corner with the horizontal element sitting on the masonry wall. Press the vertical leg of the downstand unit firmly against the upstand unit, starting at the internal corner and working outwards.

4) Apply two lengths of double sided tape vertically across both upstand and downstand units, one on each return wall, ready to receive the lengths of cavity tray. When the cavity trays are sealed to the upstand units, join them to the floor membrane.

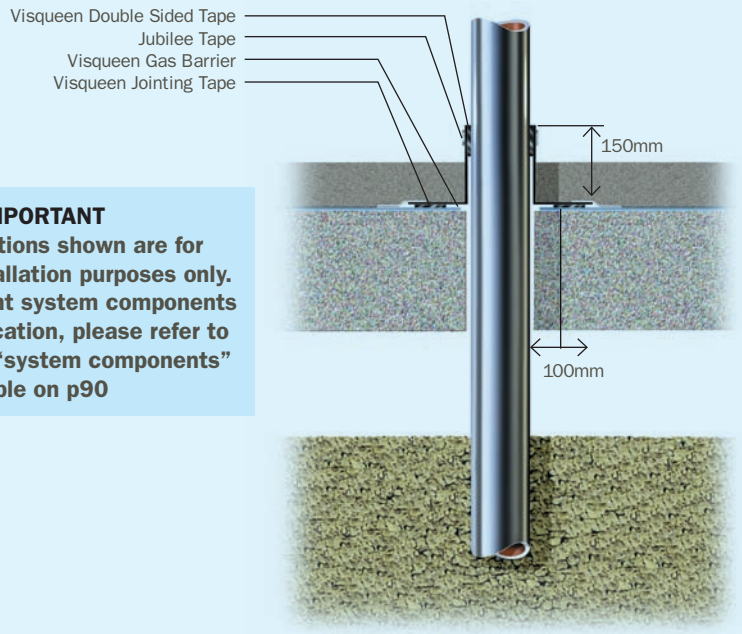
SERVICE PIPE PENETRATIONS

Damp proof and airtight seals should be formed around all service entry points. Visqueen Top Hat Units are available for sealing around pipe units. The full system consists of;

- Rigid preformed pipe sleeve (top hat) unit – available for either 110mm, 135mm or 160mm external diameter pipes.
- Flexible preformed pipe sleeve (Top Hat) unit – supplied to suit pipe external diameter as required.
- Double sided jointing tape.
- Girth lap tape.
- Foil lap tape – for gas applications.

IMPORTANT
The illustrations shown are for guideline installation purposes only. For the relevant system components for your application, please refer to the products "system components" table on p90

A TYPICAL TOP HAT DETAIL



HOW TO MAKE A GAS-TIGHT SEAL WHEN A PIPE PASSES THROUGH THE MEMBRANE

Visqueen Radon (red) membrane used for illustrative purposes only.



Cut a circular hole in the membrane as close as possible to the pipe, or pipe socket. Ensure that pipe penetrations do not occur at joints in the membrane.



With the pipe in position, slide the Visqueen Preformed Top Hat Unit over the pipe (various diameters are available – 110mm being the most common).



Mark the extent of the square horizontal skirt over the membrane and also mark the line of the top of the top hat unit around the pipe.



Raise the top hat unit and cut four lengths of Visqueen Double Sided Jointing Tape, one for each side of the horizontal skirt. Allowing for an overlap at each corner. Cut one length to go round the pipe.



Start to remove the protective paper from the double sided tape around the pipe and raise it up at an angle so that it will project above the top hat unit when it is stuck to the membrane.



Release the protective paper from each of the four lengths of double sided tape. Lower the top hat unit, ensuring that the free end of the protective paper around the pipe is reachable, and seal the horizontal skirt to the membrane.



Gradually remove the remainder of the protective paper from the double sided tape around the pipe.



Seal the junction of the horizontal skirt and the membrane with the appropriate sealing tape and secure the top hat unit to the pipe with a jubilee clip.

SEALING TO CAVITY WALL CONSTRUCTIONS

Visqueen supply various components to secure the DPC (tray and preformed units) to cavity wall constructions. The most common surface fix or face fixed applications are shown below.

VISQUEEN ZEDEX DPC FIXING STRIP AND PINS FOR MASONRY

DESCRIPTION

The fixing strip is a semi-flexible black plastic strip which is pre-drilled at approx. 150mm centres. The fixing pin is robust and strong incorporating a central nail. By hammering the central nail into the body of the fixing, it expands the fixing and secures it in the drilled hole.

APPLICATION

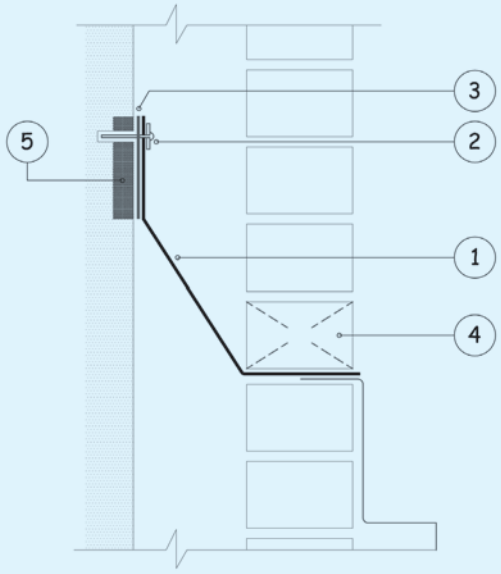
For securing surface (face) fixed DPC cavity trays to blockwork, cast concrete, etc, inner leaves of cavity wall constructions.

INSTALLATION

- Bond the vertical portion of the cavity tray to the inner leaf with Visqueen Zedex DPC Jointing Tape.
- At one end of the fixing strip, drill a 6mm diameter hole (through the DPC and tape) into the inner leaf of the cavity wall, to a depth of 55mm, using the hole in the fixing strip as a guide.
- Insert the fixing pin through the fixing strip into the drilled hole and secure in position.
- Repeat for each hole of the fixing strip.

A TYPICAL STANDARD SURFACE FIXING DETAIL FOR MASONRY IS SHOWN BELOW (SF-01)

KEY: 1) Visqueen Zedex CPT DPC (preformed cloaks to suit). 2) Visqueen Fixing Strip (25x2mm, pre-drilled with 8mm Ø holes). 3) Visqueen Zedex 100mm Jointing Tape on primed, flush inner skin. 4) Weepholes at 900mm centres (min 2no. per opening). 5) Visqueen HP Tanking Primer.



VISQUEEN ZEDEX DPC FIXING STRIP AND PINS FOR INSULATION

DESCRIPTION

The fixing strip is a semi-flexible black plastic strip which is pre-drilled at approx. 150mm centres. A strong and robust fixing pin with the purpose of securing the fixing strip and cavity tray in position.

APPLICATION

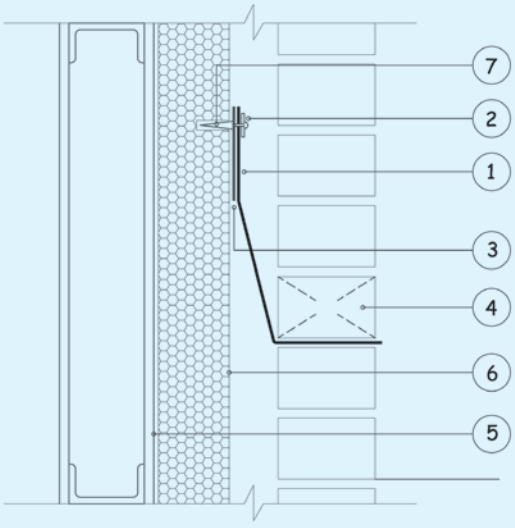
For securing surface (face) fixed DPC cavity trays to the rigid urethane foam facing of composite inner leaves in cavity wall constructions.

INSTALLATION

- Bond the vertical portion of the cavity tray to the inner leaf with Visqueen Zedex DPC Jointing Tape.
- At one end of the fixing strip, use a bradawl to form a pilot hole (through the DPC and tape) into the insulation, using the hole in the fixing strip as a guide.
- Push the fixing pin through the fixing strip into the pilot hole.
- Repeat for each hole of the fixing strip.

A TYPICAL STANDARD SURFACE FIXING DETAIL FOR METAL FRAME IS SHOWN BELOW (SF-02)

KEY: 1) Visqueen Zedex CPT DPC (preformed cloaks to suit). 2) Visqueen Fixing Strip (25x2mm, pre-drilled with 8mm Ø holes) Visqueen Fixing Pins at 150mm centres. 3) Visqueen Zedex 100mm Jointing Tape. 4) Weepholes at 900mm centres (min 2no. per opening). 5) Metal frame construction by specialist. 6) Rigid insulation board. 7) Visqueen No.2 Fixings.



PROTECTING MEMBRANES

Visqueen offer three different protection boards to suit a variety of applications. From a bitumen composition to a reinforced LDPE blend, the varying boards are all;

— Light and easy to handle: allows ease of storage and transferring on site.
— Easy to install – can be cut and shaped on site.

VISQUEEN PROTECTION BOARDS

Heavy Duty – a tough, durable and rot resistant bituminous board that protects DPMs and tanking DPMs against mechanical damage, pedestrian or vehicular traffic and puncture from backfilling. Available in 1m x 2m x 3mm board.

Light Duty – a strong corrugated plastic board that protects Stormwater, UDG, membranes from backfill. Also protects loose laid membranes from following trades. Available in 1.22mm x 2.44mm x 3mm board.

High Impact – a reinforced PE compound board that protects DPMs and tanking DPMs against mechanical damage, pedestrian or vehicular traffic and puncture from backfilling. Available in 1.22mm x 2.44mm x 1mm board.

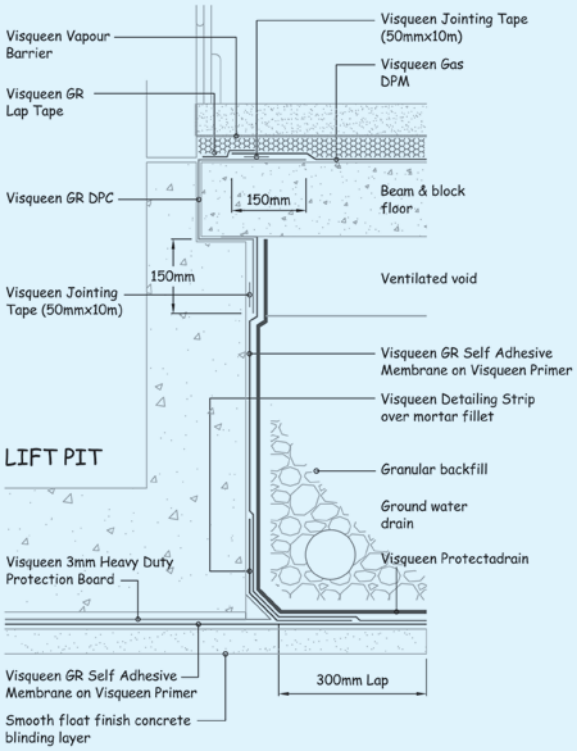
Protect&Drain – acts as a heavy duty protection medium for Visqueen damp proofing, gas proofing and tanking membranes. The product is 6mm thick and supplied in rolls 1.1m x 50m.

INSTALLATION

Boards are loose laid and butt jointed. Where necessary the joints can be over taped with Visqueen Girth Jointing Tape applied equidistant over the junction. Ensure surfaces are clean and dry prior to application of tape. Apply pressure to the tape to ensure adhesion.

An example detail shows where protection boards are used.

EXTERNALLY TANKED LIFT PIT SUSPENDED FLOOR (SW-03)



APPENDIX 3

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Hawthorne Villa, 1 Old Parr Road,
Banbury, Oxfordshire, OX16 5HT

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info@brduk.com
www.brduk.com

GAS PROTECTION MEASURES INSPECTION REPORT			
Site:		**Plot(s):**	
Project No.		**Gas Characteristic Situation:**	Amber 1 / Amber 2 CS2 / CS3 / CS4
Client:		**Development Type:**	Residential / Commercial
Inspection date:		**Building Description:**	Traditional Detached House
Inspection by:		**Foundation Type:**	Suspended floor / raft etc
Weather Conditions:		**Gas Protection Type:**	Passive / active

GAS MEMBRANE	
Gas Membrane Type:	
Membrane Condition:	
Underside of gas membrane:	
Jointing tape product:	
Laps, Welds and joint seals:	
Service entry seals:	

VENTILATION	
Sub-Floor Void:	
External wall air bricks:	
Internal sleeper walls:	
External vent trenches / ducts or other features:	

Photographs:

Photo 1 –

Photo 2 –

Photo 3 –

Photo 4 –

Photo 5 –

Photo 6 –

CONCLUSION:	