GeoDyne

Geotechnical &
Environmental
Consultants

Millfield House
Spalding Common
Spalding

Ground Gas Verification Plan
For
Seagate Homes Limited

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Project No: D44007		**Date: 3rd May 2024**	
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Comments			

1.0 INTRODUCTION

1.1 Introduction

GeoDyne Ltd has been instructed by the Client, Seagate Homes to prepare a Ground Gas Verification Plan relating to a development site to the east of Spalding Common, Spalding.

1.2 Project Understanding

It is understood that it is proposed to develop the site with 9No. houses with associated gardens, parking and an access road.

The proposed site layout is shown on the following drawing which is included in Appendix I:

- Seagate Homes drawing '*Proposed Residential Development, Millfield Nursery, Spalding Common, Lincs. PE11 3AU – Site Plan*', drawing No. MHS-SH-PD-SP-02-C, dated 30th June 2023 (Revision C).

1.3 Previous Works

The following report has previously been prepared for the site:

- GeoDyne Limited report entitled '*Millfield House, Spalding Common, Spalding – Environmental Assessment*' prepared for Seagate Homes Limited, Ref: D44007, dated 20th February 2024.

The Desk Study enquiries obtained as part of the above Environmental Assessment revealed the potential for hazardous ground gases (i.e. methane and carbon dioxide) at the site. It was proposed by the Client to install ground gas precautions at the site, in lieu of a programme of ground gas monitoring. This was based on the knowledge of the ground gas regime at their adjoining and ongoing residential development of the former Millfield Nurseries. The following relevant reports, which include the results of a programme of ground gas monitoring relate to the adjoining site:

- GeoDyne Limited report entitled '*Millfield Nursery, Spalding – Combined Phase I Desk Study & Phase II Exploratory Investigation*' prepared for Seagate Homes, Ref: D38185, dated 20th August 2019.

A summary of the foregoing reports, with respect to ground gas issues, is provided in Section 2.1. We would recommend that the above documents are read in conjunction with this report.

1.4 Details of Verification Plan

This Ground Gas Verification Plan (GGVP) is intended to act as a standalone document which draws together the information relating to the ground gas risk assessment and ground gas protection system design proposals (prepared by others) for the development. This GGVP has been prepared based on the requirements of BS8485:2015 +A1:2019 '*Code of practice for the design of protection measures for methane and carbon dioxide ground gases for new buildings*' and CIRIA guidance C735 '*Good Practice on the testing and verification of protection systems for buildings against hazardous ground gases*' (2014). These documents are hereafter referred to as BS8485 and C735, respectively.

We would note that the responsibility for the design of the ground gas protection system rests with others. This GGVP prepared by GeoDyne Ltd serves to summarise the ground gas protection system designed by others and provides a methodology for the verification of installed ground gas protection measures.

1.5 Limitations

Where comments in this report are made based on information obtained from third-parties, GeoDyne Ltd assumes that all third-party information is true and correct. No independent action has been undertaken to validate the findings of third-party information unless specifically stated.

This report has been prepared in accordance with our understanding of current good practice. However, changes to good practice, guidance or legislation may necessitate revision of this report after the date of issue.

This report relates solely to the verification of the ground gas protection system and does not address issues with respect to remediation and validation of gardens/soft landscaped areas or any pre-construction remediation (where applicable). For a detailed review of the sites setting and recommendations relating to all other matters, reference should be made to the reports referenced in Section 1.3.

GeoDyne Ltd has prepared this report for the sole use and reliance of the Client, Seagate Homes Limited, in accordance with our Standard Conditions and Limitations (included in Appendix VI). This report may not be used or relied upon by any unauthorised third-party without the explicit written agreement of GeoDyne Ltd.

2.0 SITE SPECIFIC GROUND GAS RISK ASSESSMENT

2.1 Summary of Environmental Assessment

The Environmental Assessment report, prepared for the current site area and referenced in Section 1.3 revealed the potential presence of sources of hazardous ground gases (i.e. methane and carbon dioxide) at the site. These sources were considered to be associated with any natural peat / organic deposits beneath the site and any infill materials to the former drainage ditch within the sites western boundary.

With respect to ground gas issues the Environmental Assessment report concluded '*It is understood that the Client is proposing to incorporate ground gas protective measures within the proposed dwellings which will be consistent with those installed at the ongoing adjoining residential development of the former Millfield Nurseries. The provision of ground gas protective measures is based on the Clients knowledge of the ground gas regime in the immediate vicinity of the site and is in lieu of a programme of ground gas monitoring at the current site.*

Therefore, it is understood that these protective measures will meet the requirements of Characteristic Situation CS2 in accordance with BS8485:2015 +A1:2019 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' and will include the provision of a clear ventilated sub-floor void (beneath a beam and block type floor) and well installed suitable ground gas resistant membrane (i.e. Juta GP-1, or similar). To comply with BS8485, the membrane should be validated by a third party in accordance with the requirements of CIRIA C735 'Good practice on the testing and verification of protection systems for buildings against hazardous ground gas' (2014). Should an alternative design of ground gas protection measures be proposed, this should be approved in writing by the Local Planning Authority / Warranty Provider in advance of implementation on site'.

2.2 Summary of Ground Gas Monitoring

A site-specific programme of ground gas monitoring has not been undertaken at the current site, however, the Client has based the proposals for the provision of ground gas protection measures at the current site on the findings of the programme of ground gas monitoring undertaken at the adjoining Millfield Nurseries site.

The findings of the programme undertaken at the adjoining former Millfield Nurseries site were reported in the reports referenced in Section 1.3 and may be summarised as follows:

Combined Phase I & II Works (2019)

As part of the Combined Phase I & II works, a total of 9No. ground gas monitoring points were installed across the site to facilitate an initial programme of ground gas monitoring which comprised 6No. monitoring visits carried out over a six week period.

The findings indicated that elevated concentrations of methane and carbon dioxide (up to 84.1% by volume and 14.7% by volume respectively), along with notable flow rates (up to 15.9 litres/hour) were recorded within one of the monitoring points (WS1). In the remaining 8No. monitoring points, low carbon dioxide concentrations (up to 1.6% by volume) and no methane were recorded. A maximum flow rate of 15.9 l/h was recorded within borehole WS1, with no or low flow rates (up to 0.3l/h peak rate) recorded within all remaining boreholes.

With respect to the assessment of ground gases, the Combined report concluded '*The results of the preliminary gas monitoring carried out at the site have indicated elevated ground gas concentrations and flow rates in one of the monitoring standpipes (WS1), with low ground gas concentrations and flow rates recorded elsewhere at the site. It is considered that the ground gas concentrations recorded at the site are likely to be due to the presence and degradation of Peat in the underlying Natural soils in WS1. However, it is noted that Peat has been encountered in a number of the other borehole locations where gas monitoring standpipes have been installed and monitored, yet only relatively low gas concentrations and flow rates have been recorded during the monitoring carried out elsewhere at the site.*

Given the noted variability of the ground gas readings recorded at the site, despite generally similar ground conditions being encountered across the site (including the presence of Peat in numerous locations), it is recommended that further characterisation of the site is undertaken from a ground gas risk assessment perspective, in order to determine the requirement for gas protection measures at the site. Further characterisation of the site is likely to involve the installation of further monitoring points and an extended period of ground gas monitoring and potentially detailed risk assessment works'.

Supplementary Monitoring Programme (September 2022)

Taking account of the conclusions within the Combined report a programme of supplementary ground gas monitoring was undertaken at the site. It is noted that the boundary of the site was changed between the time of the Combined works in 2019 and the Supplementary monitoring works in 2022, the previous borehole WS1 lies beyond the northeastern corner of the former Millfield Nurseries site boundary and it is understood that the area of the site which incorporates WS1 would be sold off as a separate development parcel.

At the time of the supplementary monitoring works, the original 9No. monitoring points were no longer present. In order to facilitate supplementary ground gas monitoring, a total of 12No. new ground gas monitoring points were installed across the current proposed development site area. This included boreholes advanced within the current site area in close proximity to the location of the former borehole WS1 (which is beyond the former Millfield Nurseries site).

The supplementary borehole installations were monitored on six occasions between June and September 2022. The Supplementary report provided a summary of all the ground gas monitoring visits undertaken at the site including WS1, together with a separate summary which just related to the boreholes. Taking account that WS1 is no longer within the site, the results relating to WS1 are excluded from following summary.

The monitoring of the boreholes (from both the initial and supplementary monitoring programmes) within the current proposed development site revealed a maximum methane concentration of 1.4% v/v and a maximum carbon dioxide concentration of 7.0% v/v. A maximum peak flow rate of 0.3 l/h was recorded. Gas Screening Values (GSVs) of 0.0014 l/h and 0.007 l/h were calculated for methane and carbon dioxide, respectively for the current site area.

2.3 Site Classification

With respect to the ground gas regime and site classification in accordance with BS8485, the Supplementary report noted that the site would be initially classified as Characteristic Situation CS1, based on the calculated GSVs. However, it was noted '*where methane and carbon dioxide concentrations exceed 1% and 5% by volume respectively, the British Standard recommends that consideration should be given to increasing the ground gas regime from CS1 to CS2.*

As carbon dioxide concentrations exceeding 5% by volume have been recorded in monitoring points across the proposed development area, together with a methane concentration exceeding 1% by volume locally, it is recommended that gas protection measures corresponding with a CS2 ground gas regime are adopted in the proposed new dwellings at the site.

It is also understood that it is proposed to raise levels across the site as part of the development works including the placement of fill onto existing levels. The raising of site levels is considered as a potential material change to the ground gas regime, therefore it is recommended that the inclusion of gas protection measures within proposed new buildings would be an appropriate precautionary mitigation measure to protect future end users at the site.

In lieu of a programme of ground gas monitoring at the current site and taking account of the findings of the gas monitoring of the adjoining former Millfield Nurseries site, a CS2 classification is considered to be applicable to the current site.

2.4 Ground Gas Protection Score

To establish the level of ground gas protection required at a site, a ground gas protection score may be established from Table 4 of BS8485. The score takes account of the Characteristic Situation of the site and Building Classification (in accordance with Table 3 BS8485).

The gas protection score for the site is summarised in Table 1.

TABLE 1 – GROUND GAS PROTECTION SCORE

Development Proposals	Characteristic Situation (1)	Building Classification (2)	Gas Protection Points Required (3)
Residential Housing	CS2	A	**3.5**

Notes
(1) Characteristic Situation established from site specific ground gas monitoring data, in accordance with BS8485.
(2) Building Classification is considered to be the most applicable building type based on Table 3 BS8485.
(3) Ground Gas Protection Points in accordance with Table 4 BS8485.

On this basis, ground gas protection measures achieving a minimum score of 3.5 points should be included within all proposed dwellings at the site.

3.0 GAS PROTECTION SYSTEM

3.1 Introduction

In accordance with BS8485, the ground gas protection system should be designed to score an appropriate amount of points from two or more of the following elements:

- Structural barrier.
- Ventilation measures.
- Membrane.

The points assigned for each element vary on the design of that element, as detailed in Section 7.2 of BS8485.

3.2 Gas Protection System Summary

We understand that the dwellings will be constructed to be consistent with the dwellings on the adjoining former Millfield Nurseries site, this will include a suspended thermal precast beam and block type flooring system (eFloor Plus) with a clear ventilated void and a ground gas/ vapour resistant membrane.

The ground gas protection system is summarised in Table 2

TABLE 2 – GROUND GAS PROTECTION SYSTEM

Element	Proposed Design	Score Minimum
Structural Barrier	Precast beam and block type thermal flooring system (eFloor Plus)	0
Ventilation Measures	Minimum 150mm clear void with periscopic airbricks and good performance sub-floor cross ventilation	1.5 (1)
Membrane	Juta GP-1 (2)	2 (3)
	Total Minimum Points score for gas protection system	**3.5**

Notes
(1) Assuming good performance passive sub floor dispersal layer for proposed ventilation design. A higher score (2.5 points, for very good performance) may be achievable subject to demonstrable full compliance with the requirements of Appendix B.6 of BS8485:2015 with respect to the sub-floor void, inclusion of side ventilation and ventilation of internal obstructions.
(2) The properties of the Juta Titanflex membrane are summarised in Section 3.5.
(3) For a membrane to achieve 2 points, the membrane must satisfy the performance criteria detailed within Table 7 BS8485, inclusive of third-party verification in accordance with C735.

Table 2 reveals that the proposed ground gas protection system for the proposed dwellings will achieve a minimum score of 3.5 points, which is in compliance with the requirements of BS8485.

The following standard detail drawing relating to the ground gas protection measures is included in Appendix II:

- Seagate Homes drawing '*Gas Membrane Details*', drawing No. MNSC-SH-SD-AR-3004, dated January 2023, Revision A.

Each element of the ground gas protection system is detailed in the following sections.

3.3 Structural Barrier

The floor slab for the dwellings will be an eFloor Plus flooring system. We understand this comprises an insulated precast concrete flooring system. The membrane is to be laid over the insulation and directly beneath the screed/structural surface topping.

The Gas Membrane Details drawing (Appendix II) shows a schematic section through the proposed insulated flooring system.

3.4 Ventilation Measures

It is understood from the Standard Detail drawings (included in Appendix II) that a minimum sub-floor void of 150mm will be constructed beneath the dwellings, with periscopic vents. The periscopic vents are to be provided to all external walls of the dwellings at maximum 2m centres and positioned to avoid doorways.

Sub-slab cross ventilation is also to be provided within internal walls, these are to comprise gaps within the blockwork spaced at maximum 2m centres.

3.5 Gas Resistant Membrane

It is understood that the membrane to be installed in all plots will comprise the Juta GP-1 membrane, which is to be supplied and installed by MB Membranes in accordance with their Method Statement included in Appendix V.

The Juta GP-1 membrane comprises a multi-layer reinforced low density polyethylene (LDPE) membrane with an aluminium core. In accordance with the requirements of BS8485, the membrane is ISO15105-1 certificated and is indicated to have a methane transmission rate of ≤ 0.09 ml/m^2/day/atm which satisfies the performance criteria of BS 8485. A technical datasheet and BBA Certificate relating to the membrane is included in Appendix III.

3.6 Membrane Installation Process

It is anticipated that the membrane will be installed adopting a total lineout approach (i.e. the membrane will be installed in a single stage). The components of the Juta GP-1 system should form a continuous gas resistant barrier throughout the structure, across the cavities and across adjoining party walls between plots.

3.7 Jointing and Sealing Methodology

All joints will be formed by hot air fusion. The overlaps should be a minimum of 100mm.

Corner details and service penetrations will be fabricated from a compatible Self-Adhesive Gas Resistant Membrane (SAGRM). The SAGRM is bitumen based and incorporates a layer of aluminium foil.

3.8 Subgrade Preparation

The subgrade (i.e. insulation layer) should be swept to remove all debris prior to installation of the membrane. The subgrade should be inspected and approved by the installer prior to commencement of the membrane installation. Where a smooth surface cannot be achieved it may be necessary to provide a sand blinding or geotextile layer across the subgrade on top of which the membrane can be placed.

Any missing, broken or sunken blocks in the insulation layer should be replaced prior to installation of the membrane.

3.9 Screed

We understand that the screed is to be poured directly onto the installed membrane and the screed will be structural (i.e. is likely to include reinforcement). The ground gas membrane should at all times be suitably protected against the possibility of inadvertent puncture. Where required, a protective fleece/geotextile or similar should be employed to protect the membrane, as appropriate. The contractors responsible for pouring the floor should be made aware of the importance of the membrane and the need to protect it and work carefully to avoid any inadvertent damage.

The screed should be poured as soon as possible following the installation and validation of the membrane, to minimise the opportunity for damage to the membrane from both follow on trades and the elements. Where the membrane is left exposed to the elements for prolonged periods of time, the membrane and SAGRM may start to degrade.

Please note that we cannot validate a membrane that has been covered over by screed (or is otherwise not visible) prior to our attendance to site.

3.10 Membrane Installers & Qualifications

We understand that the membrane will be supplied and installed by MB Membranes, who are a specialist installation company.

The installation teams should ideally be led by an installer who holds an NVQ Level 2 qualification in Sub-Structure Work Occupations (Construction – Installation of Gas Membranes). We understand that some of the MB Membranes installers hold an NVQ Level 2 qualification and that their installation teams are led by a qualified installer.

4.0 RISK BASED APPROACH TO VERIFICATION

The site specific GSV calculated for methane and carbon dioxide based on the results of the monitoring programme revealed that the site would fall into characteristic situation CS1, however, the monitoring revealed concentrations of methane and carbon dioxide above the thresholds for sites where consideration should be given to increasing the characteristic situation to CS2. The CS2 classification may be regarded as 'Low Risk'.

Annex 1 of CIRIA C735 provides guidance with respect to the level of verification and integrity testing required on a development site. Table A3 of Annex 1 relates to low-rise housing developments with a ventilated void and is considered to be the most applicable table for the proposed dwellings at the site.

However, given that there are only nine plots within the current site area, it is considered appropriate to undertake a visual inspection of all plots. The visual inspection will be supplemented by mechanical point stress tests (i.e. pick tests).

5.0 VERIFICATION PROCESS

The following sections summarise our proposals to undertake a visual inspection of the ground gas protection measures installed at the site.

5.1 Inspecting Engineer(s)

Inspection of the gas protection system would be undertaken by a suitably trained and experienced Engineer from GeoDyne. As a minimum, our inspecting Engineers have attended '*The A – Z of Ground Gas*' training course jointly hosted by PAG and GGS or have undergone similar approved training. Our lead inspecting Engineers also hold a NVQ Level 4 qualification in '*Verification of Ground Gas Protection Systems*'.

Wherever possible we would propose for the same Engineer to carry out all inspection visits at the site to maintain consistency throughout the inspection process. Where this is not possible, we would endeavour to use as few Engineers as possible.

5.2 Inspection of Sub-Floor Ventilation Measures

As part of the verification process, photographic records of the sub-floor voids, including cross ventilation gaps, should be obtained by the Client, prior to construction of the Floor Plus System. These photographs should be forwarded to the inspecting Engineer (i.e. GeoDyne) for review. The inspecting Engineer will obtain supplementary photographs of any plots where the sub floor void is exposed during our inspection visits, and we will also assess the presence and condition of periscopic vents where accessible/visible.

5.3 Inspection of Subgrade

To minimise the risk of damage/punctures to the underside of the membrane, it is imperative that the upper surface of the eFloor Plus system is swept prior to installation of the membrane. Any missing, broken or sunken blocks in the insulation layer should be replaced prior to installation of the membrane.

The Installer should be satisfied that this has been carried out and where a suitably clean/level surface cannot be achieved it may be necessary to provide a sand blinding or geotextile layer over the sub-grade to minimise the risk of damage to the underside of the membrane.

5.4 Inspection of Membrane

A suitably trained and experienced third-party inspecting Engineer should attend site during the membrane installation process, to carry out a visual inspection together with mechanical stress testing i.e. pick testing (where appropriate and as far as practicable) of the membrane installed within the dwellings. Wherever possible the inspections should be carried out whilst the membrane installers are on site. The inspection should ensure that the installation is in general accordance with the Standard Detail drawing (Appendix II) and the specification of the membrane manufacturers in conjunction with the MB Membranes Method Statement (to be forwarded to the inspecting Engineer when it becomes available). The inspection should ensure that the membranes are suitably installed and free from damage and defects.

Third-party verification undertaken by GeoDyne Ltd represents a 'second check' of the membrane based on inspection of observable elements of the membrane on the day of our works. No responsibility will be taken for areas of membrane that cannot be inspected or for any damage which occurs to the membrane after our visit.

The inspections should be carried out in accordance with good practice and should include the following as a minimum.

- Review of the installer's relevant qualifications/training certificates (i.e. CSCS cards or NVQ certificates). Ideally the lead installer should hold an NVQ Level 2 qualification for membrane installation.
- Obtain photographic records of the membrane during the installation process. An '*Inspection of Gas Protection Measures*' pro forma (based on the requirements of CIRIA C735) should be completed for each plot inspected, to maintain records of the installed membranes (refer to Appendix IV).
- Visual inspection of the seams in the membrane to assess the continuity of the membrane throughout the dwellings. Mechanical point stress (Pick) tests will be undertaken along the edge of the seams to identify any unbonded seams, as far as practicable.
- Visual inspection of the seals around the corners and service pipe penetrations, with point stress testing adopted, where appropriate.
- Records of all materials used for ground gas protection (inclusive of serial numbers, where possible/appropriate) should be obtained during the inspection. Ideally a 'Test Weld/Joint' should be carried out on a section of membrane by the installer during each inspection visit, to be retained by the inspecting Engineer for in-house records.
- Should it become necessary for the membrane installers to deviate from the standard detail drawing, membrane manufacturers specifications (and the installers method statements) during the membrane installation, the inspecting Engineer should be notified by the Client. Confirmation and approval of such changes should be sought by the Client/ Membrane Installers from the inspecting Engineer and potentially the Local Authority (if the changes are deemed to be significant) prior to installation. Records and photographic evidence of any changes to the installation detail should be taken by the inspecting Engineer during the inspection visit.

5.5 Non-Compliances

Should any non-compliances (i.e. punctures/tears to the membrane, defective joints/seals etc.) be identified during the inspection, corrective action in accordance with the membrane manufacturers specification and industry good practice should be undertaken by the installer. Therefore, we would expect to see repair patches in accordance with current industry good practice. On this basis, repair patches (comprising SAGRM) should typically be a minimum of 200mm square (located centrally over and extending 100mm beyond the damage and fully adhered over the damage. Following appropriate repair of defective areas, the repair should be reinspected by the inspecting Engineer. A photographic record will be obtained of the defective/damaged areas of the membrane and subsequent repair works.

5.6 Completion of Inspection

Following satisfactory installation of the membrane and satisfactory repair to any defective/damaged areas of the membrane, the membrane will be considered to 'Pass' the verification process.

5.7 Post Inspection Membrane Protection

The Client should note that following inspection, the membranes should be appropriately protected during follow-on construction works to minimise damage. It should also be noted that where the membrane is left exposed to the elements for prolonged periods of time the membrane and SAGRM will be susceptible to damage and may start to degrade. Ideally, the finished floor (i.e. screed) should be poured as soon as possible following inspection to provide permanent protection to the membrane.

Alternatively, temporary protection may be provided which may comprise the provision of loose laid boarding over the membrane or the implementation of an exclusion zone preventing other Contractor's access onto the membrane prior to placement of insulation/pouring of screed.

Where unavoidable, any person(s) requiring entry onto the membrane should be provided with a Toolbox talk to raise awareness of the importance of the gas resistant membrane and to identify the risks associated with their entry, and control measures to be adopted. GeoDyne can provide the Toolbox talk if required.

Should any damage occur to the membrane following inspection, the Client should ensure that appropriate remedial action, in accordance with industry good practice and the protocols of the membrane manufacturer/installer is undertaken prior to pouring the screed. Any damage should be revalidated in accordance with the established methodology.

5.8 Service Pipe Penetrations

It should be borne in mind that where the service penetrations (typically 150mm pipes) are to be used as ducting for smaller service pipes (e.g. water or electricity supply etc.) an appropriate method of sealing the smaller pipes within the ducting should be adopted, (such as closed cell expanding foam) to minimise the risk of the ducting acting as a conduit for ground gases to enter the dwellings.

5.9 Role and Responsibilities

The following roles and responsibilities apply with respect to ground gas protection measures:

I Detailed design of ground gas protection system

The Client (or appointed consultant such as an Architect or Structural Engineer) is responsible for the detailed design of ground gas protection measures at the site, with protection measures being appropriate to the ground gas regime identified and compatible with the Clients construction methodology.

II Installation and certification of ground gas membrane

The membrane installation company is responsible for the supply of a suitable ground gas resistant membrane and ancillary products such as pre-formed top hats, corner details, seal tape and lap tape etc (where applicable).

The membrane company is responsible for the suitable installation of the ground gas membrane etc. An installation certificate should be provided by the membrane company to the Client for each plot.

Primary responsibility for the installation and certification of the installed ground gas membrane rests between the (specialist) membrane installation company and the Client.

III Third-party check on installed ground gas protection measures

Third-party verification undertaken by GeoDyne Ltd represents a 'second check' of the membrane based on inspection of observable elements of the membrane on the day of our works. No responsibility will be taken for areas of membrane that cannot be inspected (or are not accessible at the time of our visit) or for any damage which occurs to the membrane after our visit.

IV Post inspection protection and sealing of service pipes in ducting

The Client is responsible for providing suitable protection to the installed and inspected membrane. Should any damage occur to the membrane, appropriate repairs should be implemented by the Client and subject to third-party verification, as necessary. The Client should also ensure that following the installation of any services within ducting the services are appropriately sealed within the ducting to form a gas-tight seal.

6.0 VALIDATION REPORT PREPARATION

Validation reports will be prepared on a rolling basis to suit the requirements of the Client following completion of all elements of the gas protection measures installation. The validation reports will be prepared in general accordance with BS8485 and confirm the details of the materials used and include relevant photographic evidence of the membrane installed, to demonstrate compliance with the standard drawings and the installers method statement (to be forwarded to GeoDyne once available). Any variation from the standard drawings for the membrane installation will also be reported, with appropriate justification for the variation.

The Validation Report should typically include installation certificates prepared for each plot by the membrane installation company.

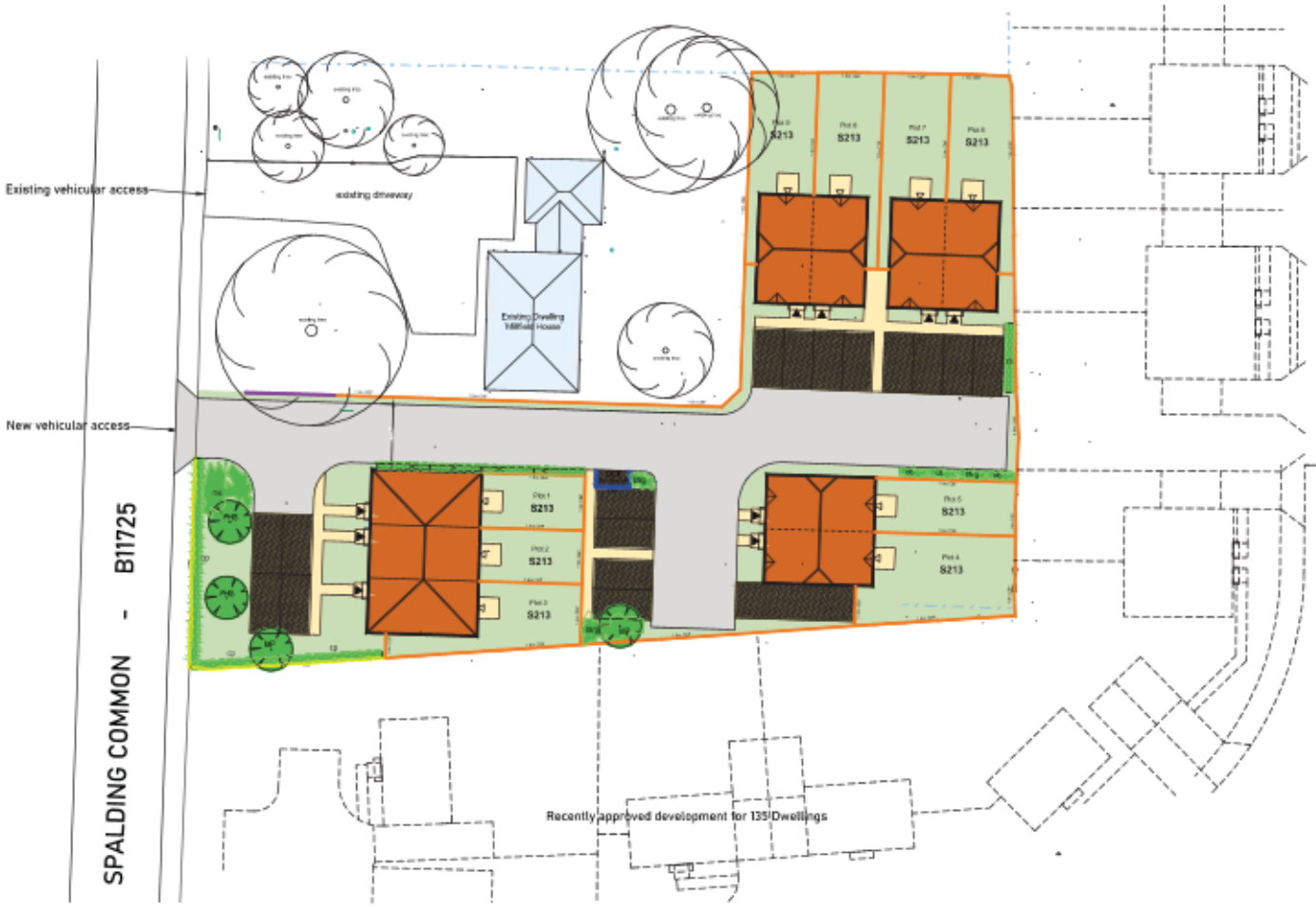
The Validation Report should be submitted by the Client, to the Local Authority for review and approval, as part of the planning process.

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APPENDIX I

Proposed Site Layout

MILLFIELD HOUSE, SPALDING COMMON





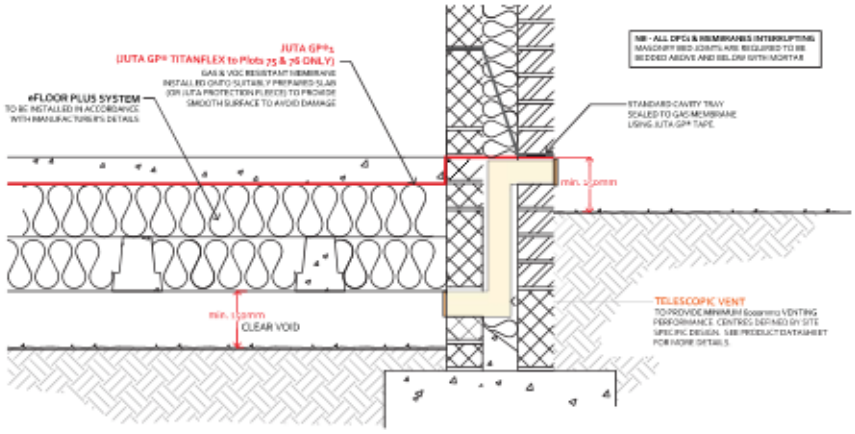


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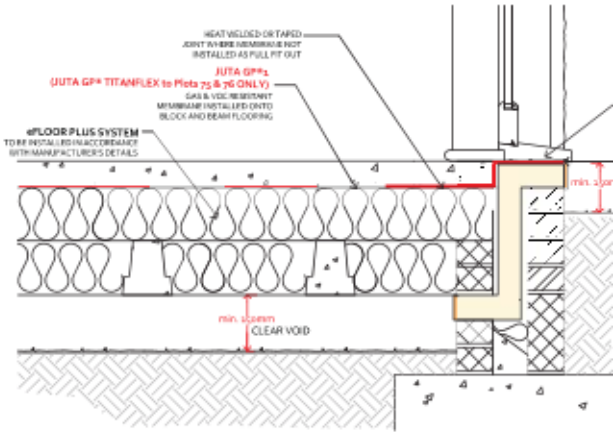
APPENDIX II

Seagate Homes Gas Membrane Details Drawing

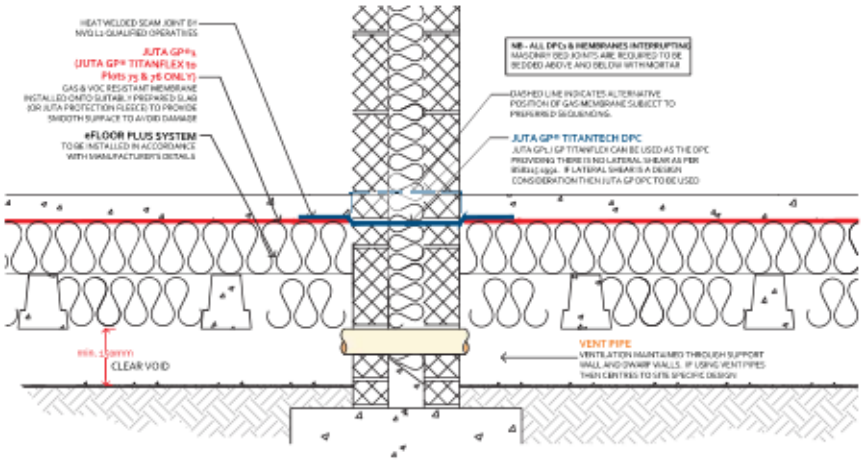
MILLFIELD NURSERIES - SPALDING COMMON



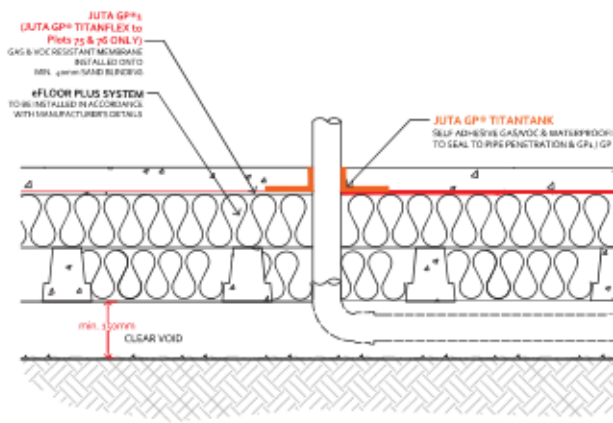
FLOOR / PERIMETER DETAIL - MEMBRANE ABOVE SLAB



FLOOR / PERIMETER DETAIL - TYPICAL THRESHOLD DETAIL



FLOOR / PARTY WALL DETAIL - STEPPED MEMBRANE



FLOOR DETAIL - PIPE PENETRATIONS

NOTE: DETAILS SHOWCASE GAS MEMBRANE PLACEMENT ONLY, BASED ON MANUFACTURER'S INFORMATION - ARCHITECTURAL DETAILS SHOWN ARE AN EXAMPLE ONL

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APPENDIX III

Membrane Technical Data & BBA Certificate

GP® 1

Rev: June 2019

Ground Gas Protection

Juta GP® 1 – Gas Barrier 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, VOC/Hydrocarbon vapors, air & moisture protection system.

JUTA GP® 1			
Characteristics	Test Method	Unit	JUTA GP® 1
Physical Properties			
Thickness	EN 1849-2	mm	0.6
Thickness - Between Scrim	BS EN ISO 9863-1:2016	Mm	0.4
Width	EN 1849-2	m	Various
Length	EN 1849-2	m	Various
Weight	EN 1849-2	G/M2	370
Hydraulic Properties			
Thickness	EN 20811	-	>300
Resistance to Water Penetration	EN 13967, EN 1928	-	Pass
Water Tightness	EN 1296, EN 1367, EN 1928	-	Pass
Hydraulic Properties			
Resistance to Static Load	EN 12730-B	Kg	20
Tensile Strength (MD)	EN 12311-1	N/50mm	600
Tensile Strength (CMD)	EN 12311-1	N/50mm	480
Tensile Elongation (MD)	EN 12310-1	%	20
Tensile Elongation (CMD)	EN 12310-1	%	20
Puncture Resistance	EN 12236	kN	1.25
Resistance to Tearing (Nail Shank) MD	EN 12310-1	N	330
Resistance to Tearing (Nail Shank) CMD	EN 12310-1	N	400
Durability and Chemical Resistance			
Transmission Rate of Volatile Liquids - Diesel	ISO 6179:2010 (B)	g/m2/h	0.246
Transmission Rate of Volatile Liquids - Xylene	ISO 6179:2010 (B)	g/m2/h	0.571
Transmission Rate of Volatile Liquids - Toluene	ISO 6179:2010 (B)	g/m2/h	0.583
Transmission Rate of Volatile Liquids - Petrol	ISO 6179:2010 (B)	g/m2/h	0.135
Gas Permeability			
Methane Permeability	BS EN ISO 15105-1	ml/m2/day/atm	<0.09
Carbon Dioxide Permeability	BS EN ISO 15105-1	ml/m2/day/atm	<0.09
Radon Permeability	K124/02/95	m2/s	8.0 x 10-15
Compliance and Certification			
CE Mark - EN13967:2012			
NHBC Standards Compliant			
BS 8485:2015 + A1 2019 Accordant			
BBA Certified - Certificate No. 12/4912			

Contact us to find out more information.
info@juta.co.uk | 01772 754177 | JUTA.CO.UK
Melton Grove Works, Church Road, Lytham, FY8 5PL

JUTA

riba product selector

Ground Gas Protection

Additional Information

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

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

JOINTING AND SEALING
It is recommended JUTA 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. JUTA GP® 1 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

- JUTA GP® 1 Starter Band
- JUTA GP® Tape
- JUTA GP® Self Adhesive Membrane
- JUTA GP® Primer
- JUTA GP® Top Hats and Preformed Corners
- JUTA GP® Protection Fleece
- JUTA GP® Void Vent (25/40mm)

PLEASE CONTACT JUTA UK DIRECTLY FOR MORE INFORMATION ON JUTA GP® 1

Contact us to find out more information.
info@juta.co.uk | 01772 754177 | JUTA.CO.UK
Melton Grove Works, Church Road, Lytham, FY8 5PL

JUTA

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GP® SAM

Rev: June 2019

Ground Gas Protection

JUTA GP® SAM – Gas Protection – Self Adhesive Membrane, is a bituminous gas proof and water proof sheet, composed of self-adhesive SBS polymer modified bitumen incorporating an aluminium foil with an upper surface finish of white cross laminated HDPE, and a lower surface finish of siliconized paper release film. JUTA GP® SAM is used for the gas/waterproofing of underground structures where harmful ground gasses are anticipated.

JUTA GP® SAM			
Characteristic	**Test Method**	**Unit**	**GP® SAM**
Physical Properties			
Thickness	EN 1849-2	mm	1.00
Width	EN 1849-2	M	0.3 or 1
Length	EN 1849-2	M	20
Weight	EN 1849-2	g/m²	1100
Hydraulic Properties			
Watertightness	EN 1928	-	PASS
Water Vapour Transmission	EN 1931	g/m²/day	0.013
Mechanical Properties			
Tensile Strength (MD/CMD)	EN12311-2	N/mm²	3
Elongation (MD/CMD)	EN 12311-2	%	>120
Resistance to Static Load	EN 12370	kg	20kg
Joint Strength	EN 12317-2	N	>30
Durability and Water tightness (ageing and chemicals)	EN 1847	-	PASS
Resistance to Nail Tear (MD/CMD)	EN 12310-1	N	>100
Reaction to Fire	EN 13501	Euro Class	F
Gas Permeability			
Methane Permeability	BS EN ISO 15105 - 1	ml/m²/day/atm	< 0.53
Carbon Dioxide Permeability	BS EN ISO 15105 - 1	ml/m²/day/atm	< 0.53
Radon Permeability	K124/02/95	m²/s	5.0×10^{-14}

JUTA GP® SAM complies with the latest codes of practice as published by BRE, CIRIA and BSI (BS 8485:2015).

Contact us to find out more information.
info@juta.co.uk | 01772 754177 | JUTA.CO.UK
Melton Grove Works, Church Road, Lytham, FY8 5PL

JUTA

BBA CE riba product selector

Ground Gas Protection

Additional Information

HANDLING

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

STORAGE

Rolls of JUTA GP® SAM should be stored horizontally, and pallets should not be stacked on top of one another.

JUTA GP® SAM should be stored 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.

INSTALLATION

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

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

ACCESSORY PRODUCTS

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

PLEASE CONTACT JUTA UK DIRECTLY FOR MORE INFORMATION ON JUTA GP® SAM

Contact us to find out more information.
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JUTA

BBA CE riba product selector

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website: www.juta.co.uk

Agrément Certificate
12/4912
Product Sheet 1

JUTA GAS-RESISTANT MEMBRANE

GP1 GAS BARRIER

This Agrément Certificate Product Sheet[1] relates to GP1 Gas Barrier, for use as a low-density polyethylene gas barrier and damp-proof membrane in concrete ground floors, above and below the slab not subject to hydrostatic pressure, to protect the building against moisture, radon, methane and carbon dioxide from the ground.

(1) Hereinafter referred to as 'Certificate'.



CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Resistance to water and water vapour — the membrane provides an effective barrier to the passage of liquid water and water vapour from the ground (see section 6).

Resistance to underground gases — the membrane is capable of restricting the ingress of radon, methane and carbon dioxide into the building (see section 7).

Resistance to puncture — the membrane has a high resistance to puncture and on a smooth or blinded surface will not be damaged by foot or site traffic (see section 8).

Durability — under normal service conditions, the membrane will remain effective against the ingress of water and water vapour, and will restrict the ingress of radon, methane and carbon dioxide during the lifetime of the flooring construction in which it is installed (see section 12).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Third issue: 29 October 2018

Originally certificated on 10 July 2012

John Albon – Head of Approvals Construction Products

Claire Curtis-Thomas
Chief Executive

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct. Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

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Regulations

In the opinion of the BBA, GP1 Gas Barrier, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	**C1(2)**	**Site preparation and resistance to contaminants**
Comment:		When properly installed in a correctly designed structure, the membrane forms an effective barrier to radon, methane and carbon dioxide, enabling compliance with this Requirement. See section 7.1 of this Certificate.
Requirement:	**C2(a)**	**Resistance to moisture**
Comment:		When properly installed in a correctly designed structure, the membrane forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Requirement. See section 6.1 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The membrane is an acceptable material. See section 12.1 and the *Installation* part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)**	**Durability, workmanship and fitness of materials**
Comment:		The membrane can contribute to a construction satisfying this Regulation. See section 12.1 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	3.1	Site preparation – harmful and dangerous substances
Standard:	3.2	Site preparation – protection from radon gas
Comment:		The membrane will enable a floor to satisfy the requirements of these Standards, with reference to clauses 3.1.2[(1)(2)], 3.1.6[(1)(2)], 3.1.7[(1)(2)], 3.1.8[(1)(2)], 3.2.1[(2)] and 3.2.2[(1)(2)]. See section 7.1 of this Certificate.
Standard:	3.4	Moisture from the ground
Comment:		When properly installed in a correctly designed structure, the membrane forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Standard, with reference to clauses 3.4.2[(1)(2)], 3.4.4[(1)(2)] and 3.4.6[(1)(2)]. See section 6.1 of this Certificate.
Standard:	7.1(a)	Statement of sustainability
Comment:		The membrane can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		Comments in relation to the product under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	**23(a)(i) (iii)(b)(i)**	**Fitness of materials and workmanship**
Comment:		The membrane is acceptable. See section 12.1 and the *Installation* part of this Certificate.
Regulation:	**26**	**Site preparation and resistance to contaminants**
Comment:		When properly installed in a correctly designed structure, the membrane forms an effective barrier to radon, methane and carbon dioxide enabling compliance with this Regulation. See section 7.1 of this Certificate.
Regulation:	**28**	**Resistance to moisture and weather**
Comment:		When properly installed in a correctly designed structure, the membrane forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Regulation. See section 6.1 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: 1 *Description* (1.2) of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, GP1 Gas Barrier, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapters 4.1 *Land quality – managing ground conditions* and 5.1 *Substructure and ground bearing floors.*

CE marking

The Certificate holder has taken the responsibility of CE marking the product, in accordance with harmonised European Standard BS EN 13967 : 2012. An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 GP1 Gas Barrier is a multilayer, low-density polyethylene membrane, reinforced with a polypropylene reinforcing grid with an integral aluminium foil.

1.2 The membrane has the following nominal characteristics:

Thickness (mm)	0.6
Roll length (m)	various
Roll width (m)	various
Mass per unit area ($g \cdot m^{-2}$)	370
Tensile strength* ($N \cdot 50\ mm^{-1}$)	
Machine direction	600
Cross direction	480
Elongation (%)	
Machine direction	20
Cross direction	20

Nail tear resistance* (N)	
Machine direction	330
Cross direction	400
Watertightness*	pass
Colour	
upper surface	various
lower surface	various.

1.3 Ancillary products for use with the membrane include:

- butyl or bitumen tape — for use for joints and laps
- jointing tape — for securing laps and joints.

1.4 Ancillary products for use with the membrane, but outside the scope of this Certificate, include:

- GP Top Hats — to seal around entry points to the membrane
- GP Internal Corner Cloaks — prefabricated corner details
- GP External Corner Cloaks — prefabricated corner details
- GP Primer — used to provide adhesion for application of bitumen enhanced geomembranes
- GP Void Vent 25 — cuspated high-density polyethylene (HDPE) drainage core with a non-woven polypropylene geotextile separator/filter bonded to one side
- GP Void Vent 40 — cuspated HDPE drainage core with a non-woven polypropylene geotextile separator/filter bonded to one side
- GP Protection Fleece — to form a protective layer to prevent damage to the membrane
- GR-SAM — gas-resistant self-adhesive membrane
- GP DPC — a gas resistant damp-proof course (dpc).

2 Manufacture

2.1 The membrane is manufactured by an extrusion/coating process.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Juta a.s. has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 and BS EN ISO 14001 : 2015 by Bureau Veritas (Certificates CZ002814-1 and CZ002815-1 respectively).

3 Delivery and site handling

3.1 Rolls are wrapped in polythene film. Each roll has a leaflet enclosed describing the membrane and installation details. The BBA logo and the number of this Certificate are printed on the leaflet and pallet label.

3.2 The rolls must be stacked on a flat surface, kept under cover and protected from sunlight and mechanical damage.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on GP1 Gas Barrier.

Design Considerations

4 Use

4.1 GP1 Gas Barrier is satisfactory for use as a gas-resistant barrier to restrict the ingress of radon, methane and carbon dioxide into buildings from landfill and naturally occurring sources.

4.2 Buildings in areas of risk should be constructed in accordance with the recommendations of BRE Report BR 211 : 2015 and following the guidance set out in BS 8485 : 2015.

4.3 The membrane is also satisfactory for use as a damp-proof membrane in accordance with CP 102 : 1973 Section 3, BS 8000-0 : 2014 and BS 8000-4 : 1989.

5 Practicability of installation

The membrane is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

6 Resistance to water and water vapour



6.1 The membrane, including joints, when completely sealed and consolidated, will adequately resist the passage of moisture into the building and enable a roof to comply with the requirements of the national Building Regulations.

6.2 The membrane is impervious to water and provides a waterproof layer capable of accepting minor structural movements without damage.

7 Resistance to underground gases



7.1 The membrane will restrict the ingress of radon, methane and carbon dioxide into buildings from landfill and naturally occurring sources and satisfy the performance criteria for a gas-resistant membrane as defined in BS 8485 : 2015.

7.2 Measured gas permeability/diffusion values on unjointed membrane are given in Table 1.

Table 1 Gas permeability of GP1

Gas	Method	Result
Methane	BS ISO 15105-1	<0.09 $ml \cdot m^2 day^{-1} \cdot atm^{-1}$
Carbon dioxide	BS ISO 15105-1	<0.09 $ml \cdot m^2 day^{-1} \cdot atm^{-1}$
Radon	K124/02/95	8.0×10^{-15} $m^2 \cdot s^{-1}$

7.3 BRE Report BR 211 : 2015 recommends a 300 µm thick polyethylene sheet as the minimum required thickness for a radon gas-resistant membrane. It is generally accepted that other materials with comparable or higher gas resistance are suitable, provided they can withstand the construction process. In the opinion of the BBA, the membrane satisfies these criteria.

8 Resistance to puncture

8.1 The membrane can be punctured by sharp objects and care should be taken when handling building materials over the exposed surface.

8.2 Provided there are no sharp objects present on the membrane's surface prior to and during installation of the protective layer, the membrane will not be damaged by normal foot traffic.

9 Compatibility with other materials

The membrane contains an aluminium foil interlayer which may be subject to corrosion by alkaline conditions if damage to the membrane and exposure occurs. However, under normal circumstances, the polyethylene faces of the membrane are compatible with other materials and products typically used in the same areas, with the exception of those containing pitch.

10 Underfloor heating

There will be no adverse effect on the membrane from the underfloor heating under normal service conditions. In other circumstances, the Certificate holder's advice should be sought.

11 Maintenance

As the membrane is confined under concrete and has suitable durability (see section 12), maintenance is not required. However, any damage occurring before enclosure must be repaired (see section 15).

12 Durability



12.1 The membrane will, in normal circumstances, remain effective against the ingress of water and water vapour, and will restrict the ingress of radon, methane and carbon dioxide during the lifetime of the building.

12.2 Long periods of exposure to ultraviolet light will reduce the effectiveness of the membrane.

Installation

13 General

13.1 GP1 Gas Barrier must be installed and fixed in accordance with this Certificate, the Certificate holder's instructions, the relevant clauses of BRE Report BR 211 : 2015 and the guidance given in BS 8485 : 2015.

13.2 The membrane can be installed in all normal site conditions, provided that the air temperature is not below 5°C to prevent the risk of surface condensation.

14 Procedure

14.1 The membrane must only be applied to surfaces that have a smooth finish, ie they should be free from voids, projections and mortar deposits. Surfaces should be dry and free from dust and frost.

14.2 Concrete surfaces should be dense. Vertical surfaces of brickwork and blockwork must be dry and rendered to provide an even surface. Brickwork or blockwork not rendered must be flush pointed to give a smooth surface without sudden changes in level.

14.3 The membrane is rolled out with the printed side uppermost, ensuring that it is properly aligned. All end and side overlaps should be a minimum of 100 mm and prepared in accordance with the Certificate holder's instructions.

14.4 When the membrane is laid below the concrete slab, it should be loose-laid to accommodate any small movements.

14.5 All surfaces must be dried thoroughly prior to joining. Roll edges can be welded or taped. A strip of the tape is unrolled over the membrane with its nearest edge 50 mm from the membrane edge. The protective paper is removed from the butyl tape prior to rolling an adjacent run of the membrane, which must be carefully unrolled over the jointing tape, ensuring a 100 mm overlap.

14.6 All service penetrations and direction changes should be properly detailed in accordance with the Certificate holder's instructions. Service ducts should be vented to prevent the possibility of gas accumulating in confined spaces.

14.7 The continuity of the gas protection must extend over the footprint of the building, and the membrane must be sealed to a gas-resistant dpc where required.

14.8 The membrane should be covered by a screed or other protective layer, such as GP Protection Fleece, as soon as possible after installation. If blockwork protection is used, care must be taken to avoid damage to the membrane during construction.

14.9 The membrane installation should be subject to third-party independent validation, in accordance with BS 8485 : 2015.

15 Repair

Any damage to the membrane must be repaired using a patch of the membrane, and laps welded or sealed with double sided tape and secured with the butyl tape. All patched areas must extend a minimum of 100 mm from the damaged area. If required by the local authority, repair work should be confirmed by an independent validation report, as all gas membrane installations should be subject to third-party validation in accordance with BS 8485 : 2015.

Technical Investigations

16 Tests

16.1 An assessment was made of data to BS EN 13967 : 2012 in relation to:

- tensile strength and elongation
- nail tear resistance
- watertightness
- resistance to static loading.

16.2 Tests were carried out to determine:

- thickness, width, density and mass per unit area
- dimensional stability, low temperature flexibility and water vapour permeability
- tensile strength and elongation on controls and after 12 weeks heat ageing at 70°C, and after 100 hours UVB exposure
- watertightness on controls and after 12 weeks heat ageing at 70°C
- nail tear strength on controls and after 12 weeks heat ageing at 70°C
- resistance of joints to air pressure
- tensile strength of joints on controls and after 12 weeks heat ageing at 70°C

to assess:

- membrane characteristics
- durability of the membrane and joints.

17 Investigations

17.1 An evaluation was made of the results of the test data regarding permeability of radon, methane and carbon dioxide.

17.2 A site visit was conducted to assess practicability of installation.

17.3 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

BRE Report BR 211 : 2015 *Radon : Guidance on protective measures for new buildings*

BS 8000-0 : 2014 *Workmanship on construction sites – Introduction and general principles*
BS 8000-4 : 1989 *Workmanship on building sites — Code of practice for waterproofing*

BS 8485 : 2015 *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*

BS EN 13967 : 2012 + A1 : 2017 *Flexible sheets for waterproofing — Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet — Definitions and characteristics*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

BS EN ISO 14001 : 2015 *Environmental management systems – Requirements with guidance for use*

BS ISO 15105-1 : 2007 *Plastics. Film and sheeting. Determination of gas-transmission rate. Differential-pressure methods*

CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*

K124/02-95 *Radon diffusion coefficient by Czech Technical University to test number 124-11 – Measurement of radon coefficient*

18 Conditions

18.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

18.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

18.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

18.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

18.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

18.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

GeoDyne

APPENDIX IV

Membrane Verification Proforma

INSPECTION OF GAS PROTECTION MEASURES

Site name	Millfield House, Spalding Common, Spalding	**Client**	Seagate Ho
Project number	**D44007**	**Date**	
Plot number		**Visit by**	

In general accordance with Appendix A5 of CIRIA C735 'Good practice on the testing and verification of protection systems for buildings against hazardous ground gas' (2014)

No.	Item	Comments (see notes)
1	**Gas Membrane**	
1.1	Condition of sub-grade and underside of gas membrane	
1.2	Gas membrane type	
1.3	Gas membrane condition	
1.4	Joining tape product	
1.5	Lapping design	
1.6	Laps, welds, joints and seals	
1.7	Service entries seals	

No.	Item	Com
2	**Passive Venting**	
2.1	Sub-floor void	
2.2	External wall airbricks	
2.3	Internal sleeper walls	
2.4	External vent trenches/ducts	
3	**Active Venting**	
3.1	System details	

Areas Unavailable for Inspection

Installers Name & Company:	**NVQ Level 2 Qualified?**		
	Yes	No	Ongoing
	Yes	No	Ongoing
	Yes	No	Ongoing

Photographic Evidence Requested from Site Manager/In

Non-Conformance/Corrective Measures Sheet Completed?	Yes	No

The gas protection measures inspected:

- A – Are acceptable and comp
- B – Are acceptable but attent
- C – Are not acceptable due t

Additional Notes -

Photographs, As A Minimum & Where Applicable (✓)						
Overall Plot / Area		Membrane Joint / Welds		Corner Details		Defe
Stanchions		Air Bricks / Venting		Service Pipe Seals		Repa

Name	**Signature**	**Date**

NON-CONFORMANCE/CORRECTIVE MEASURES SHEET

Site Name	Millfield House, Spalding Common, Spalding	Project No.	D44007	Client	Seagate Homes Limite

Ground Floor Layout (Identify location of Non-Compliance on Layout)	Plot No		Ref. No.	Des Punch Servi Tear Other
			1	
			2	
			3	
			4	
			5	
			6	
			7	
			8	
			9	
			10	
			11	
			12	
			13	
			14	
			15	
			16	
			17	
			18	
			19	
			20	

Date of Initial inspection		Initial Inspection Visit by		Date of Re-Inspection	

GeoDyne

APPENDIX V

MB Membranes Method Statement

Minor Works Method Statement

Contractor	SEAGATE HOMES LTD.	Project No	22/491
Site Address	Former Millfield Nursey, Spalding Common, Spalding. PE11 3JZ		
Site Contact	Rob Fox	Site Contact No	07497 668882
Document Author	NEIL MCNAMARA	Issued to	Rob Fox
MS Issue No	002	Date	01/02/2023
Description of works	ALL PLOTS EXCEPT 75 & 76 - SUPPLY AND INSTALLATION OF JUTA GP 1 GAS BARRIER – FULL LINE OUT. 225MM UPSTAND AT PERIMETER AND PARTY WALLS. PLOTS 75 & 76 - SUPPLY AND INSTALLATION OF TITANFLEX GAS BARRIER – FULL LINE OUT. 225MM UPSTAND AT PERIMETER AND PARTY WALLS.		

Works expected to commence	JAN 2023	Works expected to be completed		Duration of works in days	36 No. Team Days.
Site opening Times	MON – FRI	7.30 – 5.00	SAT		SUN
Comments or additional notes	SEE GEODYNE - D38185 Verification Plan.				

Management and Supervision			
MC Contracts Manager	Rob Fox	Contact No	07497 668882
MBM Project Manager	Steve Benson	Contact No	07889 255366
MBM Contracts Manager	Neil McNamara	Contact No	07881 225246

This Method Statement has been developed with and must be read with the following MBM Risk Assessments:
MBM_RA_001A,002A,003A,004A,005A,007A, 008B,1000
SPILL CONTROL PROCEDURE TBTSCP.V1.0
Site-Operating-Procedures-Reference-Document 01_04_2022
The-Use-of-Face-Coverings-in-Construction-during-Coronavirus-Reference-Document 01_04_2022

Please provide details of all Emergency and welfare arrangements			
First Aid	PC to provide qualified first aider and all first aid requirements. MBM to record all incident information as per MBM Policies	Fire evacuation	Follow site specific procedures. PC to brief all operatives via inductions. MBM to provide task specific Fire extinguishers
Allocated First Aider	TBC	Allocated Fire Marshall	TBC
Emergency Spill	Both PC & MBM to supply spill kits. PC to supply means of disposal	Welfare	PC to provide all welfare facilities

Personal protective equipment (PPE) details						
	Head protection	Protective footwear	Hi-vis clothing	Gloves	Eye Protection	Hearing Protection
Mandatory	EN 397	EN 345-1	Vest (Yellow)	EN 388/420		
Task specific				EN 374	EN166-F EN166-B	EN352-1
Please provide details of any specific permits required						

Minor Works Method Statement

Hot Works Permit: Hot works permit required prior commencement of works and operatives to observe and work in accordance with all hot works procedures. Hot works permit is not required for items which do not expose a naked flame unless environment or site dictate.	
Permit to be issued by	Client as detailed above
Comments	
Temporary works details	PC to provide suitable means of access/egress to excavations or open trenches, barriers and signage for open trenches, excavations and areas which need to be cordoned off to be inspected and monitored and maintained for duration of works by PC and MBM. PC to provide Temporary works Coordinator (TWC) where deemed necessary.

Description of work of safe method of works
This Method Statement provides details of a safe system of works and is part of MBM Health and Safety policies and procedures. For further information, please refer to relevant policies, data sheets, risk and COSHH assessments

Precautions prior attending site:

I. READ MBM 008B
II. MBM & client management team to agree areas, details and sequence of works, outline safe system of works, ensuring any additional hazards are identified and necessary measures put in place
III. MBM to agree the following: on site parking for mobile workshop, expected material deliveries and storage requirements
IV. Issue 2 copies of approved RAMS; Email copy to contracts manager/site management team and supply hard copy to operatives attending site.
V. All copies of MBM RAMS to be issued and signed prior to commencement of works*
VI. MBM management team to ensure only fully trained, competent operatives attend site (see training matrix for details) and attend site with all necessary accreditation required
VII. Ensure all operatives are provided with all the necessary information required to carry out the works efficiently and safely
VIII. Ensure operatives are equipped with the tools, machinery and equipment suitable to carry out the task they are intended for, all are maintained, serviced and have a valid pass or PAT certificate (110v or battery-operated tools only)
IX. SEAGATE HOMES LTD. to ensure adequate access and egress to site and works area. All temporary works are in place where required and suitable for their intended use. SEAGATE HOMES LTD. to inspect on a regular basis and provide a temporary works coordinator (TWC) if deemed necessary.

Arrival on site:

I. READ MBM 008B
II. On attendance, all operatives to park vehicles in designated parking areas as previously specified by SEAGATE HOMES LTD., dress with site mandatory PPE, sign-in, in the site visitor's book and make themselves known to the site management team
III. Ensure all operatives attend site induction/pre-start briefings and sign up to all relevant documentation (RAMS)
IV. Supervisor to confirm details/sequence or works and ensure all necessary permits, fire, first aid procedures are in place
V. Operatives to check hazard board and familiarize themselves with daily site hazards
VI. Supervisor to carry out initial check/inspection of the works areas to ensure the above are all in place and safe to commence

VII. Supervisor to provide all operatives with specific works briefing (verbal) detailing the following: any additional potential hazards i.e. weather, sequence of works, material storage, power requirements and locations, cable routes, fueling locations and storage/waste procedures

VIII. SEAGATE HOMES LTD. to provide blocks/bricks as a holding down method and to ensure they are provided in a suitable location to reduce any effects of manual handling and slips, trips and falls. All operatives to observe manual handing regs and MBM procedures.

Commencement of works:

1. **Site Management should be familiar with 'Hazardous ground gas - a site management guide (C801)'**
2. READ MBM 008B
3. SEAGATE HOMES LTD. to have MBM works area fully cleared and cleaned, with all debris and snots removed PRIOR TO OUR VISIT.
4. **The SUBBASE MUST be as smooth as possible. We WILL NOT install on rough area with high points AS THEY WILL FAIL 3rd Party Validation.**
5. Our works areas are not to be cleared on the day we attend.
6. SEAGATE HOMES LTD. to set out all walls and thresholds.
7. SEAGATE HOMES LTD. to have blocks placed adjacent to MBM works area to enable MBM to weigh down the membrane.
8. All brickwork is to be fully in place and not 'green'.
9. MBM will require van access to the works area for materials and welding plant.
10. MBM will install GP1 (75 & 76 - TITANFLEX) across the slabs and to the perimeter and internal walls.
11. All corners, thresholds and pipes will be 'cut in'.
12. MBM will form and seal all corners, pipes and thresholds with GMA.
13. MBM will heat seal the GP1 (75 & 76 - TITANFLEX) joints.
14. SEAGATE HOMES Ltd. is responsible for protection of the barrier during the build.
15. Membrane sealing: The membrane sheets are sealed together using a Leister Hot Air Gun and hand-held pressure roller. The gun is then pre-heated to the correct temperature required to achieve a good seal. A test seal is then completed to ensure the seal is satisfactory and the operative can continue. Placing the Leister nozzle between the two sheets of material, the material is then steadily compressed together with a Leister hand pressure roller providing a gas tight seal. This process is to continue for each joint. After each seal the operative will continue to check the seal by running along the joint with a pick to ensure there are no gaps or flaps.
16. Sealing: All corners, internal wall ends, cavity stop ends and pipes etc will be formed and sealed with GMA Self Adhesive Gas Membrane as per detail.
17. The GMA is heated, formed and pressure roller applied to create a gas tight seal.
18. Penetrations & Repairs: Any penetrations through the membrane will be sealed using patches of GMA Self Adhesive Gas Membrane. For areas of damage less than 150mm in diameter an adhesive patch will be cut at least 100mm larger than the damaged area. For areas larger than this, a new piece of membrane will be cut and sealed as per section h.
19. VALIDATION ENGINEER MUST attend whilst MBM is on site to carry out validation.

Details of main materials

Material	Hazardous Y/N	If hazardous, are data sheets available	COSHH Ref
GP 1	No		
GMA	No		
TITANFLEX	No		

Additional COSSH requirements i.e. storage/disposal	Hazardous materials are stored in the mobile works shop or on drip trays/nappies when in use and removed from site at the end of each shift. All COSHH products are disposed of in accordance with COSHH regs and MBM policies.
Waste management/controls	All waste items to be disposed of in accordance with site and MBM waste control procedures. PC to supply means of disposal. Where PC is unable to provide suitable means of waste disposal, PC to notify MBM and all waste items to be returned to MBM for disposal as per policy

Equipment/Machinery and tool table	Inspection information
Portable petrol generator	Visual before use, formal monthly, service annually
Leister ST Triac hot air gun, 110v	Visual prior use, formal monthly, PAT every 3 months
Leister Twinney T heat welding systems, 110v	Visual prior use, formal monthly, PAT every 3 months
Extrusion welder, 110v	Visual prior use, formal monthly, PAT every 3 months
Reciprocating saw, 110v	Visual prior use, formal monthly, PAT every 3 months
Paddle mixer, 110v	Visual prior use, formal monthly, PAT every 3 months
Hammer drill, 110v	Visual prior use, formal monthly, PAT every 3 months
Combi drill/impact driver 18v	Visual prior use
Extension leads 110v	Visual prior use, formal monthly, PAT every 3 months
Deployer bars, chains and shackles	Formal prior use
Propane (LPG) gas burner	Visual prior use
Test Certificates	All test certificates are available upon request

Personnel details (Include task specific training, skills, qualifications required)				
Name	Position	Training	Signature	Date
Benson, Stephen	Technician	CSCS: 01478541 SMSTS, NVQ 2		
Benson, Jack	Technician	CSCS: 05666199 SSSTS NVQ 2		
Carey, Gary	Technician	CSCS: 04435499 SSSTS, NVQ 2		
Hill, Gary	Technician	CSCS: 06305926 SSSTS NVQ 2		
Shipwright, Alfie	Technician	CSCS: 06274480 NVQ 2		
Shaves, Jake	Technician	CSCS: 5789628 NVQ 2		
South, Chris	Technician	CSCS: 02184098 SSSTS, NVQ 2		
South, Jack	Technician	CSCS: 05926158 SSSTS NVQ 2		
Geogarty, Lee	Technician	CSCS:13279895		
Newman, James	Technician	CSCS: 05066481 SSSTS NVQ 2		
Stanton, Robert	Technician	CSCS: 2938179		
Aguilar, Ricky	Technician	CSCS: 04625742		

		NVQ 2		
Lewis, Curtis	Technician	CSCS: 13527391		
Horwell, Stuart	Technician	CSCS: ABS00779		
Stanton, Matthew	Technician	CSCS: 04699411		
Stanton, Chris	Technician	CSCS: 1385469 NVQ 2		
Hall, Richard	Technician	CSCS: 04746549 NVQ 2		
Neville, Phil	Technician	CSCS:02657760 NVQ 2		
Confirmation of operatives briefing		By signing and completing the above, you are confirming you are completely satisfied with the information provided and given the opportunity to discuss any points which you did not understand or felt were important in the interest of health and safety or welfare to yourself or others.		

Please note; this is a working document and if any of the aforementioned items or processes change please contact your supervisor who will assess any additional risks amend all relevant documentation.

GeoDyne

APPENDIX VI

Conditions & Limitations

Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.

3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.

2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.

3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.

4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.

5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.

6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create 'soft spots', therefore, should the Client wish to designate 'no dig' zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.

7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.

8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1 Payment terms are strictly 28 days from the invoice date.

2 Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.

3 Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.