



**Castledine
Environmental**

LAND CONTAMINATION SURVEYS

Phase 3 Remediation Strategy and Verification Plan

for

The Erection of a Four-Storey Building to Provide 10 No. Self- Contained Apartments Together with Car-Parking, Associated Landscaping and Boundary Treatment

on the site of

**No.2 Wilbraham Road,
Manchester M14 6GF**

Date: December 2023

Status:

Final Report

Reference:

3661A P3 OG Estates – Manchester

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1.0 QUALITY ASSURANCE

Castledine Environmental confirm that all reasonable efforts have been made to ensure that the information outlined within this report is accurate.

Castledine Environmental would further confirm that due care, attention and technical skill were used in the creation of this report.

For and on behalf of Castledine Environmental.

Kevin Castledine

(Director)

2.0 LIMITATIONS

The conclusions and recommendations made in this report are limited to those based on the findings of the investigation. Where comments are made based on information obtained from third parties, Castledine Environmental assumes that all third-party information is true and correct. No independent action has been undertaken to validate the findings of third parties. The assessments and interpretation have been made in line with legislation and guidelines in force at the time of writing, representing best practice at the time.

This survey has not included asbestos within existing structures, invasive plant species, geotechnical considerations or any elements unconnected with potential ground contamination at the site. If required, such surveys should be undertaken by suitably accredited organisations.

There may be other conditions prevailing at the site which have not been disclosed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation.

3.0 INTRODUCTION

Castledine Environmental have been appointed by Mr. K. Din to undertake a Phase 3 remediation Strategy and Verification Plan for No.2 Wilbraham Road, Manchester M14 6GF.

The following reports have been undertaken for the site:

- Phase 1 Land Contamination Risk Assessment for Site at No.2 Wilbraham Road, Manchester – Produced by Castledine Environmental in October 2023 and referenced: 3618D.
- Phase 2 Land Contamination Risk Assessment for No.2 Wilbraham Road, Manchester M14 6GF in November 2023 and referenced 3637D.

4.0 SCOPE

Castledine Environmental have prepared this report for the sole use and reliance of Mr. K. Din and his appointees for the purpose of ensuring compliance with:

- Paragraph(s) 174, 179, 183 & 184 of the National Planning Policy Framework 2021.
- Part C1 of the building regulations.
- Condition No. 18 of Manchester City Council planning approval reference 126743/FO/2020 and outlined below:

‘Before the development hereby approved commences, a report (Preliminary Risk Assessment) to identify and evaluate all potential sources and impacts of any ground contamination, groundwater contamination and/or ground gas relevant to the site shall be submitted to and approved in writing by the City Council as local planning authority. The Preliminary Risk Assessment shall conform to City Council’s current guidance document (Planning Guidance in Relation to Ground Contamination).

In the event of the Preliminary Risk Assessment identifying risks which in the written opinion of the Local Planning Authority require further investigation, the development shall not commence until a scheme for the

investigation of the site and the identification of remediation measures (the Site Investigation Proposal) has been submitted to and approved in writing by the City Council as local planning authority

The measures for investigating the site identified in the Site Investigation Proposal shall be carried out, before the development commences and a report prepared outlining what measures, if any, are required to remediate the land (the Site Investigation Report and/or Remediation Strategy) which shall be submitted to and approved in writing by the City Council as local planning authority'

This report may not be used or relied upon by any unauthorised third party, or for any other proposed use than that specified above, without the explicit written agreement of Castledine Environmental.

The report consists of a Remediation Strategy and Verification Plan in accordance with

- BS10175:2011+A2:2017, Investigation of potentially contaminated sites. Code of practice
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings and
- CLR11 "Model Procedures for the Management of Land Contamination".
- LCRM "Land Contamination Risk Management".

The objectives of the report are:-

- Report the existing information relating to the soil contamination and the ground gas regime within the area of the site.
- Set out the remediation measures and validation processes to be followed on site to ensure the site development does not pose a risk to human health.

5.0 SITE DESCRIPTION

The site is located in Fallowfield, Manchester at National Grid Reference: 385467,394046 and is approximately 0.12ha in area.

The site is square in shape and is orientated north to south, east to west. The site is located in a predominantly urban area, being directly bounded by a car-park to the north, being associated with a church directly east, Wilbraham Road to the south and a residential apartment block to the west. The surrounding areas beyond this are predominantly residential, with parkland to the north west of site, beyond housing and a university campus to the north east. The site interior comprises a vacant plot of land, occupied by gravelled made ground deposits, fly-tipped debris and overgrown northern, western and southern site boundaries.

Access to site was provided through heras fencing located on the eastern boundary of site, leading west and onto site. The ground conditions across the site can be broadly described as a gravelled made ground medium, formed by rolled stone, tarmac gravels and rubbles with some areas of intact concrete noted. Standing water and overgrown vegetation were noted across the site, with areas in the west of site noted to be occupied by a green, slimy matter underfoot – this may potentially be Nostoc, a form of cyanobacteria which forms in areas high in phosphorus, is it not poisonous nor harmful to plants, animals or humans, save for trip and slip hazards underfoot. The intact concrete on site along with 2 No. standing stanchions in the east of site were marked as evidence of a former building located on site, having been removed. The scattered fly-tipped debris on site comprised carpets, linoleum, pottery and plastics in the north east of site, furniture including reclining sofas in the west of site, and scattered debris and refuse such as take-away containers, generic wastes and plastics across the remainder of site.

Potential sources of contamination noted on the walkover include the gravelled made ground medium on site, evidence of a demolished building formerly located on site and scattered refuse and fly-tipping across the site. Topographically, the site and surrounding areas are level.

6.0 OVERVIEW OF FINDINGS AND RECOMMENDATIONS FROM PREVIOUS REPORTS

6.1 SUMMARY OF SOIL CONTAMINATION

The historical usage of the site (erection and demolition of a structure and outbuilding on site, made ground deposits, construction compound usage and vehicle storages) and the development of the immediate surrounding areas (various erections and demolitions, usage of a car-park directly adjacent to site) are considered to have the potential to have impacted site with various contaminants.

Following the completion of the recommended Phase 2 works. The risks to end-users of the site were considered to be moderate when assessed against the sensitive, residential end-usage of the site and the identified exceedances of both lead and significant exceedances of PAHs within shallow made ground deposits on site. No suitable material has been identified on site during the site works nor from the following laboratory analysis that is considered suitable for areas of proposed soft-landscaping (exceedances of lead, significant exceedances of PAH's, material is largely ubiquitous across site and sharps such as glass and broken ceramics were noted in the deposits). As such, should onsite soils be used to form soft-landscaping areas, there exists credible pathways for contamination to impact end-users of site (inhalation of dusts, direct contact with soils, direct and indirect ingestion, cuts from sharps). Furthermore, whilst no exceedances of hydrocarbons have been identified on site, the presence of hydrocarbons has been identified and – due to the sites history, the ground conditions encountered and the residential end-usage – it is recommended that a VOC-resistant membrane is installed within the proposed development, as a matter of prudence and inline with BS8485:2015:A1_2019. Additionally, the likely potential for hydrocarbon / PAH impact to new potable supply piping is considered a hazard to end-users of the stie via impacted potable supplies.

6.2 SUMMARY OF GROUND GAS AND HAZARDOUS VAPOURS

Previous reporting identified no significant or potential sources of ground gas generation on or in proximity to site. A number of infilled ponds were identified on historical mapping within the local area; however, these features were all removed by circa.1905 and as such, are likely well outside their gas generational window. Additionally, a series of former railway cuttings located to the south of site (also being recorded as artificial ‘void’) have been identified, however this has also been discounted as a potential source of ground gas, as the feature has never been infilled and remains as a public footpath / cycleway.

Whilst environmental sampling did not identify any exceedances of hydrocarbons / TPH CWG above the respective residential GAC, the presence of hydrocarbons has been confirmed on site (elevated readings at TP03 and slightly elevated at remaining locations tested). As such, due to the history of the site, the nature of environmental sampling carried out on site and the sensitive, proposed residential end-usage of the site, it is considered prudent to install a VOC-resistant membrane and protection measures within the proposed development, inline with BS8485:20014+A1:2019.

7.0 CAPPING OF SOFT LANDSCAPING AREAS

Due to the presence of elevated contaminants identified onsite, it was recommended that any identified soils are excavated from areas of soft landscaping to sufficiently allow the placement of a minimum 600mm of pre-certified clean soils to be imported in placed.

Guidance found in Section A.3 of BS3882:2015: ‘*Specification for Topsoil*’ states that the minimum rooting depth for grass, shrubs and trees should be at least 450mm, 600mm or 900mm, respectively; however, in this case a minimum of 600mm depth of soils is recommended.

Prior to the spreading of the important materials, the receiving areas should be de-compacted to increase underlying permeability, to further plant growth and sustainability.

Material can be sourced from other developments and commercial companies. Dependent on the source of the material it can be classified as either from a 'Greenfield/Manufactured' or 'Brownfield/Screened' source.

Broadly speaking material can be classified as follows:

- Greenfield - Where documentary evidence is provided confirming that the source site has not been developed and that no past contaminative uses have occurred. Should evidence not be provided or approved by the Local Authority, please note that the source would be expected to be assessed as though it were a brownfield source.
- Manufactured – from a commercial company who manufacture material by mixing or blending mineral soils (subsoil or sand) with an organic amendment (compost). If other soil component sources are used, documentary evidence should be provided confirming that the source site has not been developed and that no past contaminative uses have occurred. Should documentary evidence not be provided or approved by the Local Authority, please note that the source would be expected to be assessed as though it were a brownfield source.).
- Brownfield – material from a donor site that has previously been developed.
- Screened – material from a company who deal with skip/demolition waste which is screened for unsuitable material i.e. bricks, wood, plastic etc.

Brownfield and screened material are more likely to be of a lesser quality and will require more robust testing to prove their suitability therefore Greenfield or Manufactured material will be used. Imported soil must not contain materials such as plastics, metals, asbestos, glass, tarmac, demolition rubble etc.

Any supplied testing results from a commercial company must be from the actual material to be imported and be no more than two months old. This should be provided to the relevant Local Authority prior to importation.

If certificates are not supplied then testing should be done before being brought to site, the testing should be carried out by a UKAS accredited laboratory. If certificates are not supplied then testing should be done before being brought to site, the testing should be carried out by a UKAS accredited laboratory. Castledine Environmental can carry this out, should certification not be provided to the relevant Local Authority.

Imported soils should be as specified in BS 3882:2015 for topsoil and BS8601:2013 for subsoil as 'suitable for their intended purpose'. Both British Standards relate mostly to nutrient content of topsoil and phytotoxic contamination and they do not consider contaminants that pose a risk specifically to human health. Soils should be tested for contaminants that are considered to pose a risk to human health in addition to those specified in the relevant British Standards to ensure that they are suitable for their intended use.

Each test must include as a minimum:

Virgin Quarried Material sampling needs to be 1 or 2 samples depending on the type of stone utilised, to confirm the inert nature of the material. Testing to include standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn).

Crushed Hardcore, Stone, Brick (excluding asphalt) a minimum of 1 sample per 500m³. Testing to include standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).

Greenfield/ Manufactured Soils a minimum of 3 samples or, dependent on source and receptor, between 1 per 50m³ and 1 per 250m³. Testing to include standard metals/metalloids (as above), PAH (16 USEPA

speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).

Brownfield/ Screened Soils a minimum of 6 samples or dependent on source and receptor, between 1 per 50m³ and 1 per 100m³. Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).

The assessment criteria need to be UK based, e.g. LQM S4ULs, Defra C4SLs or other similarly derived GACs.

Environmental samples of imported materials will be tested inline with current CLEA Soil Guideline Values and relevant Generic Acceptance Criteria (GAC) and SGV's.

Imported material should preferably not be stockpiled on site but placed in the intended area immediately so as to not cause cross contamination.

Test results for the intended imported material must be submitted to the local authority and approved before being brought onto site.

All transfer notes and/or receipts for the soil should be retained.

The thickness of the soil placed will require evidence either via photographs during its placement or by digging of post placement verification trial holes.

8.0 GAS PROTECTION MEASURES DESIGN

As discussed in Section 6.2, gas protection measures are required for the proposed development. These should be designed in line with the current British Standard BS8485:2015+A1:2019 'Code of Practice for the design of protective measures' and should be formed of a VOC-resistant membrane.

8.1 DETERMINATION OF PROTECTION MEASURES

A combination of two or more of the following protection measures should be used to achieve the Gas Protection Score, as determined in Section 4.3.1 of BS8485:2015+A1:2019:

- Structural barrier, or basement slab and wall if present.
- Ventilation measures.
- Gas resistant membrane.

8.1.1 FLOOR SLAB

The residential property is to have a beam and block floor. Based on Table 5 of BS8485:2015+A1:2019, this will achieve a Gas Protection Score of 0 points.

Notes:-

- There should be no movement joints in the substructure masonry below the membrane level and all perpend, gaps and openings should be sealed to avoid gas migration
- Before laying the membrane, the beam-and-block floor should be thoroughly wetted and all joints grouted with a 4:1 sand and cement grout brushed into all the joints. All projections that may puncture or damage the membrane must be removed. A layer of sacrificial polythene could be used.

8.1.2 VENTILATION MEASURES

The properties are to have a minimum 150mm clear ventilated sub floor void, with ventilation provided via telescopic air vents around the perimeter of each block at 2m centres.

The number of telescopic vents is to be confirmed but will meet or exceed the building regulations requirements of 1,500mm²/m run of wall.

The void should be well cross-ventilated (airbricks located on opposite walls) and if there are sleeper walls or other obstructions (change in levels etc) then there should be four or five times the area of the side vents provided in the obstruction.

This should be sufficient to provide very good performance. Based on Table 6 of BS8485:2015+A1:2019, this will achieve a gas protection score of 2.5 points.

8.1.3 GAS RESISTANT MEMBRANE

A gas resistant membrane which meets all of the requirements of Table 7 of BS8485:2015+A1:2019 (reproduced as Table 1) will achieve a score of 2 points.

TABLE 1. BS8485:2015 TABLE 7 GAS PROTECTION SCORE FOR THE GAS RESISTANT MEMBRANE REPRODUCED FROM BS8485:2015

Protection element/system	Score	Comments
Gas resistant membrane meeting all of the following criteria: • sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. For example, a minimum 0.4 mm thickness (equivalent to 370 g/m² for polyethylene) reinforced membrane (virgin polymer) meets the performance criteria in Table 7 (see C.3). If a membrane is installed that does not meet all the criteria in column 1 then the score is zero.

As designers, Castledine Environmental have specified a membrane which is considered suitable for use as a VOC resistant barrier at the site and this is:

- Juta GP1 loose lay membrane

Suitable accessories are:

- Juta GP1 starter band
- Juta GP Butyl tape
- Juta GP self-adhesive membrane
- Juta GP top hats and pre-formed corners

If an alternative product is proposed, then the manufacturer, membrane name and specification sheet should be forwarded to Castledine Environmental and the EHO for assessment and approval prior to installation.

The membrane shall be extended across cavities and sealed around joints/service entries. Joints can be heat welded or taped with Double sided butyl joint tape. Joints are to be overlapped by min 100mm and if joint tape is being used then it must be applied using a silicone roller to remove trapped air. Juta GP self-adhesive Gas Membrane or Juta GP Top Hats and preformed corners should be used for sealing around protuberances.

If lap tape is to be used then it should not be fitted until the double sided jointing tape has been verified

8.1.4 GAS PROTECTION SCORE SUMMARY

By implementing the above measures, the Gas Protection Score would be

TABLE 2. CALCULATION OF GAS PROTECTION SCORE

Protection Measures	Score
Precast suspended beam and block floor	0
Ventilation measures	2.5
Gas resistant membrane	2
Total	4.5

8.2 OTHER ELEMENTS

The gas membrane is to be installed when the construction is at slab level and then the insulation and screed placed upon it. This will protect the membrane from on-going site activities. Centrefold membranes must not be used.

The cavity should be filled to a level where it will support the membrane across the cavity. Any exposed sections across the cavity wall will be protected using sacrificial sheeting or DPM while any cavity work is undertaken.

Ground Gas Membrane is degraded by light and therefore if it is to be left exposed for two weeks or more it should be protected by covering with black plastic.

9.0 VERIFICATION PLAN**9.1 CAPPING MATERIAL****9.1.1 VERIFICATION OF CORRECT DEPTH OF COVER LAYER**

- **DEPTH TESTING IN SITU**

Small trial pit excavated to allow measurement of its depth by tape measure or measuring staff. This would normally be one pit per garden area. Photograph each test pit showing depth of cap.

9.1.2 PHOTOGRAPHIC EVIDENCE FOR VALIDATING THE DEPTH OF COVER

The following is guidance on photographs as additional evidence to support either of the above methods.

- Proof that the depth of inert cover has been installed
- Proof there is a geotextile separator and visual warning membranes (if used) between the made ground and suitable for use soils.
- Proof of the method of placement and different layers if appropriate
- Proof of the completed project
- Inclusion of geographic background features which will aid locating the photograph

9.2 GAS PROTECTION

In order to achieve the points claimed for the gas resistant membrane above, a validation procedure must be in place. The validation should be carried out by a suitably qualified and *independent* inspector and be undertaken in line with CIRIA C735. Membranes installed by a suitably qualified installer are more robust, require less verification (assuming that the work is to an acceptable standard) and are likely to be more cost effective. If the installation is to be carried out by a qualified and experienced installer then one visit should be carried out immediately following the fitting of the membrane. If the fitting is to be carried out by the builder / groundworker then an extra visit will be required when the site has been prepared for the membrane but before it is fitted.

On this basis, verification will be required as follows:

TABLE 3. REQUIRED VERIFICATION OF MEMBRANE

Gas regime/risk	Slab type	Installer experience	Suggested levels of verification and integrity testing
Low risk CS2 (*with venting) Basic radon protection area	Non reinforced All slabs	General builder/ groundworker / landfill operative (no relevant qualification)	Verifier (consultant or qualified and experienced installer) to conduct a thorough verification (visual) inspection prior to all concrete pours. Contractor to supply sign off sheets (verification evidence) including photographs to independent verifier.
		Qualified and experienced installer (minimum one operative to hold qualification)	Verifier (consultant or third party qualified and experienced installer) to conduct a thorough verification (visual) inspection prior to 25 to 50 per cent of concrete pours (min one visit). Installer to supply sign off sheets (verification evidence) including photographs to independent verifier for all other pours.
Intermediate risk CS2 (no venting) or CS3 (*with venting) Full radon protection area		General builder/ groundworker/ landfill operative (no relevant qualification)	Verifier (consultant or qualified and experienced installer) to conduct a thorough verification (visual) inspection prior to all concrete pours. All joints, pipe penetrations etc. independently air lanced to ASTM 04437. Contractor to supply sign off sheets (verification evidence) including photographs to verifier. Consideration given to need for/scope of integrity testing (eg initially on say 25 to 50 per cent of pours then falling to 10 to 25 per cent if acceptable results obtained and no concerns raised by visual inspections).
Intermediate risk CS2 (no venting) or CS3 (*with venting) Full radon protection area		Qualified and experienced installer (minimum one operative to hold qualification)	Verifier (consultant or third party qualified and experienced installer) to conduct a thorough verification (visual) inspection prior to 25 to 50 per cent of concrete pours (min two visits). 25 per cent all joints, pipe penetrations etc. independently air lanced to ASTM D 4437. Remaining 75 per cent joints, pipe penetrations etc tested to recognised standard by installer (as detailed in method statement/CQA plan). Installer to supply sign off sheets (verification evidence) to verifier for all other pours. Consideration given to need for/scope of integrity testing (eg initially on 10 to 25 per cent of pours then falling to 0 to 10 per cent if acceptable results obtained and no concerns raised by visual inspections).

If during the initial or subsequent inspections or based on the installer supplied information the quality of the installation is not deemed to be to a sufficient standard, then additional visits and integrity testing may be required.

10.0 WATCHING BRIEF

It remains possible that previously unexpected soil conditions may be encountered during the construction process. Examples may include oily pockets within the soil, potential for asbestos containing materials, black ashy materials, soils exhibiting strong odours, brightly coloured materials, and former demolition materials.

Should previously undiscovered contamination be encountered during the demolition/construction of the new buildings the following course of action should be adhered to:

1. The ground workers should report any suspected contamination immediately to the Client's site supervisor. The supervisor should contact the Client or their appointed agent who will in turn contact Castledine Environmental to request an engineer to visit the site to assess the extent of the 'contamination'.
2. Castledine Environmental shall make records of their inspection, and pass details of these to the Local Authority.
3. Where the conditions revealed differ from those previously anticipated, Castledine Environmental shall take samples as deemed appropriate to be dispatched for appropriate chemical testing.
4. Depending on the results of the testing either:
 - a. no further work will be required;
 - b. a further detailed risk assessment will be required; and/or
 - c. Localised specific remedial measures will be necessary. Appraisal criteria will vary depending on the nature of the assessment.
5. The results of any such testing will be sent to the Local Authority Pollution Control Section, Local Authority development control section, and the appointed building inspector. If remediation is

required, the LA/Building inspector will be informed of the date and time of the proposed works.

6. Remediation will be undertaken in accordance with a method statement submitted for approval. The works shall be supervised where necessary by Castledine Environmental who shall provide a Verification Report for the Local Authorities.
7. A copy of the discovery strategy (Appendix D) should be lodged on site and provisions made to ensure that all workers are made aware of their responsibility to observe, report and act on any potentially suspicious or contaminated materials they may encounter.

11.0 REPORTING

11.1 CAPPING MATERIAL

When the Capping layer has been completed and verified, a report should be produced for submission to the Local Authority. This should confirm that the works have been done and confirm that the site is now suitable for its intended use.

The report should contain:

- A summary of the remediation strategy and work undertaken.
- Copies of waste transfer note(s) and / or invoice(s) showing how much material has left site and its destination.
- A copy of the laboratory analysis results for imported material
- Copies of the transfer note(s) and / or invoice(s) for imported material showing the amount imported.
- Good quality photographs as indicated in section 9.1.2

11.2 GAS PROTECTION

Reporting of the verification activities will be completed following a site visit and verification of the installed gas protection measures. This should be carried out by a suitably qualified and *independent* inspector and the verification report will summarise the extent to which the remedial methods have been achieved and supporting documentation to include site plans and membrane photographs.

12.0 REFERENCES**12.1 LEGISLATION AND REGULATIONS****12.1.1 ACTS**

- [1] Environmental Protection Act 1990, Part IIA: inserted by Environment Act 1995, Section 57. See Environment Act 1995 for text of Part IIA.

12.1.2 PLANNING REGULATIONS

- [2] The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 SI1999/No.293
- [3] The Town and Country Planning (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2000 SI2000/No.2867

12.1.3 CONTAMINATED LAND REGULATIONS

- [4] The Contaminated Land (England) Regulations 2000. SI2000/No.227
- [5] The Contaminated Land (England) (Amendment) Regulations 2001 SI2001/No.663
- [6] The Contaminated Land (England) Regulations 2006 SI2006/No.1380

12.2 STATUTORY GUIDANCE

- [7] Department of Environment, Food and Rural Affairs. 2012. *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*. Department of Environment, Food and Rural Affairs
- [8] Communities and local Government, 2012: National Planning Policy Framework.

12.2.1 CL:AIRE

- [9] Card G, Wilson S, Mortimer S. 2012. *A Pragmatic Approach to Ground Gas Risk Assessment*. CL:AIRE Research Bulletin RB17. CL:AIRE, London, UK. ISSN 2047- 6450 (Online)

12.3 BRITISH STANDARDS

- [10] BS 5930:2015 Code of practice for site investigations
- [11] BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of practice
- [12] BS 8485:2015 +A1:2019 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings
- [13] BS 8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)

12.4 NON-STATUTORY TECHNICAL GUIDANCE**12.4.1 ENVIRONMENT AGENCY**

- [14] Cassella Stranger, 2002. Model Procedures for the Management of Contaminated Land, Contaminated Land Report (CLR) 11, Department for Environment, Food, and Rural Affairs.

12.4.2 CIRIA PUBLICATIONS

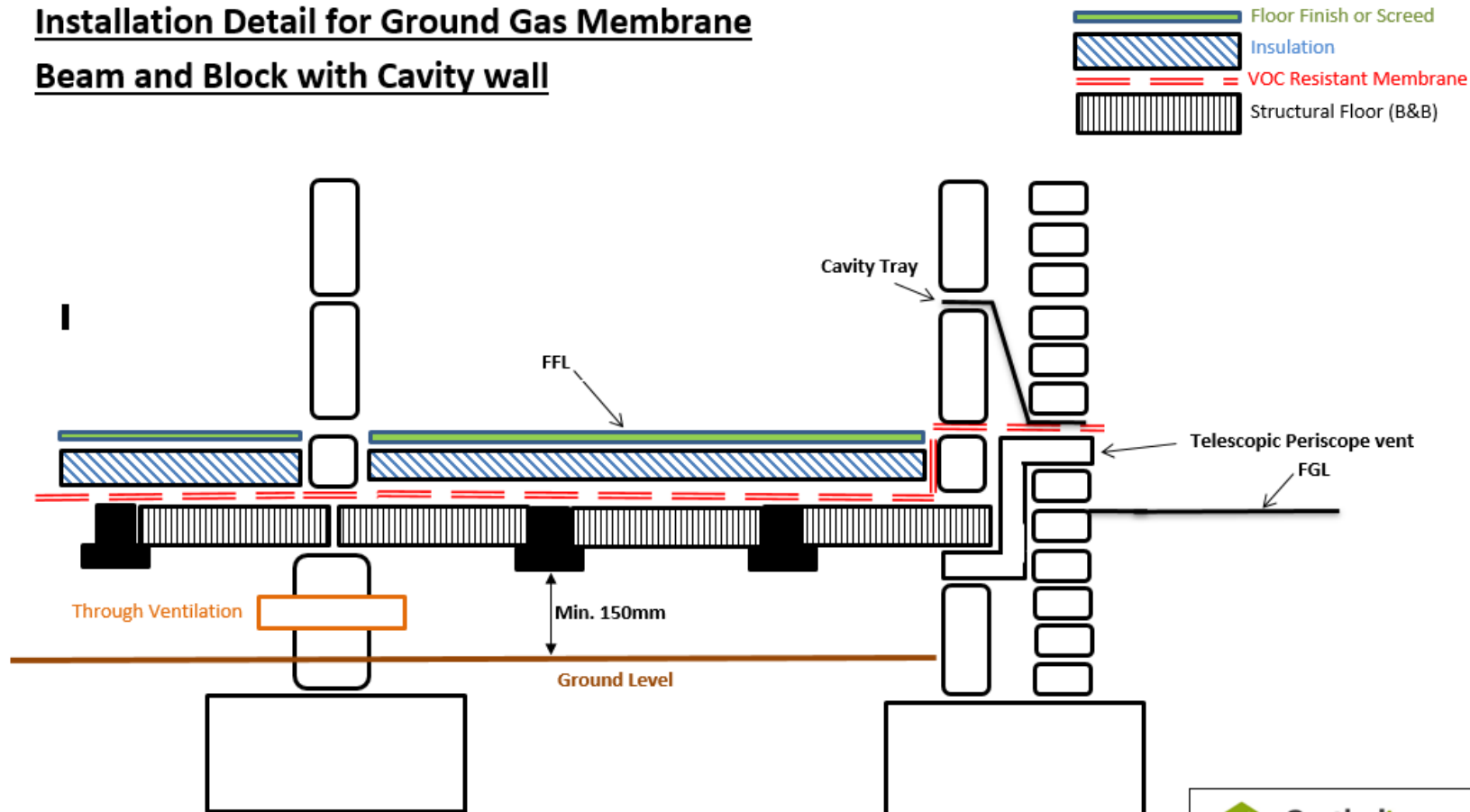
- [15] Wilson, S., Oliver, S., Mallett, H., Hutchings, H., and Card, G.. 2007, *C 665 Assessing risks posed by hazardous ground gases to buildings* London: Construction Industry Research and Information Association
- [16] Mallett, H., Cox, L., Wilson, S. and ,Corban M... 2014, *C 735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* London: Construction Industry Research and Information Association
- [17] Wilson, S., Sopp, G., Mallett, H., Happold, B., Card, C., CBCard & Partners...2020, *CIRIA C795 Retrofitting hazardous ground protection measures in existing or refurbished buildings*. London: Construction Industry Research and Information Association

13.0 APPENDICES

APPENDIX A

GAS PROTECTION PLAN

Installation Detail for Ground Gas Membrane
Beam and Block with Cavity wall



All structural detail to be confirmed by Architect

Note: All DPC / Membranes through masonry bed joints are required to be bedded both above and below with mortar

APPENDIX B

JUTA STANDARD DETAIL

GP® 1

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 vapours, air & Moisture protection system.

Contact us for more information: info@juta.co.uk

CHARACTERISTIC	TEST METHOD	UNIT	JUTA GP® 1
PHYSICAL PROPERTIES			
THICKNESS	EN 1849-2	MM	0.6
WIDTH	EN 1849-2	M	Various
LENGTH	EN 1849-2	M	Various
WEIGHT	EN 1849-2	G/M²	350
HYDRAULIC PROPERTIES			
WATER COLUMN	EN 20811	–	>300
RESISTANCE TO WATER PENETRATION	EN 13967, EN 1928	–	PA55
WATER TIGHTNESS	EN 1296, EN 1367, EN 1928	–	PA55
MECHANICAL 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	B5 EN ISO 15105 – 1	ml/m²/day/atm	<0.09
CARBON DIOXIDE PERMEABILITY	B5 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			
B5 8485:2015 COMPLIANT			
BBA CERTIFIED – CERTIFICATE NO. 12/4912			

For the needs of today and the demands of tomorrow.



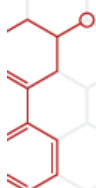
JUTA
Ability to Adapt



riba
product
selector



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

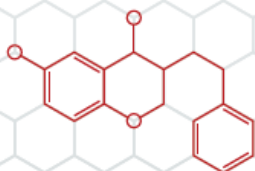
A wide range of accessories are available for use with the JUTA GP* 1 GAS BARRIER, including:

- ◉ 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)



ADDITIONAL INFORMATION

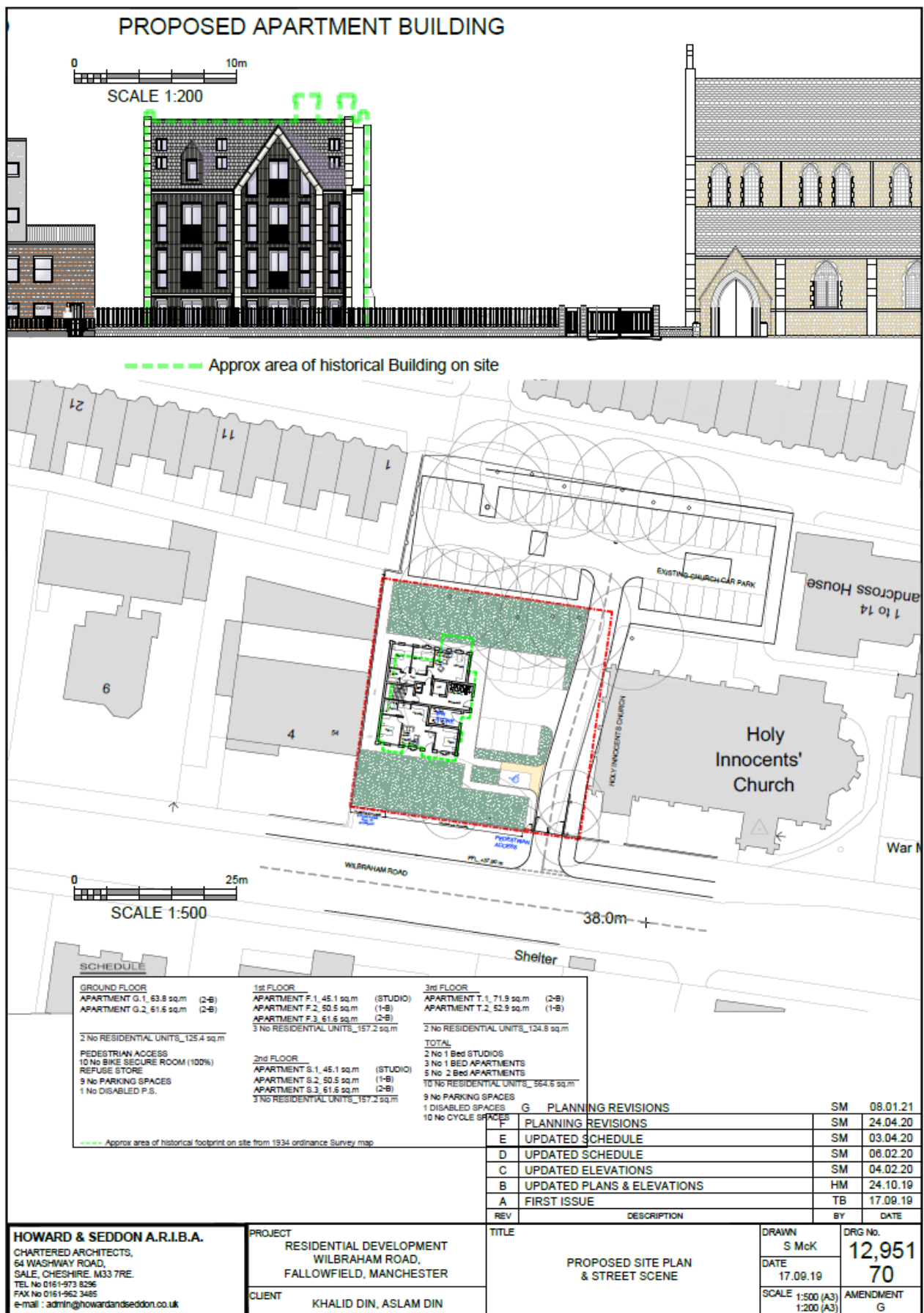
For additional information or assistance, please contact JUTA UK directly.

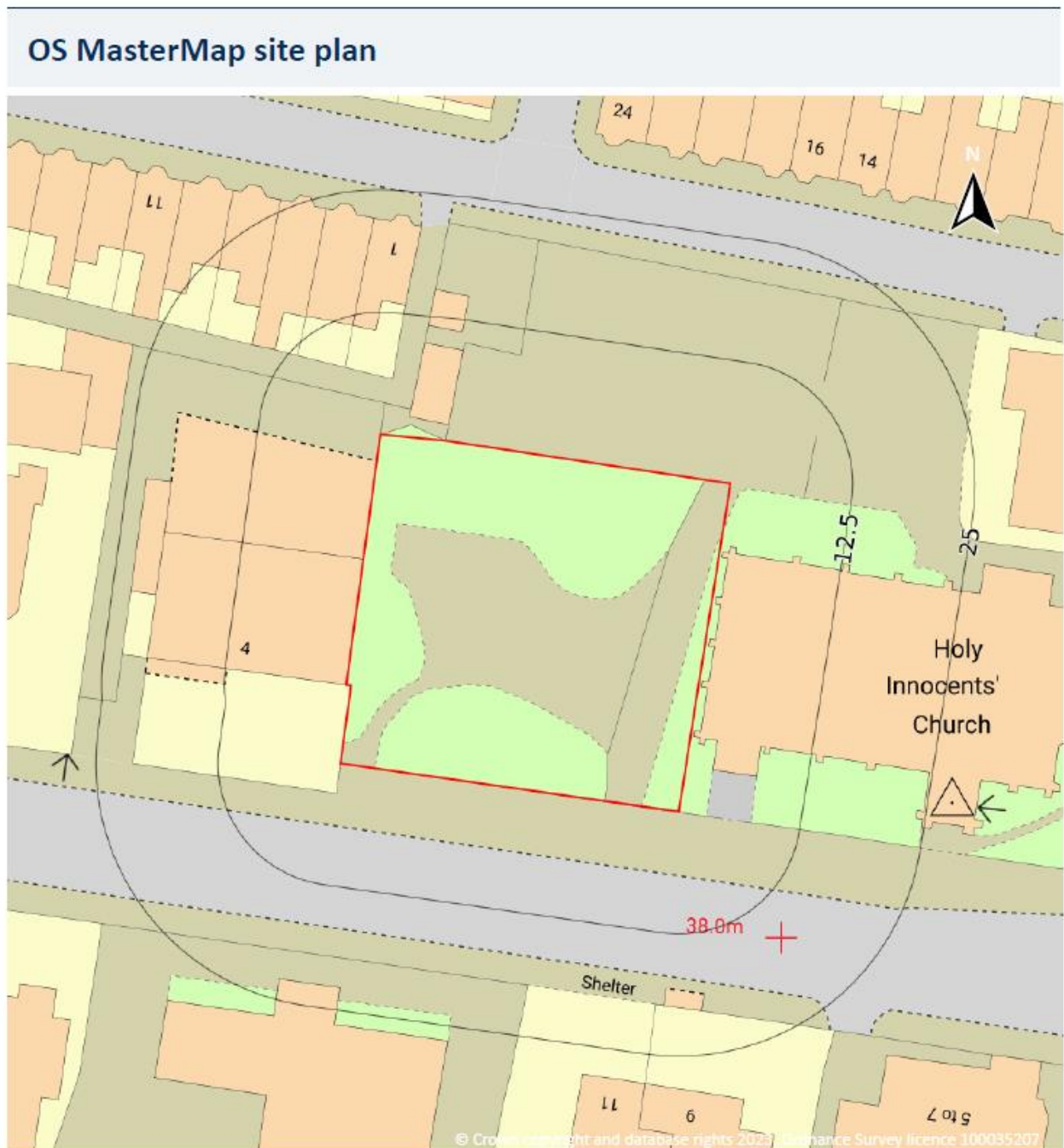


Contact us for more information: Info@Juta.co.uk

APPENDIX C

PROPOSED AND CURRENT SITE PLANS





APPENDIX D

DISCOVERY STRATEGY

