

Ground Investigation

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Project Reference: P1037.2 Rev.1
Site: Proposed Mixed Use Regeneration Scheme,
St George's Works, Trowbridge
Client: Gaiger Brothers Limited
Date: 22nd June 2018

REMEDIATION METHOD STATEMENT

1.0 INTRODUCTION

Ground Investigation Limited (GI) has been appointed by Gaiger Brothers Limited, to prepare this Remediation Method Statement appropriate for the mitigation of potential risks arising from ground contamination in connection with the proposed development at the premises known as the former St George's Works in Trowbridge.

The parcel of development land has been subject to a Ground Conditions Desk Study Report undertaken by others, followed by a Phase 2 Geo-Environmental Site Assessment Report and Proposed Remediation Strategy undertaken by GI in February 2018. The Phase 2 works undertaken are described and presented in detail in the following report, which also includes a summary of the earlier desk-based research undertaken by others:

(i)	Proposed Mixed Use Regeneration Scheme, St George's Works, Trowbridge, Phase 2 Geo-Environmental Site Assessment & Proposed Remediation Strategy, Report Number p-sw-1037.1.1.0, dated 19 th February 2018. (GI).	Ref. 1
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The report includes reference to research concerning the site history and its environmental setting, together with the findings of associated intrusive investigatory works, and remedial recommendations. A Conceptual Site Model of pollutant linkage was developed for the site and is described in the GI report (Ref. 1) in the context of the desk-based research, site walkovers and intrusive findings.

A summary of the works undertaken thus far is provided below, in order to put this remediation method statement into context.

1.1 Site Details

The subject of this report concerns two separate, albeit adjacent, development plots located within Trowbridge town centre. The main area comprises a number of disused commercial buildings and car parks at the site of the former St George's Works premises, and the smaller area is a council service yard on the northern fringe of Trowbridge Town Park, immediately to the south-east of St George's Works.

The postal address is St George's Works, Silver Street, Trowbridge, Wiltshire, BA14 8DA. The approximate National Grid Reference of the site is 385800, 157940.

The development proposals are understood to be divided into three main elements as summarised below.

- (i) The demolition of the former club building at St George's Works and its replacement with a four-storey block of 24 residential apartments with associated parking, subordinate soft landscaping and some small private garden areas.
- (ii) The conversion of a former warehouse building to provide 6 residential apartments.
- (iii) The construction of a new secure storage building for Trowbridge Town Council with associated parking and landscaping within the area of the council service yard and park.

The landscape proposals showing the hard surfacing, private gardens and communal soft landscaping, are shown on Figure 1.

Further details concerning the site location and its environmental setting are provided within the earlier report (Ref. 1).

1.2 Risks to Human Health

The report issued in January 2018 (Ref. 1) identified that a number of potential contaminants of concern were at concentrations above their GAC such that further consideration was warranted with regards to potential chronic human health risks. The elevated contaminant concentration included lead and a number of heavy-end polycyclic aromatic hydrocarbons (PAHs) and/or heavy-end petroleum hydrocarbons (TPH). Furthermore, the majority of the samples recorded the volatile organic compounds (VOCs) trichloroethene or dichloroethane above their respective GAC.

The elevated concentrations of lead and PAHs are likely to be associated with the presence of carbonaceous deposits such as ash and clinker, whilst the presence of olfactory evidence of hydrocarbons at one location would be the source of elevated TPH and some PAH. The significant legacy of the former Engineering Works at the site would almost certainly be the source of the elevated VOC compounds, which were dominated by trichloroethene. One of the main uses for trichloroethene, apart from the manufacture of other chemicals, is to remove grease from metal parts i.e. a degreaser, which may have been used in significant quantities at an engineering works.

The critical exposure pathways from lead, and the elevated heavier-end PAH and TPH compounds would be ingestion and dermal contact with soils and soil dust, whilst the critical exposure pathway from lighter-end PAH and TPH, together with VOCs such as trichloroethene in the near surface soils would also include the indoor inhalation of vapours, owing to their volatile nature.

It should also be appreciated, that due to the physical composition of the encountered Made Ground, which contained fractions of ash and clinker etc, that these materials would unlikely to be suitable as surface cover in garden areas or other areas of soft landscaping.

In the above regard, due to the limited extent of proposed soft landscaping, an adequate thickness of clean cover placed in landscaped areas, as part of an engineered clean cover system, was considered likely to prove the most practicable and economic solution to mitigate potential human health risks to future site users in the context of the lead and heavy-end PAHs/TPHs. As a due diligence and precautionary approach, the thickness of the clean cover specified in this document has been checked against the BRE document 'Cover Systems for Land Regeneration', BR 465, 2004, to ensure that if intermixing were to occur, then enough clean cover is present. In this regard, using average concentrations of the elevated potential contaminants of concern mentioned above, and taking $0.5 \times$ the target guideline value (GAC), the 'overall thickness of cover required', as calculated by the spreadsheet in Appendix F of the guidance is between 257 and 505 mm. Using half the GAC as the contaminant concentration of the clean cover is in our opinion a cautious approach, as the make up of imported 'clean' soils, will be very low in terms of contaminant concentrations. Moreover, the proposed use of a basal geotextile membrane and granular capillary break should ensure that significant soil mixing does not occur.

In the above context, it should be appreciated that within the permanently hard surfaced parts of the site, such as the dwelling footprints, the driveways and parking areas, which form the majority, the soils will continue to be effectively encapsulated, therefore mitigating the risks to the eventual occupiers.

In the context of the lighter-end TPHs and/or VOCs, as a precautionary measure, it was proposed that gas protection measures are afforded to the ground floor construction of the apartment blocks at the site, with

the gas-proof membrane upgraded to a vapour barrier that will afford protection to the ingress of TPH/VOC vapours. Notwithstanding this, it should be appreciated that the main primary sources of hydrocarbon/VOC contamination (relating to the former engineering works and associated activities) will be removed from site to realise the proposed development.

In conclusion, on the basis of the conceptual site model and generic quantitative risk assessment presented in the previous report (Ref. 1), a requirement has been identified for remedial works to mitigate the potential risks to the future site users of the development, together with future site operatives involved in maintenance works.

1.3 Risks to Controlled Waters

Considering the potential impact of the development on controlled waters, it is noted that a bedrock aquifer designation of Secondary 'A' Aquifer is ascribed to the Forest Marble Formation. However, there are no source protection zones or licensed groundwater abstractions points in the vicinity of the site, and moreover, there are no nearby surface water features. On this basis, controlled waters receptors were considered by our earlier report to be of relatively very low sensitivity.

Furthermore, and critically, a thick sequence of cohesive, low permeability soils has been proven to underlie the site which would act as a barrier against groundwater contamination migration. In this regard, the in-situ soil infiltration tests have proven this to be the case.

It should be appreciated that the proposed residential development, being associated with the removal of all former commercial and industrial usage will provide appreciable environmental betterment compared with the former land uses. Moreover, the development will also be associated with the provision of a newly engineered drainage system thus mitigating the risk from mobilisation of leachable or liquid contaminants through surface water infiltration.

Subject, therefore, to the approval/agreement of the regulatory authorities, it was concluded by our earlier report, that specific remedial measures to protect controlled waters should not be warranted.

Following consultation with the Environment Agency, subsequent correspondence (Ref. WX/2018/131682/01-L01) broadly accepted the conclusions, but identified a potential risk to controlled waters if previously unidentified pathways were to exist, and advised that work on site should proceed with caution to allow the discovery and reporting of such pathways or significantly greater concentrations of contamination, in order to protect controlled waters and site workers.

1.4 Gas Risk

The Geo-Environmental Site Assessment (Ref. 1) established that the site is underlain by variable and in places significant thicknesses of Made Ground, considered a possible source of potentially hazardous ground gas. The degradation of potential organic contaminants, as well as the presence of lighter-end TPH, PAH and VOCs, associated with the more recent industrial use of the site was also identified as source of potentially hazardous ground gas and vapour ingress.

Gas monitoring was completed on three occasions within 5 observation wells, which were monitored for methane, carbon dioxide and oxygen, together with gas flow rate, using an infrared analyser.

No gas flows were detected, whilst carbon dioxide was detected at a maximum concentration of 11.2 %, with methane at a maximum concentration of 0.3 %.

Based on the gas monitoring regime, a requirement for basic protective measures was identified, which would be expected to comply with NHBC Amber 1 requirements in the proposed residential development area and CS2 for the commercial development. It should also be acknowledged in this context, as discussed previously, that some protection from VOCs and volatile hydrocarbons would also be considered necessary within the footprint of the proposed residential development.

In the above regard, the installation of a proprietary VOC/hydrocarbon resistant gas membrane was recommended throughout the residential development area, with all joints and service penetrations being sealed, and with the converted building being retrofitted with vapour protection. It was concluded that a lower specification of membrane could be utilised for the council storage building (resistant to carbon dioxide) on the basis that contaminant concentrations within soils in this area did not exceed published GAC for the lower sensitivity commercial use.

It was noted that the proprietary gas and hydrocarbon vapour resistant membrane should be installed by suitably qualified operatives with appropriate verification.

Further to consultation with the Local Authority's Contaminated Land Officer, it has been agreed that the gas membranes will be integrity tested following installation by a specialist contractor and the test certificates will be included within the subsequent verification report.

1.5 Risks to Water Supply Services

Given the former commercial/industrial land usage at the site, together with evidence of hydrocarbon/VOC contamination based on the laboratory data, a recommendation was made for non-permeable 'Protecta-line' barrier pipe or similar to be utilised for the construction of water services entering the site and connecting the properties, with all services installed within 'clean corridors' surrounded by inert materials, in order to prevent future maintenance workers from exposure to possible contaminated materials.

2.0 PROPOSED REMEDIATION STRATEGY

2.1 Clean Cover System in Soft Landscaped Areas

The vast majority of the site is to be encapsulated by permanent or hard surfacing, including the buildings, car parking areas and driveways. However, small subordinate areas of soft landscaping are proposed to accommodate private gardens and communal landscaped areas, as shown on Figure 1.

These areas will incorporate a clean cover system, consisting of a surface layer of topsoil to support plant growth, followed by an appropriate thickness of subsoil, separated by a geotextile membrane from an underlying granular capillary break layer. Cover thicknesses will be designed to exceed the minimum determined using the BR465 guidance document, as summarised below:

Landscaped Area	Cover System Material	Thickness (mm)
Private Garden	Topsoil	~150
	Subsoil	~450
	Geotextile Membrane	-
	Granular Capillary Break	~200
Communal Soft Landscaping	Topsoil	~150
	Subsoil	~300
	Geotextile Membrane	-
	Granular Capillary Break	~200

Prior to placing the clean soil cover in the residential garden areas, any underlying in-situ materials exhibiting a significant hydrocarbon odour will be excavated and removed from site, thus ensuring there can be no adverse effect on amenity from any residual hydrocarbon contamination in these areas.

All materials that are to be brought to site to be incorporated in the clean cover system shall be from a reputable supplier with delivery notes/receipts and the source of the materials known.

The soils used as cover will comprise the certified clean imported material detailed above, which complies with published Soil Guideline Values (SGVs) and other Generic Assessment Criteria (GAC) appropriate for a residential end use.

The construction of a clean cover system in areas of soft landscaping, such as that detailed above, will break the pathway between any residual potentially contaminated soils that have the potential to be present beneath the site, and the future site users.

Validation of the construction of the clean cover system will be undertaken with site photographs and trial pit records, together with laboratory certificates and delivery/transit notes for any imported soils.

2.3 Gas/Vapour Membrane

As discussed above, a requirement has been identified for the ground floor slabs of the proposed residential buildings to include basic gas protection measures, designed to comply with NHBC 'Amber 1' or CS-2, depending on the type of building. It is proposed that the gas protection in these residential buildings will be upgraded to include a proprietary hydrocarbon vapour resistant membrane. The council storage building will also be provided with basic gas protection corresponding to CS-2 of the public guidance, which following consultation with the Local Authority's Contaminated Land Officer, will be upgraded to also provide hydrocarbon vapour protection.

A Visqueen Ultimate GeoSeal Gas/Vapour membrane will be utilised for both the residential and commercial buildings, in order to provide the necessary degree of resistance to ground gas, hydrocarbons and volatiles. A product data sheet for this material, verifying its suitability is presented in Enclosure A.

In the context of the above, an engineering drawing showing details of the retrofitted protection in the refurbished block as well as the proposed ground floor slab construction of the new block, which has been designed by the Client's Structural Engineer, is presented in Figure 1.

This drawing clearly shows that, within the refurbished block, the VOC resistant membrane is retrofitted over the existing floor slab and dressed up the internal face of the wall. The proposed new block has the VOC resistant membrane laid over the beam and block floor, and taken across the full width of external and internal walls, over a ventilated sub-floor void. All joints and service penetrations will be taped and sealed.

The gas protection measures will be installed by suitably qualified operatives with appropriate verification. Integrity testing of the installed membranes will be undertaken by a specialist contractor on completion using a non-toxic tracer gas and the test certificates will be included in the verification report.

2.4 Reporting of Unexpected Contamination (Discovery Strategy)

Careful vigilance will be exercised throughout the groundworks phase of construction for any visual or olfactory evidence of soil and/or groundwater contamination, materials differing to those described within the recent reports, or indeed any unforeseen underground features such as USTs, supply pipes etc. The construction workforce will be fully briefed in this context during their initial site induction.

In the above regard, an anomalous void feature identified beneath one of the existing building floor slabs by the intrusive investigatory works will be investigated during the demolition works/initial preparatory groundworks.

Based on the stated requirements of the Environment Agency, as discussed above, the initial stages of the site works will proceed with due caution and under an appropriate level of technical supervision, to allow the discovery and reporting of any previously unidentified pathways, or significantly greater concentrations of contamination.

Should any such evidence of such features, or any contaminated/differing soils be encountered, the Contractor will stop work in this area pending further investigation and assessment by a competent geo-environmental specialist. The provision for reporting of unexpected contamination is particularly important, given the former site use.

Both the Environmental Health Officer dealing with Contaminated Land at the Public Protection Department of Wiltshire Council and the Environment Agency will be informed in the eventuality that unexpected contamination or potential migration pathways are encountered.

3.0 ENVIRONMENTAL CONTROL OF WORKS

The proposed works shall be undertaken during normal working hours in such a manner that they are not associated with excess noise and environmental disturbance.

The removal of excavation spoil from the site will be undertaken in a carefully controlled manner using a designated route to avoid cross contamination of the ground surface. Measures shall be taken to suppress airborne particulate matter during any bulk earthmoving operations and any lorries removing soils from site shall be covered.

The Contractor will take the necessary steps to ensure surface water run-off from the site during the course of the construction works cannot enter any drains/watercourses. In this regard, the proposed remedial works will be undertaken in such a manner as to adhere to Environment Agency (EA) protocols.

4.0 HEALTH AND SAFETY CONSIDERATIONS

The potential health risks to groundworkers involved in the proposed remedial works, and the general public, will be considered in the context of the pre-construction Health and Safety Plan prepared by the Contractor.

Suitable welfare facilities will be provided, together with appropriate personal protective equipment to prevent direct dermal contact with potentially contaminated soils or liquids.

Measures will be taken to control airborne particulate matter and personnel will not be permitted to enter unsupported excavations unless the sides are adequately battered.

5.0 VALIDATION & REPORTING

The planned remedial works will be undertaken under an appropriate level of technical supervision during which photographs will be taken and other documentary evidence collected to verify the satisfactory completion of the works. Following completion of the remedial works a walkover of the site will be undertaken and, where appropriate, trial excavations will be opened and inspected to confirm the depth and nature of clean cover in those areas that require it.

Documentary evidence in the form of waste transfer notes and chemical test certificates for imported materials will be examined, as well as purchase receipts for proprietary membranes, surfacing and geotextiles. A validation report will be prepared on completion of the works for submission to the regulatory authorities.

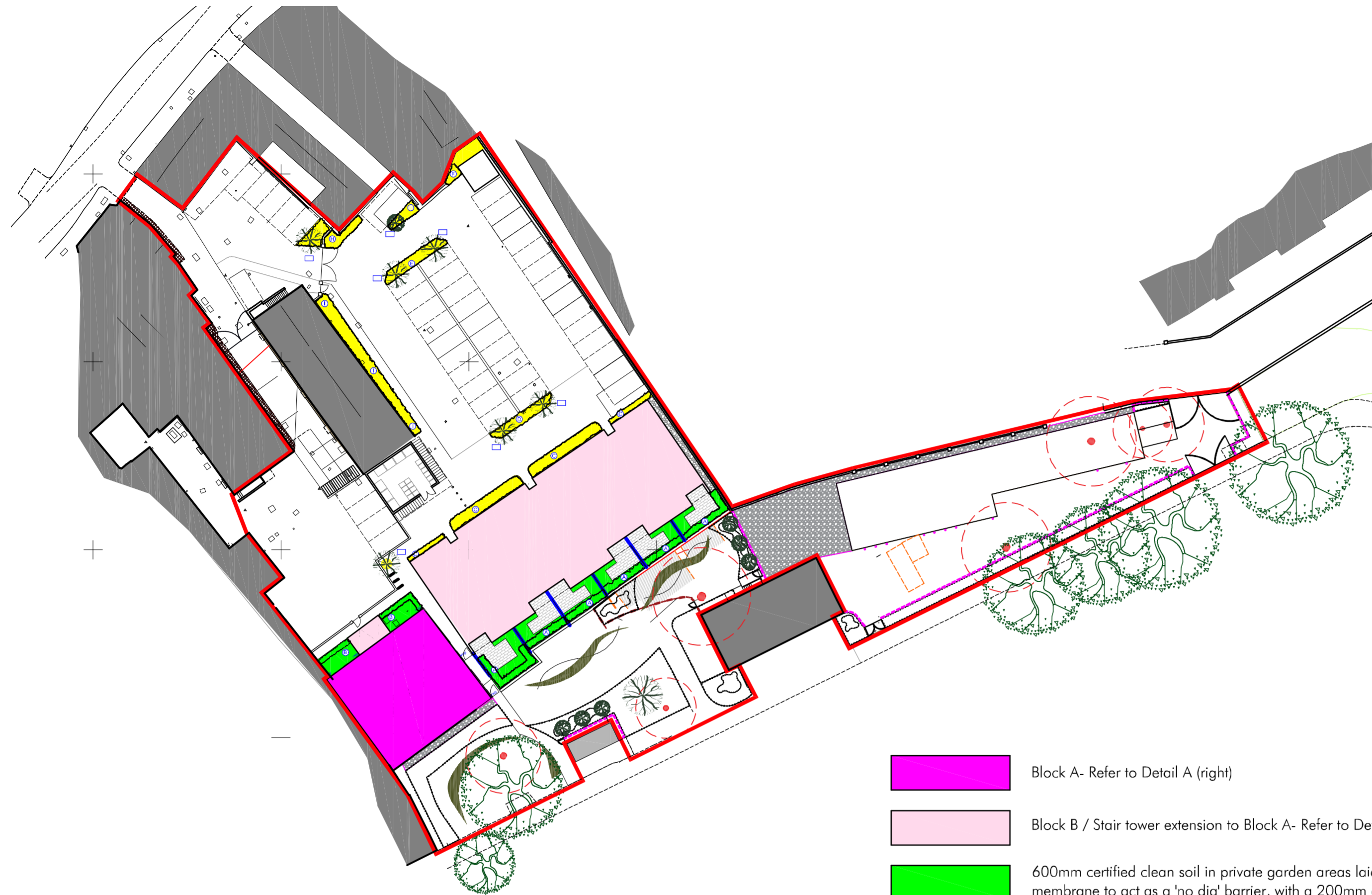
Certification of soils suitable for re-use in soft landscaped areas will include analysis for a range of metals, together with speciated polycyclic aromatic hydrocarbons, total petroleum hydrocarbons and asbestos, undertaken by a UKAS accredited laboratory. The results of these analyses will be compared with contemporary generic assessment criteria published for the standard residential land use. Subject to the requirements of the Environmental Health Officer dealing with Contaminated Land at the Public Protection Department of Wiltshire Council, further analysis of the imported soils will also be undertaken to verify their suitability.

Gas protection measures will be independently validated by photographic evidence of installation and completion in accordance with the design specification included in Figure 1. Certificates will be included for the integrity testing completed following installation of the membranes.

6.0 ENCLOSURES

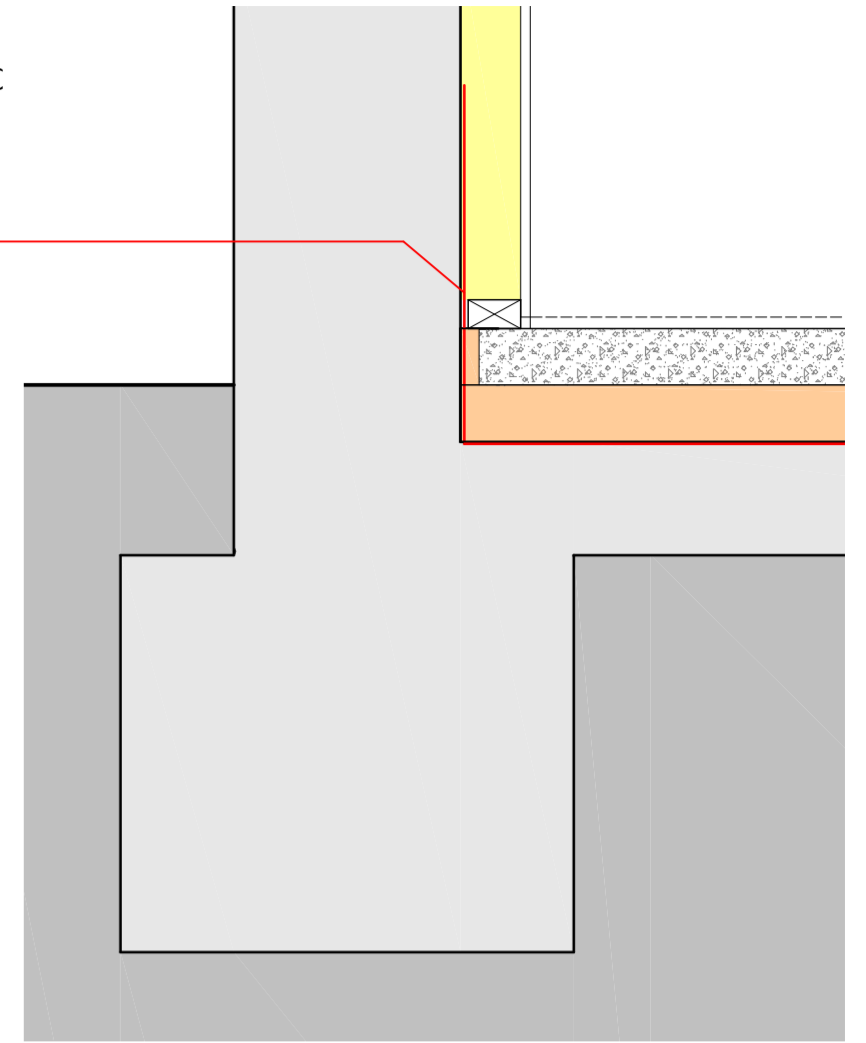
- Figure 1 – Landscape Proposals and Proposed Substructure Details
- Enclosure A – Visqueen Ultimate GeoSeal Datasheet

ENCLOSURE A



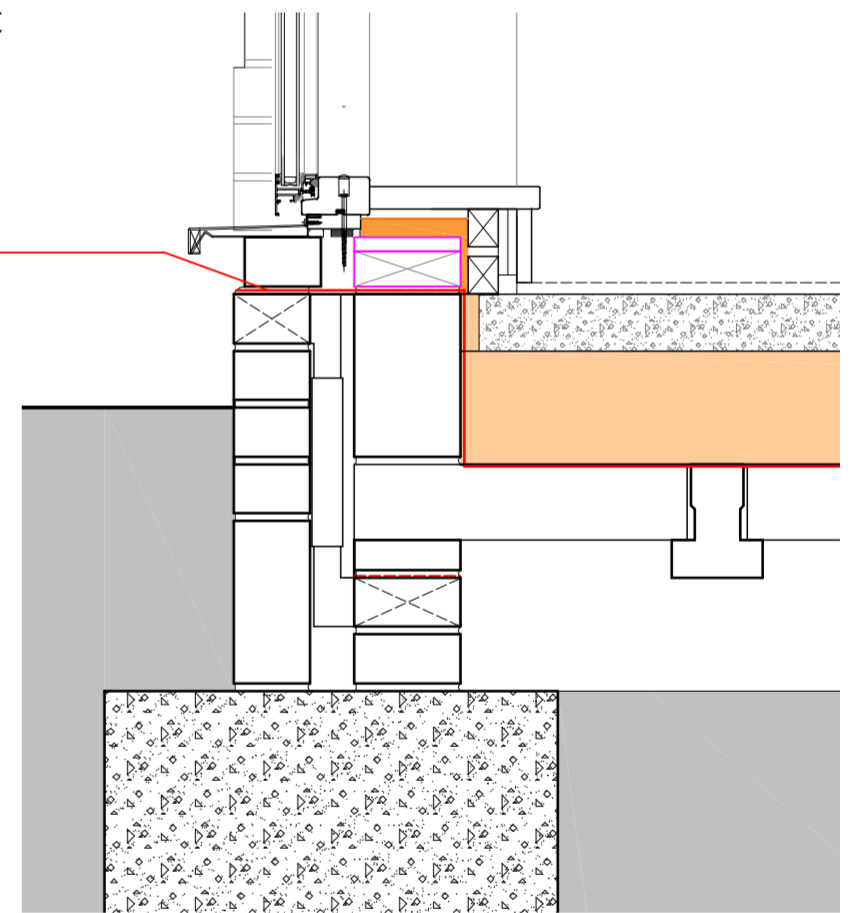
- Block A- Refer to Detail A (right)
- Block B / Stair tower extension to Block A- Refer to Detail B (right)
- 600mm certified clean soil in private garden areas laid over a geotextile membrane to act as a 'no dig' barrier, with a 200mm course granular capillary break layer beneath.
- 450mm certified clean soil in communal soft landscaping areas laid over a geotextile membrane to act as a 'no dig' barrier, with a 200mm course granular capillary break layer beneath.

Visqueen Ultimate GeoSeal gas / VOC resistant membrane laid over existing floor slab and dressed up internal face of wall.






DETAIL A

Visqueen Ultimate GeoSeal gas / VOC resistant membrane laid over beam and block floor and taken across full width of external / internal walls



DETAIL B

REVISIONS

	<p>© This drawing is the Copyright of PKA Architects Ltd Registered in England and Wales No B605083. Do not rely on scaled Dimensions. If in doubt - ASK All dimensions to be checked on site by contractor OS copyright licence AR100010276</p>		
<p>FILE PATH X:\Projects\Current Projects\1741-Gaiger St Georges Works Trowbridge\02- Issues\2018-06-12\1741-landscape1.dwg DATE PRINTED Tuesday, 12 June, 2018</p>			

Client		Gaiger Bros Ltd	
Site		St. Georges Works, Trowbridge	
Drawn by	mc	Date	11-06-2018
Checked by	nts	Scale	nts
Title			
Site remediation plan			
Remediation-1741-landscape1.dwg			

ISSUED FOR
PLANNING
APPLICATION

	<p>RIBA CHARTERED PRACTICE</p> <p>PKA Architects Ltd Featherbrook, Whistley Road, Potterne, Devizes, Wiltshire. SN10 5TD tel 01380-725688 email: peter@pka-architects.com www.pka-architects.com</p>
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ENCLOSURE B



Visqueen Ultimate GeoSeal

A robust gas and chemically resistant pre-applied membrane

- Conforms in full to BS8102:2009, CIRIA C748 and BS8485:2015
- Unique pre-applied and gas resistant membrane
- Excellent VOC & methane barrier resistance
- Suitable for both Tanking and DPM applications
- Utilises Visqueen's unique technology
- Exceptional puncture resistance - No protection required
- Welding and Visqueen Gas Resistant tape system options

Description

Visqueen Ultimate GeoSeal is a pre-applied membrane designed to comply with current guidance on waterproofing, Volatile Organic Compounds (VOCs) and ground gases. Manufactured using Visqueen's advanced barrier technology and drawing on our extensive knowledge and expertise in gas protection, Visqueen has developed a new barrier membrane suitable in applications that are affected by aggressive chemicals such as Benzene, Toluene, Ethyl Benzene and Xylene (BTEX).

The product is textured on one side to aid adhesion to concrete and available in a large roll format to minimise jointing and quick installation times. The membrane is grey and black and 2.44m x 41m x 1mm (100m²), in single wound roll format and packaged in a clear outer wrap.

The membrane should be installed grey and textured side up.

Applications

Visqueen Ultimate GeoSeal is suitable for the following applications:

- Waterproofing applications to BS8102:2009 type A
- Slab edges and permanent shutter work
- Tanking below ground structure e.g. lift pits
- VOC/Hydrocarbon contaminated sites in accordance with CIRIA C748
- Carbon dioxide and methane sites in accordance with BS8485:2015

The membrane can withstand normal on-site foot traffic and the activities associated with the laying of a reinforced concrete slab without the need for additional membrane protection. In addition, when applied with welded joints the membrane can provide protection against hydrostatic water pressure.

Due to a diverse range of waterproofing applications and variations in attack chemicals we strongly advise contacting Visqueen's technical department for correct specification – 0333 202 6800

The innovative Visqueen - Advanced Barrier Technology

1. An advanced gas barrier structure
2. Superior physical and chemical resistant barrier properties
3. Easy & rapid welding
4. Good environmental stress crack resistance

Advanced barrier technology utilises Visqueen's extensive manufacturing technical expertise and experience to ensure buildings and occupants are safe from hazardous ground gases and VOCs.

Specific Approvals / Standards

■ **BS8102:2009** – Code of practice for protection of below ground structures against water from the ground. Type A membrane

■ **CIRIA C748** – Guidance on the use of plastic membranes as VOC vapour barriers.

■ **BS8485:2015** - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

■ **CE Mark EN13967** - Flexible sheets for waterproofing. Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet. Definitions and characteristics

Validated test data and compliance to the latest standards

CIRIA C748 and BS8485:2015 are the latest and most relevant standards and codes of practice for protecting buildings on contaminated land. These documents ensure any risks are mitigated by using best practice in design and selection of gas membranes. The documents intend to **harmonise test methods and result units** for the industry and to mirror the application in order that the appropriate membrane can be selected.

Visqueen embarked on an extensive testing regime to ensure its membranes are the best in class and comply with the new standards. Visqueen's Ultimate range have all passed the stringent **methane 40ml/m²/day/atm** (ISO15105-1 to BS8485:2015 requirement) threshold and physical property requirements. CIRIA C748 states a VOC membrane must be tested as a minimum to the below challenge chemicals. Visqueen have conducted VOC vapour and chemical resistance testing (including conducting application cocktail testing) to these challenge chemicals below in accordance C748. The actual test results by a 3rd party approved laboratory are shown in the datasheet.

- Benzene
- Toluene
- ethyl benzene
- (m,p, and o) xylenes
- Hexane
- vinyl chloride
- tetrachloroethene (PCE),
- trichloroethene (TCE),
- Naphthalene

System Components

- Visqueen GX Double Sided Bonding Tape
- Visqueen Gas Resistant Lap Tape
- Visqueen Retaining discs and nails
- Visqueen GX Top Hat Units
- Visqueen Detailing strip

Please note that the membrane can be welded as a preferred

alternative to using tapes.

Installation

Visqueen Ultimate GeoSeal and system components should be installed in accordance with the recommendations of the relevant codes of practice and industry guidance, such as CP102:1973, BS8102:2009, BRE414:2001, CIRIA C748, BR211:2007 and BS8485:2015.

The membrane should not be taken through any masonry wall. The relevant Visqueen damp proof or gas proof course should be taken through and extended beyond the wall by a minimum of 250mm where it can be jointed to the membrane.

When installed horizontally, the membrane should be applied to a smooth concrete blinding or alternatively sand blinding. The surface should be free from loose aggregates or other sharp protrusions. Any standing water should be removed to prevent potential lap joint contamination. The membrane should be laid with the textured surface facing away from the blinding.

Formwork installation

When installed vertically, Visqueen Ultimate GeoSeal should be pre applied to temporary formwork or the adjoining structure. Visqueen Retaining Discs are available to provide a means for securing the leading edge of the membrane to the temporary formwork. The membrane should be installed with the smooth surface facing the formwork.

Using oval nails, Visqueen Retaining Discs should be mechanically fixed, at maximum 400mm centre, to the internal face of the shuttering. Using a suitable power tool and 6mm drill bit to create a pilot hole in the membrane, the Visqueen Ultimate GeoSeal should be secured over the protruding section of the retaining disc. The top edge of the membrane should be trimmed to approximately 20mm below the top edge of the slab.

Once the concrete has set, the oval nails should be removed by pulling through from the external face of the shuttering. When the temporary formwork is removed the Visqueen Retaining Discs should be visible on the external (smooth) face of the membrane. Continuity of the membrane system with the damp or gas proof course is maintained using Visqueen GR Self Adhesive Membrane (see Visqueen Typical Details)

Waterproofing

When a combined waterproofing system is required Visqueen recommend a suitable drainage system should be designed and incorporated. Visqueen Cavity Drain System provides a type C internal protection and information is available on this link. Please contact Visqueen to ensure correct specification for your project support including design and membrane selection 0333 202 6800.

When using GeoSeal in an external waterproofing application hydrostatic pressure can be relieved by using Visqueen Protect&Drain. The design and installation should be in accordance with BS8102:2009 – please visit [www.visqueenbuilding.co.uk/ products/external-water-management/protect-%26-drain](http://www.visqueenbuilding.co.uk/products/external-water-management/protect-%26-drain)

Lap joints

Visqueen Ultimate GeoSeal has been designed to exhibit superior welding properties using hot edge, hot air, or extrusion welding. Therefore onsite welding of membrane lap joints is recommended for all applications and must be employed when hydrostatic water pressure or hydrocarbon/VOC contamination is present.

Where required, Visqueen's network of preferred installers can install the membrane and offer the client a fully warranted system.

Tape Joints

Alternatively, when Visqueen Ultimate GeoSeal is used for damp proofing, ground gas protection and sites where hydrostatic water pressure or hydrocarbon

ULTIMATE
GEOSEAL

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contamination is of low risk, lap joints can be bonded with Visqueen GX Double Sided Jointing Tape and then sealed with Visqueen Gas Resistant Lap Tape. When using tapes to secure laps, the overlap should be minimum 150mm and the membrane surfaces to be jointed should be dry and free from contamination such as dust or sand. Once the tapes are applied, the lap should be well rolled with firm pressure to ensure complete adhesion and continuity.

Service penetrations, corners and junctions

All service pipe penetrations should be fully sealed using welded membrane or Visqueen GX Preformed Top Hat Units. The base and collar of the preformed unit should be bonded using Visqueen GX Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Lap Tape. The collar should be secured with a mechanical fastening.

To ensure system integrity, all internal and external corners should be provided with either welded corners or Visqueen Preformed Units bonded to the membrane using Visqueen Double Sided Jointing Tape and sealed with Visqueen GR Single Sided Lap Tape. Complex or awkward junctions should be sealed using either welded membrane or Visqueen Detailing Strip.

Precautions

When the weather is cold, Visqueen jointing tapes and self-adhesive materials should be kept in a warm, dry place until needed. Unless welded, membrane installation is not recommended below 5°C.

To avoid high linear expansion when installed in hot weather, the membrane should be covered immediately after installation with concrete or screed.

Storage and Handling

Visqueen Ultimate GeoSeal is classified as non-hazardous when used in accordance with the relevant British Standards. The product is chemically inert and is not affected by acids and alkalis that may be present in the sub-soils. The product should be stored in a warm dry environment and not exposed to long periods of sunlight.

A roll weighs 97 kilos and should be handled with care following on site health and safety procedures.

Product & Performance Data:

All tests are conducted by a 3rd party approved laboratory

Characteristic	Test Method	Units	Criteria	Result
Colour				Grey and Black
Length	EN 1848-2	m	-0/+10%	41
Width	EN 1848-2	m	-0/+10%	2.44
Thickness	EN 1848-2	mm	+/-10%	1
Weight		kg		97

BS8485:2015 - Methane testing	Test Method	Units	Criteria	Result
Methane permeability	ISO 15105-1	ml/m ² /day/atm	<40	Pass

BS8485 and C748 physical test results	Test Method	Units	Criteria	Result
Puncture	BS EN ISO 12236:2006	N	MDV	2850
Impact resistance Method A hard surface	EN12691	mm	MDV	750
Impact resistance Method B soft surface	EN12691	mm	MDV	>2000
Tensiles Yield strength MD	ASTM D4885-01	kN/m	MDV	11.9
Tensiles Yield strength CD	ASTM D4885-01	kN/m	MDV	12.7
Elongation @ break MD	ASTM D4885-01	%	MDV	>500
Elongation @ break CD	ASTM D4885-01	%	MDV	>501
Tear resistance - trouser method A - MD	BS ISO 34-1	kN/m	MDV	79.6
Tear resistance - trouser method A - CD	BS ISO 34-1	kN/m	MDV	75.8

Tear resistance - angle method B - MD	BS ISO 34-1	N	MDV	128.3
Tear resistance - angle method B - CD	BS ISO 34-1	N	MDV	126.9

CE Mark to EN13967	Test Method	Units	Criteria	Result
Tensile Strength - MD	EN 12311	N/mm ²	>MLV	29
Tensile Strength - CD	EN 12311	N/mm ²	>MLV	27
Tensile Elongation - MD	EN 12311	%	>MLV	864
Tensile Elongation - CD	EN 12311	%	>MLV	869
Joint Strength	EN 12317-2	N	>MLV	450
Watertightness 60kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	-MLV	900
Low temperature flexibility	EN 1109	°C	-15	Pass
Durability against heat ageing	EN 1296	-	Pass/Fail	Pass
Durability Chemical Resistance	EN 1847	-	Pass/Fail	Pass
Resistance to tearing (nail shank) CD	EN 12310-1	N	MDV	445
Resistance to tearing (nail shank) MD	EN 12310-1	N	MDV	470
Resistance to static loading	EN 12730	Kg	>MLV	Pass at 20
Water vapour transmission - resistance	EN 1931	MNs/g	MDV	2385
Water vapour transmission - permeability	EN 1931	g/m ² /d	MDV	0.05
Puncture	BS EN ISO 12236:2006	N	MLV	>2500

C748 - Permeation vapour tests - 100% concentration	Test Method	Units	Criteria	Result
Benzene	ISO 15105-2	ml/m ² /day	MDV	<1
Toluene	ISO 15105-2	ml/m ² /day	MDV	<1
Ethyl benzene	ISO 15105-2	ml/m ² /day	MDV	<1
(m,p, and o) xylenes	ISO 15105-2	ml/m ² /day	MDV	<1
Hexane	ISO 15105-2	ml/m ² /day	MDV	<1
Vinyl chloride	ISO 15105-2	ml/m ² /day	MDV	<1
Tetrachloroethene	ISO 15105-2	ml/m ² /day	MDV	<1
Trichloroethene	ISO 15105-2	ml/m ² /day	MDV	<1
Naphthalene	ISO 15105-2	ml/m ² /day	MDV	<1

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