

MORRIS STREET RADCLIFFE

REMEDIATION STRATEGY AND VERIFICATION PLAN

Job Number: LKC 21 1616
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Document Verification

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1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Watson Construction Ltd to provide a Remediation Strategy and a Verification Plan for the proposed residential development for land at Morris Street, Radcliffe.

The Remediation Strategy is required to determine the work necessary in order to ensure the site is “suitable for use” for the proposed residential development with regards to potential contaminated land pollutant linkages.

With regards to the Verification Plan Land Contamination Risk Management (LCRM) Stage 3 remediation and verification¹ states

You will need to produce a verification plan. This will be a part of the remediation strategy. It will need to set out all of the data requirements, including compliance criteria and monitoring details. This will establish a ‘lines of evidence’ approach which will verify remediation is working or has worked.

The Verification Plan is provided in Section 8 and has been written with recourse to the Remediation Strategy.

1.2 Site Details

A summary of site details is presented in Table 1-1. Site location and proposed development plans are provided in Appendix A.

Location	To the southwest of Morris Street in Radcliffe. Centred at approximate National Grid Reference 380130E 408160N.
Area	9,600m ² .
Site History	Agricultural use until a residential development in the north and a chemical works to the south by the 1920s. A cotton weaving mill and cabinet works in the northeast. The site was then developed as a bowling green and tennis court in the 1950s. The site formed part of the wide Halls factory site until 2004. It is understood that the study site formed part of a remediation and enabling works scheme for an adjacent residential development recently undertaken by ADM Regeneration. The current study site was utilised during these works as an area for the placement of a Japanese Knotweed burial cell and the burial of Asbestos Containing Materials (ACMs) to the south of the site near the riverside walkway. An embankment has also been constructed on the southern boundary. This is part of flood defence works actioned by the Environment Agency under application 63559. Historical aerial photos (April 2020) capture the installed sheet piles prior to the current grassed embankment. A memo on the planning portal (application 65015) states <i>“Flood defence works are currently being undertaken on part of the site by the Environment Agency (Application: 63559). Limited site investigation found that ground conditions generally comprised of topsoil/made ground over alluvial deposits over cohesive and granular glacial deposits over the Coal Measures Secondary A aquifer. Elevated levels of arsenic, lead and PAHs (D(ah)A) and the presence of asbestos were found in the soil. Elevated levels of leachable arsenic and zinc in the soil. Japanese Knotweed, Giant Hogweed and Himalayan Balsam were identified on site. Remedial actions to deal with this contamination, including the excavation and removal of impacted soils, is currently proposed under Application: 63559.”</i> On this basis LKC assume this area of the site is suitably remediated for public open space use.

Table 1-1: Summary of site details.

¹ <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-3-remediation-and-verification>

Current Land Use	The site is currently vacant with dense vegetation and an embankment along the northeast and south of the site.
Proposed Development	25no. residential dwellings including access roads, gardens, soft landscaping and car parking.

Table 1-1 (continued): Summary of site details.

2 SUMMARY OF EXISTING INFORMATION

2.1 Previous Reports

Notwithstanding the site history including remediation and enabling works carried out by ADM Regeneration in 2012/2013 and flood mitigation works by the Environmental Agency (c. 2019/2020), LKC are aware of the following reports recently carried out on the site by e3p Ltd. These reports should be read in conjunction with this document:

- 'Phase I & II Geoenvironmental Site Assessment' (reference 14-527-R1-1, dated June 2021).
- 'Ground Gas Addendum Report' (reference 14-527-R2-1, dated September 2021).

2.2 Contamination Considerations

The e3p conceptual model developed from the findings of the site investigation has been reproduced in the plates below and overleaf.

TABLE 9.14 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals; non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors	Likely	High	LOW
Discussion: Heavy metals (arsenic and lead) identified throughout Made Ground between depths of 0.80 m and 2.00 m. Recommendation: Cover system to garden and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
Assessment: Asbestos in the form of loose chrysotile and amosite fibres has been identified throughout the Made Ground. Quantification confirms that only trace fibres are present in the soils at <0.001 %. Visible asbestos was identified in WS104 at 2.30 m and laboratory analysis confirms that this is Chrysotile/hard cement type material. Information provided by Andrew Campbell, the site correspondent has indicated an area of significant contamination with buried asbestos. The area is believed to be within the southern section of the site where a raised embankment is present. Recommendation: The soils will require placement in accordance with the asbestos CSM. Further investigation is required to confirm the extent of buried asbestos in the southern sector. Visible asbestos will require hand picking, double bagging and removing from the site. Construction works completed with PPE and provision of welfare.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile contaminants such as hydrocarbons, solvents (Made Ground, mills, works)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Low Likelihood	Low	To be determined
Assessment: No significant concentrations of SVOCs or VOCs were identified in the soils submitted for chemical analysis.						
Recommendation: A watching brief should be completed during remediation works to ensure any unidentified contamination is managed.						
PL4	Methane, carbon dioxide (peat, coal measures and potentially infilled features on and within 250 m of the site)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Moderate	To be determined
Assessment: Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1/Green, and in these areas, it is considered that gas protection measures will not be required. However, WS104 and WS102 is assessed as CS3/Amber 2.						
The high levels of methane and carbon dioxide at WS104 may be associated with the presence of organic material noted within the natural granular soils in this location between 2.50 m and 5.45 m bgl. WS104 is also located in the area where Japanese Knotweed was deposited (as shown on Drawing 14-527-015, Appendix III). The buried invasive plant species is a likely source of the elevated ground gas concentrations.						
For the remainder of the site (outside of WS104 and WS102) initial monitoring suggests that no specialist mitigation measures are required in the construction of new dwellings. This will need to be confirmed on the completion of the monitoring.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Recommendation: Following the completion of the gas monitoring schedule, it may be necessary to complete further continuous gas monitoring through the installation of gas claims to accurately determine the ground gas regime and inform a robust risk assessment. It may be possible to reduce the classification of CS3/Amber 2 for proposed plots in the vicinity of WS102 and WS104. Remediation works to excavate the buried invasive plant species would likely reduce the ground gas classification.						
PL5	Mobile contaminants (Made Ground, mills, works)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (secondary A aquifer). Surface water (River Inwell).	Low Likelihood	Low	LOW
Assessment: Heavy metal contamination has been identified in the soil, leachate and groundwater samples in the western sector of the site. Drawing 14-527-018 (Appendix III) shows the extent of these exceedances. WS105 is set within the Made Ground strata, therefore the heavy metal exceedances are likely associated with the shallow perched water and are not representative of the true groundwater. Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation.						
The site is underlain by a mixed geology, generally granular drift at shallow depth, and cohesive soils from circa 4.00 m bgl to 14.00 m bgl. The granular deposits will afford less protection to the underlying secondary A aquifers and the adjacent River Inwell. Impacted groundwater has the potential to migrate laterally and vertically towards nearby controlled water receptors, including the river and aquifers, as a result of this high permeability strata. However, the significant depths of cohesive soils will act to inhibit migration and the sensitivity of the aquifers is reduced given there are no groundwater abstractions within 500 m and no potable groundwater abstractions within 1 km.						
As the site is currently open space, with little hardstanding surface cover, rainfall is not being intercepted and subsequently infiltrates freely into the underlying Made Ground, potentially mobilising the identified contaminants.						
The proposed development will create areas of hardstanding cover, thus reducing the amount of infiltration generated. This will in turn, reduce the amount of contaminants present in leachate off the site and reduce the risk further to the underlying aquifers and adjacent river.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
As the m-BAT and Pb screening tools have confirmed, the surface water receptor, the River Irwell, is not at risk from the heavy metal contaminants identified. Therefore, it can be said that although heavy metals exceed EQS thresholds, the heavy metal concentrations are not causing a risk to controlled waters as they are not bioavailable and the elevated metal concentrations at the site are not impacting the River Irwell or causing an increased risk to aquatic life. Recommendation: Further analysis of the surface water in the River Irwell should be undertaken as groundworks progress, to ensure no future mobilisation of contaminants is caused, which may pose a risk to the watercourse. An additional round of groundwater sampling is recommended to further assess the risk to controlled waters. Given no significant sources of mobile contamination have been identified, there is considered to be a low risk to the controlled waters receptors.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Likely	Moderate/Low	LOW
Assessment: The soils at the site generally meet class DS-1, AC-1s. Elevated sulphate concentrations meeting Class DS-2, AC-1s were noted within the Made Ground deposits in TP104 at 1.50 m bgl. Recommendation: Concrete should be designed in accordance with the chemical testing results.						
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground, mills and works)	Ingestion of tainted water supply.	Future site users. Water pipes.	Likely	Moderate	LOW
Assessment: Elevated concentrations of TPH have been identified at the proposed pipeline depth (0.75 m – 1.35 m). Recommendation: Based on the assessment of current site conditions, it is likely that barrier pipe will be required. This will need to be confirmed with a UKWIR risk assessment post remediation.						
POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
Assessment: Contamination has been encountered within the Made Ground across the site which may be taken up by flora in soft landscaping. Recommendation: Installation of a clean cover system within gardens and any areas of soft landscaping to prevent plant uptake of contaminants.						

2.3 LKC Risk Assessment

Following a review of the e3p reports and with due consideration of the conceptual model and recommendations as shown in Section 2.2, LKC consider the following is appropriate:

PL3 – ACM in Made Ground

The e3p and EA data show trace levels of ACMs in the site soils (i.e. <0.001%w/w). However, considering the constraints plan in the e3p report an area in the south west corner of the site is indicated to contain “significant buried asbestos”.

This area (as drawn) covers the rear garden of Plot 15 and part of the rear gardens of Plots 16 and 17. The flood defence works appear to have avoided this area. Rather than disturb and excavate this area, LKC propose that a 1m clean cover system including a no-dig layer and an orange separation geotextile is provided (c.f. CIRIA C733 guidance) in the rear gardens of Plots 15 to 18.

PL4 – Hazardous Gas

The gas addendum report undertaken by e3p identified elevated gas concentrations in WS102 and WS104 and in the later rounds in WS105.

Within WS102 the methane concentrations vary between 0.1%v/v and 17.5%v/v and carbon dioxide concentrations vary between 2.3%v/v and 10.9%v/v. Maximum positive flow is 1.16l/hr. Generally where methane is detected then the concentrations are higher than the accompanying carbon dioxide concentrations.

Within WS104 the methane concentrations vary between 3.6%v/v and 33.3%v/v and carbon dioxide concentrations vary between 1.6%v/v and 7.2%v/v. Maximum positive flow is 1.02l/hr. Generally where methane is detected then the concentrations are higher than the accompanying carbon dioxide concentrations.

Within WS105, e3p note the first 2no. visits should be discounted as the water level was above the response zone. Presumably the well was bailed as carbon dioxide concentrations between 4.2%v/v and 12.0%v/v prevail over the next 4no. visits. The next 2no. visits show no methane, with concentrations of 4.1%v/v and 5.1%v/v over the final 2no. visits. Maximum flow in visits 2 to 6 was 3.7l/hr.

A GSV was produced which identified WS102, WS104 and WS105 and CS3 / Amber 2.

LKC have calculated the GSVs for these boreholes, using positive flow rates, and these are summarised in Table 2-1.

Borehole	Max CH ₄ GSV (l/hr)	Max CO ₂ GSV (l/hr)	CS
WS102 (MG)	0.203	0.13	CS2
WS104 (MG)	0.34	0.073	CS2
WS105 (MG)	0.189	0.444	CS2

Table 2-1: Summary of worst-case Gas Screening Values (GSV) in selected boreholes.

Notes:

CS – Characteristic Situation;

It was concluded by e3p that the source of methane in WS104 was the [rare] organic materials in the natural strata (note: the response zone was in the made ground) in addition the report states (following a ternary gas plot) that the source of the gas in WS102 and WS104 was the buried knotweed which would produce gas at low flow rates as the organics decay.

LKC note that the knotweed burial cell was seemingly not penetrated in any of the sampling locations.

Given the presence of variable methane and carbon dioxide concentrations LKC consider the rare organic inclusions in the sand strata are unlikely source of such high concentrations. The buried knotweed *may* be a plausible source of the gas; however, its presence is noted by anecdotal evidence only.

Given the variable presence of gas and with concentrations of methane > carbon dioxide in WS102 and WS104 this may be indicative of mains gas. LKC obtained a current gas main search which shows the presence of a terminated supply and valve in the remnant Morris Street hardstanding (Plate 2-2).

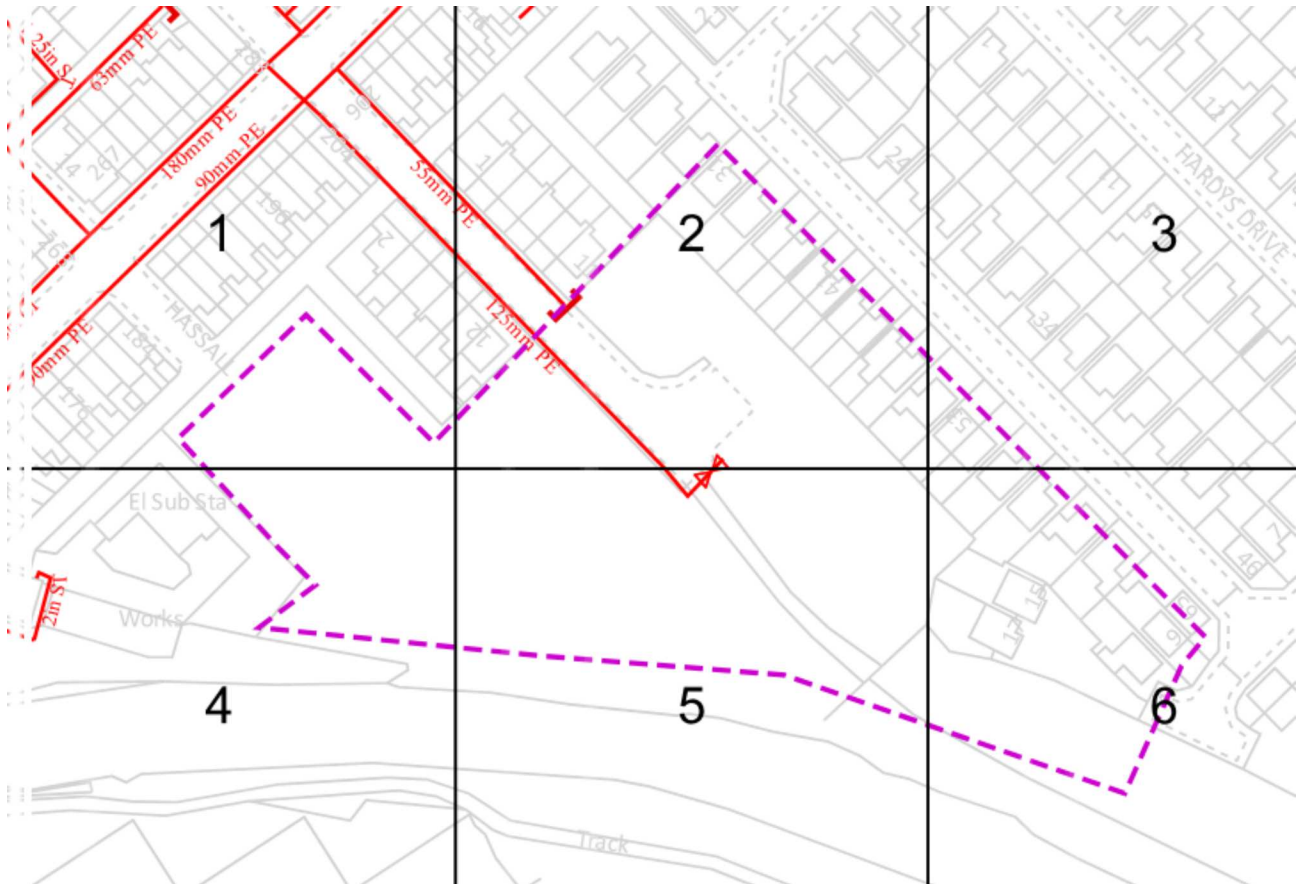


Plate 2-2: Extract of Cadent Plan (obtained 12th October 2021).

Given the amount of ground disturbance in the area, if this supply is extant then a slow leak and preferential pathway may be the source of the gas picked up in WS102 and WS104.

LKC consider it would be prudent to assess if this gas main is a potential source. Notwithstanding this, LKC consider that CS2 conditions prevail and remedial measures are required in Plots 10 to 25.

PL5 – Controlled Waters

A low risk to controlled waters has been identified; therefore given the current risk assessment rating of low, LKC see no benefit in carrying out a further round of groundwater monitoring. In addition, the Construction Management Plan for the site will include steps to mitigate against soil materials entering the River Irwell and the majority of the southern boundary is behind a flood mitigation embankment. Therefore, there does not appear to be a viable physical pathway for the enabling works to cause soil materials to enter the river. On this basis no further sampling is recommended.

2.4 Site Development Considerations

As part of the construction works, levels on the western part of the site are to be raised between 0.1m and 0.5m. Some areas of the site will therefore require minimal excavation of materials to accommodate the garden cover system.

3 SITE WIDE ENABLING WORKS CONSIDERATIONS

3.1 Construction Management Plan and Health and Safety

A Construction Management Plan and Method Statement should be produced which details appropriate Health and Safety measures to be employed during the site works.

Risks to site workers and adjacent receptors from contamination present in the site soils can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance²) should be adopted by all workers involved with site enabling and construction works.

3.2 Asbestos Management Strategy

An asbestos management strategy will be required for the investigation of buried asbestos and the bulk excavation and removal of made ground off site where required.

This risk can be managed by careful procedures and site monitoring to reduce the risk of airborne fibres, and it is recommended that an appropriate 'Asbestos Management Strategy' is developed and adopted for all intrusive ground works which disturb the made ground. This should be carried out in line with CIRIA C733³.

This shall include asbestos awareness training for site staff, provision of suitable personal and respiratory protective equipment and air monitoring.

Cement bound asbestos can be handpicked, doubled bagged and disposed of appropriately to a licenced landfill. Guidance on removing asbestos cement is described in HSE (2012)⁴. This should be undertaken by personnel suitably trained in non-licensed work.

Soil arisings should be placed directly into covered skips and disposed of at a suitable licenced landfill, after further testing to quantify the extent of asbestos contamination of the soils. It should be considered that blue asbestos is notifiable and must be removed by a licenced contractor.

3.3 Watching Brief / Unexpected or Gross Contamination

A watching brief will be maintained for evidence of contamination during the remediation earthworks and development works.

If evidence of contamination is identified then works in the area will stop pending further sampling and assessment and the Local Authority will be informed.

Delineation works will be undertaken and this may include collection of appropriate samples for laboratory analysis to further characterise the material and allow a risk assessment to be undertaken or removal of the impacted material to quarantine.

If obvious gross contamination is encountered then impacted soils will be carefully excavated and quarantined (See Section 3.4) pending further testing and assessment.

Soil samples will be taken and analysed for a suite of contaminants, including *inter alia* Soil Organic Matter, VOCs, SVOCs, BTEX, TPHCWG and asbestos.

² HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

³ CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.

⁴ HSE (2012). "Removing Asbestos Cement (AC) Debris." A11 Asbestos Essential – Non-licensed Tasks.

Soil samples should represent the impacted area and in order to determine that significantly impacted soils have been removed samples will be collected from the base and sides of the excavation.

After analysis quarantined material may be removed offsite to a licensed treatment facility or an assessment made of its potential for treatment and / or retention on site.

3.4 Disposal

If any made ground or natural material is required to be removed from site this should be undertaken under an appropriate duty of care and the results of chemical analysis should be provided to a licensed landfill for confirmation of waste classification.

Hazardous Waste Should be disposed of in accordance with the Hazardous Waste Regulations 2016. Where ACMs are stored on site prior to disposal they should be stored in a sealed receptacle (e.g. lockable skip) with appropriate signage.

Waste records such as disposal tickets should be provided in the Site Completion Report.

3.5 Buried Invasives and ACM

A Japanese knotweed burial cell is purported to be on site. It may be prudent to locate this cell or give due recognition to its potential presence in the foundation design / solution for the site.

ACM are purported to the present in the southern boundary. It would be prudent to avoid disturbing this area as much as possible and provide an increased environmental cover layer depth (rear of Plots 15-18).

4 REMEDIATION STRATEGY

4.1 Remediation and Further Work

Table 4-1 details the further works and remediation requirements which have been identified following the investigation of the site.

Further Work / Remediation Requirements	Validation Requirements
Gas Main Further investigation of the indicated main in Morris Street to identify if this is a potential source of the erratic methane and carbon dioxide concentrations in WS102 and WS104. .	N/A.
Earthworks Site Inspections A watching brief (daily / weekly) should be maintained during earthworks to confirm the ground conditions and identify any unusual ground conditions. Should any unusual ground conditions be encountered, work should stop and samples be collected for chemical analysis. Depending on the outcome of the chemical analysis further remediation may be required.	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work (TBC).
PL1 to 3 Environmental Cover System An environmental cover system will be required in garden and soft landscaped areas. The environmental cover system should be constructed as follows: Private Rear Gardens (Plots 1 to 14 & Plots 19 to 25): 600mm thick environmental cover system comprising: High visibility geotextile and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Private Rear Gardens (Plots 15 to 18): 1m thick environmental cover system comprising: High visibility geotextile overlain by 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 1m comprising clean inert fill and sufficient topsoil for a growing medium. Shared Landscaping: 300mm thick environmental cover system comprising: High visibility geotextile membrane overlain by at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. Further details on the cover system construction are provided in Section 4.2.	Depth validation of environmental cover system: excavation of a trial hole through the environmental cover system in each soft landscaping area and collecting photographic evidence with a staff. Photographic evidence of the granular physical break and geotextile layer will also be collected. Chemical validation of imported soils. See Section 4.3. Validation to be in accordance with the Verification Plan (Section 5).

Table 4-1: Further work, remediation and validation requirements.

Further Work / Remediation Requirements	Validation Requirements
<u>PL4 - Gas Protection Measures Plots 10 to 25</u> Following a review of the hazardous gas risk assessment and further assessment by LKC it is recommended that gas protection measures commensurate with CS2^{5 6} should be provided to Plots 10 to 25. LKC note that guidance provided in BS8485 states that a point score of 3.5 is required for a Type A building. This may be achieved by the following: » Proprietary gas resistant membrane (Visqueen Gas Barrier, or similar approved, suitably lapped and joined (and independently validated) – 2 points. » Passive subfloor ventilation system – 1.5 points Foundation cross sections are provided in Appendix B.	Regulator approval of foundation designs and selected gas membrane (Appendix B). Photographic evidence of sub-floor void, ventilation and suitably sealed gas membrane. Validation of gas protection measures should be in line with CIRIA 735⁷ and the Verification Plan (Section 5).
<u>Potable Water Pipes</u> A UU risk assessment should be completed. Barrier piping will be required.	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.

Table 4-1 (continued): Further work, remediation and validation requirements.

⁵ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665

⁶ BSI (2019). "Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments." BS8485:2015 + A1 2019.

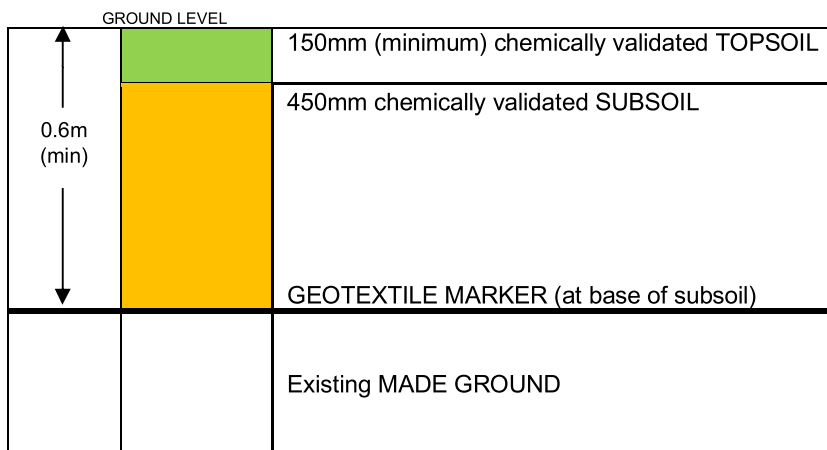
⁷ CIRIA (2014). "Good Practice on the Testing and Verification of Protection Systems for Building Against Hazardous Ground Gas". CIRIA C735.

4.2 Environmental Cover System to Gardens and Soft Landscaping Areas

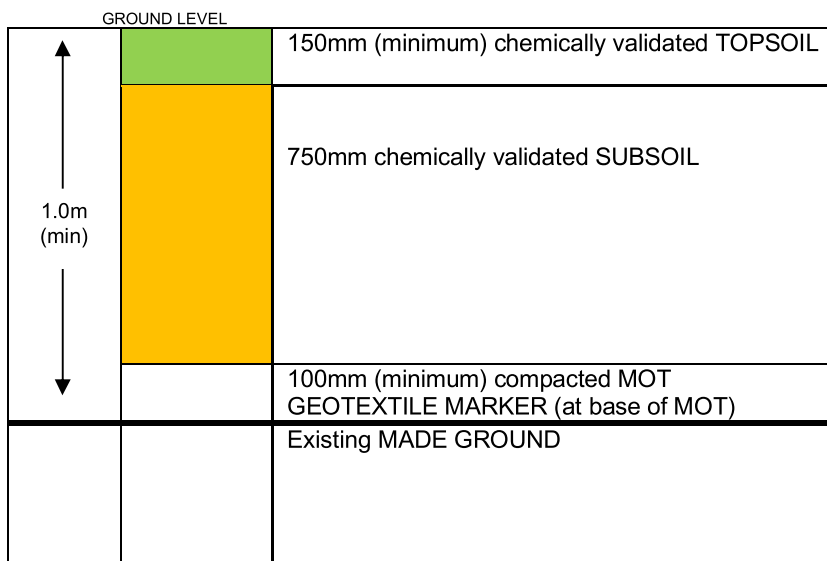
The installation of a cover system is required for all garden and soft landscaped areas.

PRIVATE REAR GARDENS (PLOTS 1 to 10 & Plots 19-25)

Private rear garden areas in these plots should comprise a cover layer depth of at least 600mm. A typical construction detail is:



PRIVATE REAR GARDENS (PLOTS 1 to 10 & Plots 19-25)



FRONT GARDENS / SOFT LANDSCAPING AREAS

Front gardens / soft landscaping areas should comprise a cover layer depth of at least 300mm. A typical construction detail is provided below:

GROUND LEVEL ↑ 0.3m (min) ↓		150mm (minimum) chemically validated TOPSOIL
		150mm chemically validated SUBSOIL GEOTEXTILE MARKER (at base of subsoil)
		Existing MADE GROUND

As an alternative the subsoil layer can be omitted in favour using topsoil.

4.3 Validation of Subsoil and Topsoil Materials

Chemical validation of all imported soils to be used on site in the environmental cover system should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements are presented in Table 4-2.

Material Type	Source	Suite of Analysis	Sampling Rate
Topsoil	Greenfield	Suite A	1 sample per 50m ³ (minimum of 3 samples per source)
	Brownfield / Unknown	Suite B	
Subsoil	Brownfield / Unknown	Suite B	1 sample per 250m ³ (minimum of 3 samples per source)
Physical Stone Break Layer and Piling Mat	First Generation i.e. quarried sand (subsoil) or stone (break layer)	No testing is required. Certification of material provenance is required.	
	Recycled Stone (6F2)	Suite B	1 sample per 500m ³ (minimum of 3 samples per source)

Table 4-2: Recommended validation sampling requirements for imported material.

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

Ideally imported material should be sampled at source to prevent double handling if soil fails, with confirmatory sampling undertaken on importation to site. However, where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in garden and soft landscaped areas to ensure suitability for use.

Remedial targets will be based upon the following hierarchy:

- Category 4 Screening Levels (C4SLs).
- LQM Sutable 4 Use Levels (S4ULs).

C4SLs have been published^{8,9} which has changed the evaluation of risk in the contaminated land guidance from 'minimal' (referred to as Health Criteria values (HCVs))¹⁰ used to generate Soil Guideline Values (SGVs) to 'low' (referred to as Lowest Level of Toxicological Concern (LLTCs)). The policy companion document and supporting letter by Defra, dated 3rd September 2014, states that C4SLs *'could be used under the planning regime, as well as within Part 2A'*. Based on these comments LKC considers the justifications and assumptions used to generate 'low' risk are suitable for the planning regime.

Where no C4SLs have been generated LKC will use the LQM S4ULs¹¹. Similar assumptions and land uses to C4SLs have been used. However, toxicological information has been based on 'minimal risk' as per previous guidelines and assumptions^{12,13,14,15}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs¹⁶. These follow the 'minimal' risk principal and more stringent exposure parameters and will be conservative.

LKC consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P possibly being a carcinogen and most toxic of the PAHs^{17,18} and naphthalene the most volatile and soluble¹⁹. The new C4SLs indicate B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible²⁰. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)²¹ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

The proposed development comprises houses with private gardens and areas of soft landscaping. Therefore, the assessment criteria for 'residential with homegrown produce' will be used for the environmental cover system.

All criteria have been generated using the CLEA V1.06 model²² based on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

A summary of the generic assessment criteria is provided in Appendix C.

Any soil with visual or olfactory evidence of hydrocarbons or asbestos containing material should be rejected.

In addition, it should be ensured that no undesirable material is present in the matrix of the topsoil.

⁸ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

⁹ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

¹⁰ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

¹¹ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

¹² EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

¹³ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

¹⁴ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

¹⁵ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

¹⁶ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

¹⁷ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

¹⁸ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

¹⁹ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5- 079/TR1.

²⁰ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

²¹ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

²² EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

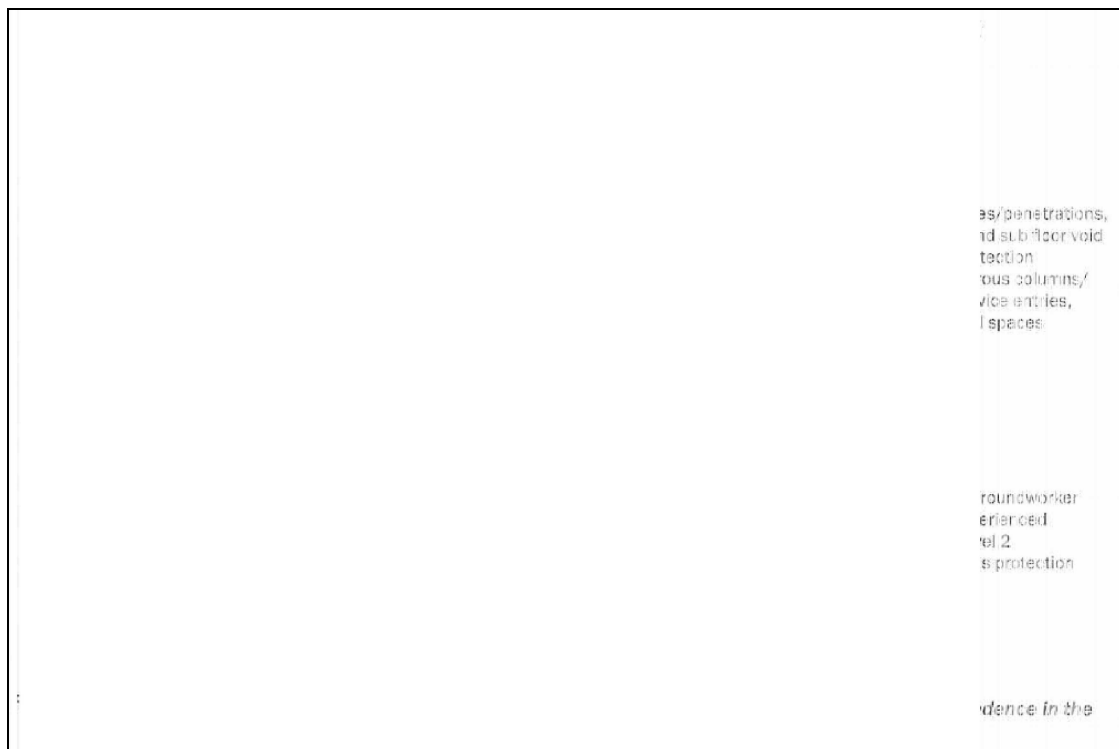
5 VERIFICATION PLAN

5.1 Gas Protection Measures

The Remediation Strategy requires the following:

- 150mm (minimum) clear void passively ventilated to atmosphere.
- Proprietary foil backed gas membrane – Visqueen Gas Barrier or similar approved.
- Proprietary gas proof cavity tray / DPM – Visqueen Gas Resistant DPC.

CIRIA C735²³ provides guidance on the scope of the verification plan and an extract is provided below:



Considering the above the gas regime is considered to be 'intermediate risk'. A 'high risk' is assumed given the large number of plots proposed for the site.

The contractor for the works will be Watson Construction Ltd who will engage NVQ qualified installers to complete the installation of the gas membrane. Therefore, a low risk is applied.

The building itself includes service entries therefore an intermediate risk is applied.

On this basis of low to high risk, visual inspections of the required measures and mechanical "pull tests" of the membrane seals are considered appropriate.

LKC will inspect the installation of the ventilated sub floor and membrane and collect photographic evidence.

A copy of the on-site inspection proforma is provided below:

²³ CIRIA (2014). "Good Practice on the Testing and Verification of Protection Systems for Building Against Hazardous Ground Gas". CIRIA C735.

Onsite Inspection Record			
Date			LKC Staff
Plot No.			
Height of Void Space (if required)			
External Wall Air Bricks	Air Bricks/Swan Necks Present?		
	Air Brick Spacing (c. 2m)		
	Distance from corners (c. 450mm)		
	Total No. of Air Bricks		
	Below Membrane / DPM?		
Materials	Membrane		
	Tape		
Extent of Membrane Coverage			
Membrane Condition	Clean / Dirty		
	Wet / Dry		
	Smooth / Gravelly below		
	Creased / Flat		
	Intact / Punctured		
	Clear / Tools / Blocks / Steels present		
	Repair Patching Required?		
	Membrane overlapped (150mm)		
	All Joints Sealed?		
	Membrane sealed to DPM?		
	Correct Sealing around Stanchions and Wind posts?		
Service Entries	No. Service Entries		
	Top Hats Present and Sealed (✓)		
Pass / Fail (✓)			
Follow on Trades Protection Required / implemented?			

LKC will collect photographic evidence of the above for inclusion in the Completion Report.

The above inspections and presentation of accompanying photographic evidence will comprise sufficient 'lines of evidence' that confirm a suitable level of gas protection has been installed to an appropriate standard.

A key consideration is the protection of the membrane against damage by follow on trades. An assessment and demonstration of any required measures will be included.

5.2 Environmental Cover Layer

The Remediation Strategy requires a nominal 600mm or 1m environmental cover layer in proposed rear garden and 300mm to front gardens and soft landscaping areas. This is due to elevated concentrations of contaminants and asbestos in the made ground.

The construction of rear garden construction should be as shown in Section 4.2.

The contractor for the works will be Watson Construction Ltd. LKC have validated the installation of environmental cover layers on previous schemes with the contractor and were satisfied with the standard of workmanship.

The verification plan for the works will be as follows:

Activity	Responsibility	Information to be provided in Site Completion Report.
1) Removal of selected made ground from site	Contractor to collate and provide Waste Transfer Notes to LKC	Copy Waste Transfer Notes.
2) Installation of geotextile	Contractor to provide delivery notes. Contractor / site manager to provide photographic evidence of the installation across the gardens and landscaped areas.	Delivery notes. Photographs.
3) Installation of MOT physical break layer in Plots 15-18	Contractor to provide delivery notes. Contractor / site manager to provide photographic evidence of the installation across the required gardens.	
4) Validation of imported subsoil and topsoil	Contractor to identify soil sources and confirm to LKC. LKC to collect soil samples for chemical validation (see Table 4-2).	Details of validation sampling, quantities required, soil risk assessment and statement of suitability.
5) Validation of cover layer depth	LKC to excavate inspection trial hole in each soft landscaped area. Depth measurement using a staff.	Photographs Statement if correct depth provided.

Collation of the above information will comprise sufficient 'lines of evidence' to show that the direct contact risk from soil contaminants has been minimised and a suitable level of remediation has been successfully carried out.

5.3 Potable water pipes

At this stage LKC understand that barrier pipe is required.

The installation will be carried out to the satisfaction of United Utilities who will provide ultimate approval by creating a water meter point. Without their approval, no supply and billing point will be sanctioned.

In order to validate the works for the Site Completion report, the site manager shall collate the following:

- Delivery notes
- Photographs of the installed barrier pipe.

5.4 Completion Report

A Completion Report detailing the remediation works will be produced which will include:

- » Provision of waste transfer documents.
- » Validation of installed gas protection measures.
- » Validation of environmental cover system.
- » Validation testing of all imported soil for garden and soft landscaping areas.
- » Information on the installation of protective pipes.
- » Details of any unexpected contamination identified onsite, suitably risk assessed and / or validated.

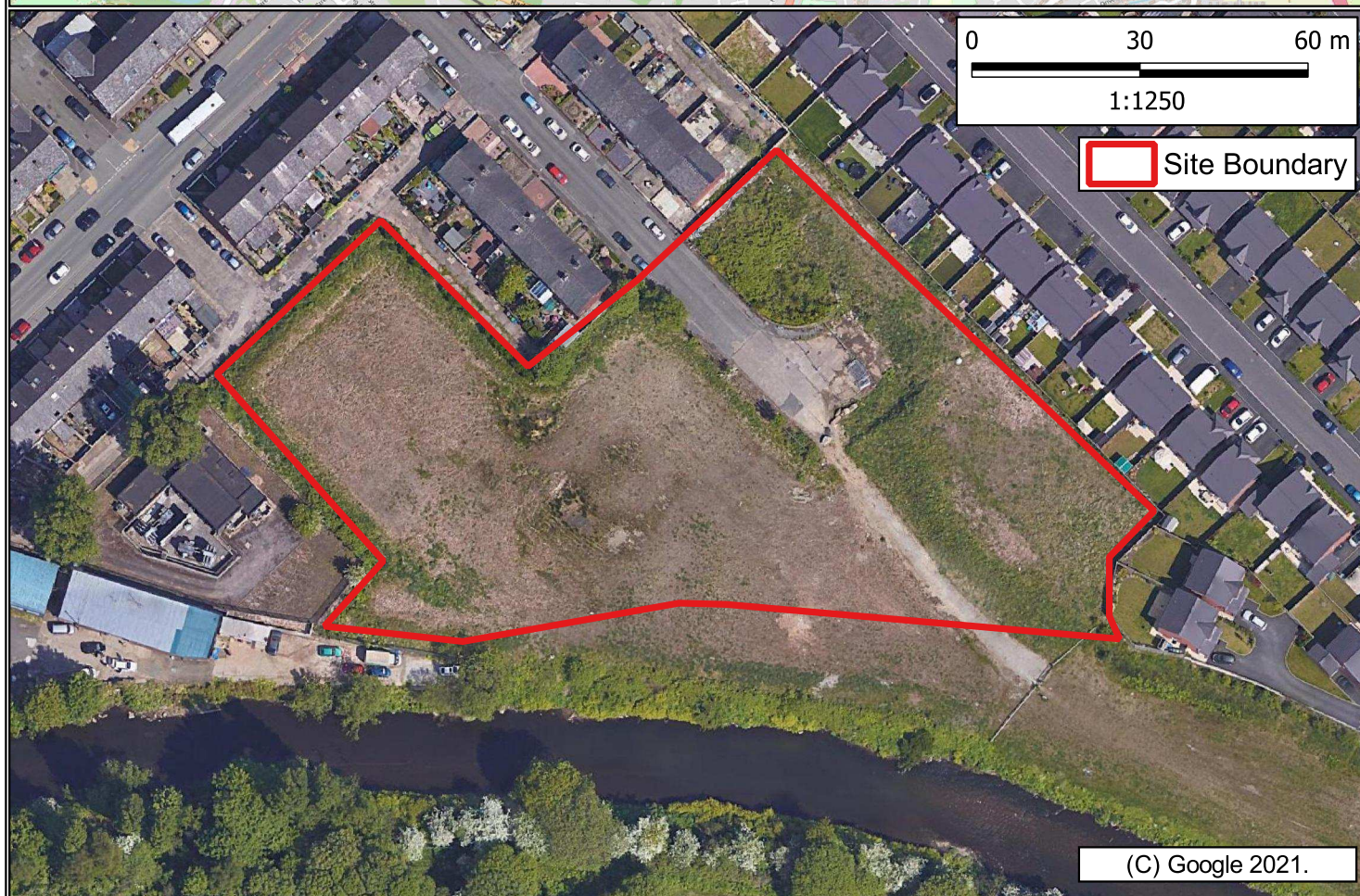
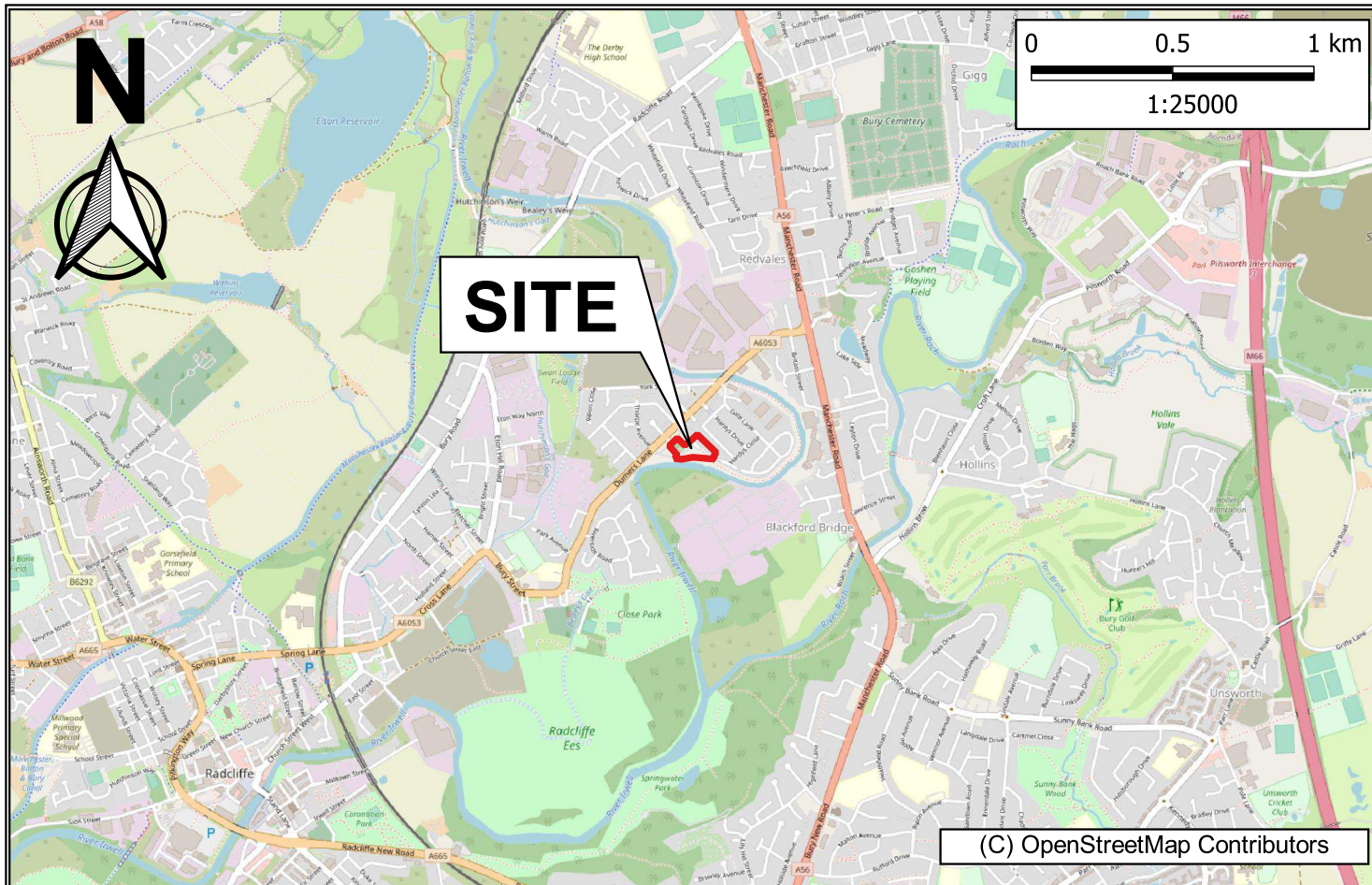
The aim of the Completion Report will be to demonstrate to the Local Authority that the site has been suitably remediated to the extent that the site is suitable for its proposed residential end use and, in accordance with the National Planning Policy Framework (NPPF)²⁴:

- » The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
- » After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and,
- » Adequate site investigation information, prepared by a competent person, is presented.

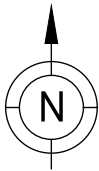
²⁴ DCL (2012). "National Planning Policy Framework." Department of Communities and Local Government. Updated July 2021.

APPENDIX A

SITE PLANS



Client: Watson Construction Ltd				Title: Site Location & Boundary Plan			
Site: Morris Street, Radcliffe				Scale (see scale bar): 1:25,000 & 1:1,250 @ A4			
Job No.: LKC 21 1616	Drawn By: HF	Checked By: MT	Drawn: Oct 2021	Figure: 1		Revision:	



KEY



Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: **Watson Construction Ltd**

Site: **Morris Street, Radcliffe**

Title: **Proposed Layout Plan**

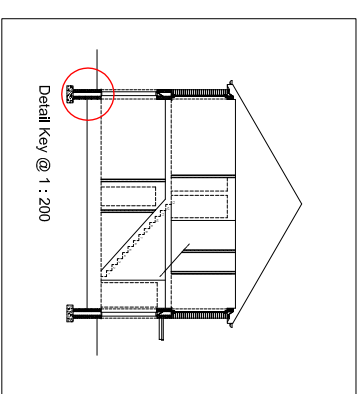
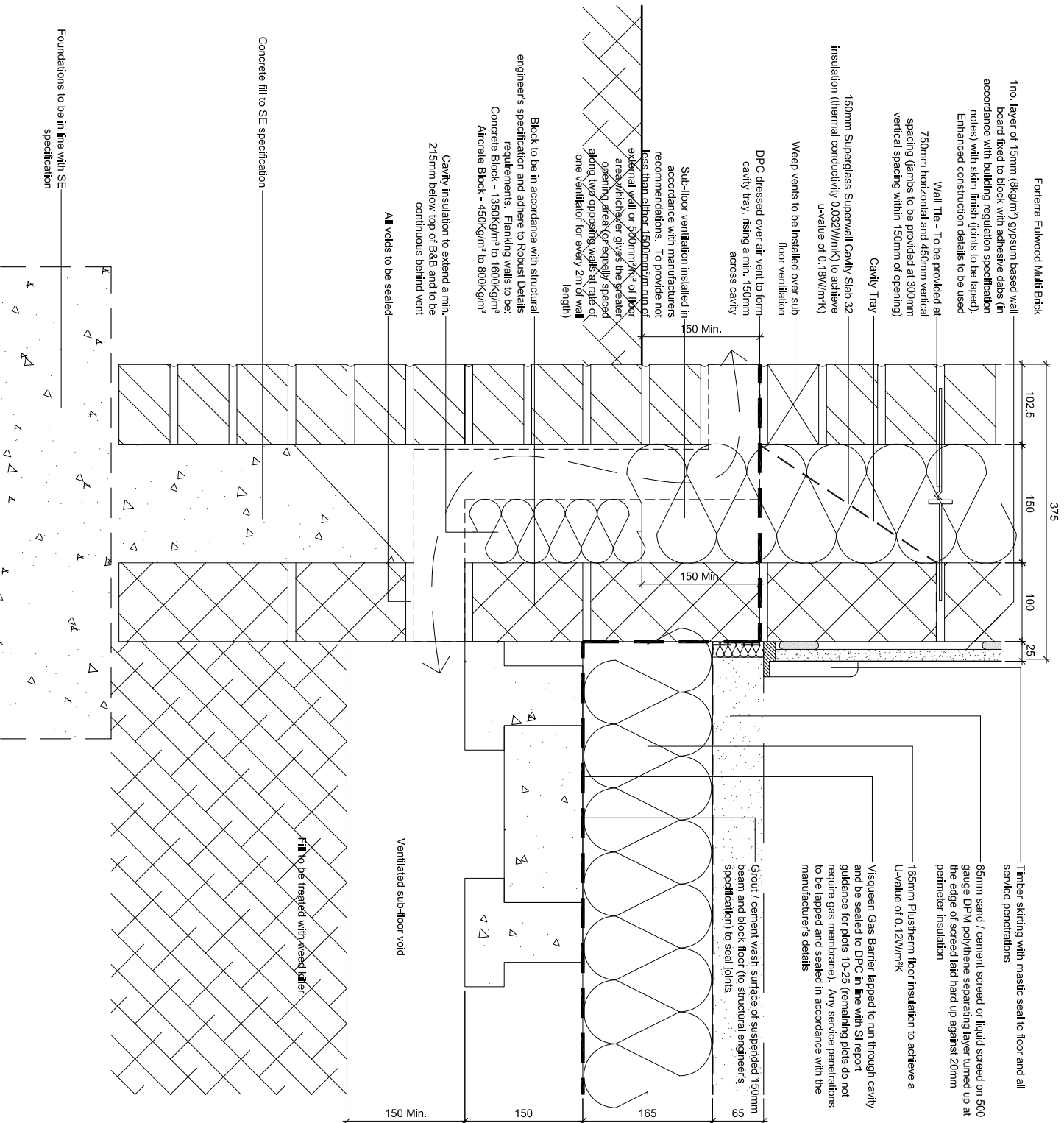
Job No:	Scale (See Scale Bar):	Figure:	Revision:
LKC 21 1616	See Scale Bar	2	
Drawn By:	Checked By:	Drawn:	
AC	MT	Oct 2021	

Extract from: Grays Architecture Limited
Drawing Ref: Proposed Site Plan, No.4560/101, Rev:B (11/08/2021)



APPENDIX B

FOUNDATION DRAWINGS & GAS MEMBRANE SPECIFICATION



All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.

This drawing is to be used in conjunction with all relevant construction and specification drawings / documents. It is not to be used in isolation.

All structural dimensions shown are inclusive of 10% 'Design' / calculation of structural members are to be provided by the Structural Engineer.

This drawing is copyright.

A. As indicated on drawings by client 14/09/2021 15/09/2021

B. As indicated on drawings by client 14/09/2021 15/09/2021

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Architecture
Limited

Tel : 01753 647 300
Email: info@graysarchitecture.co.uk

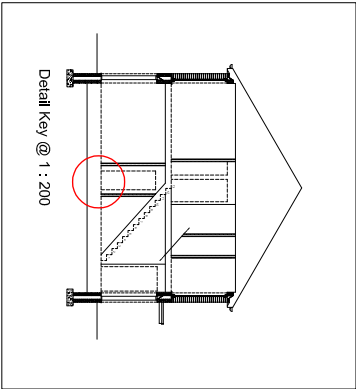
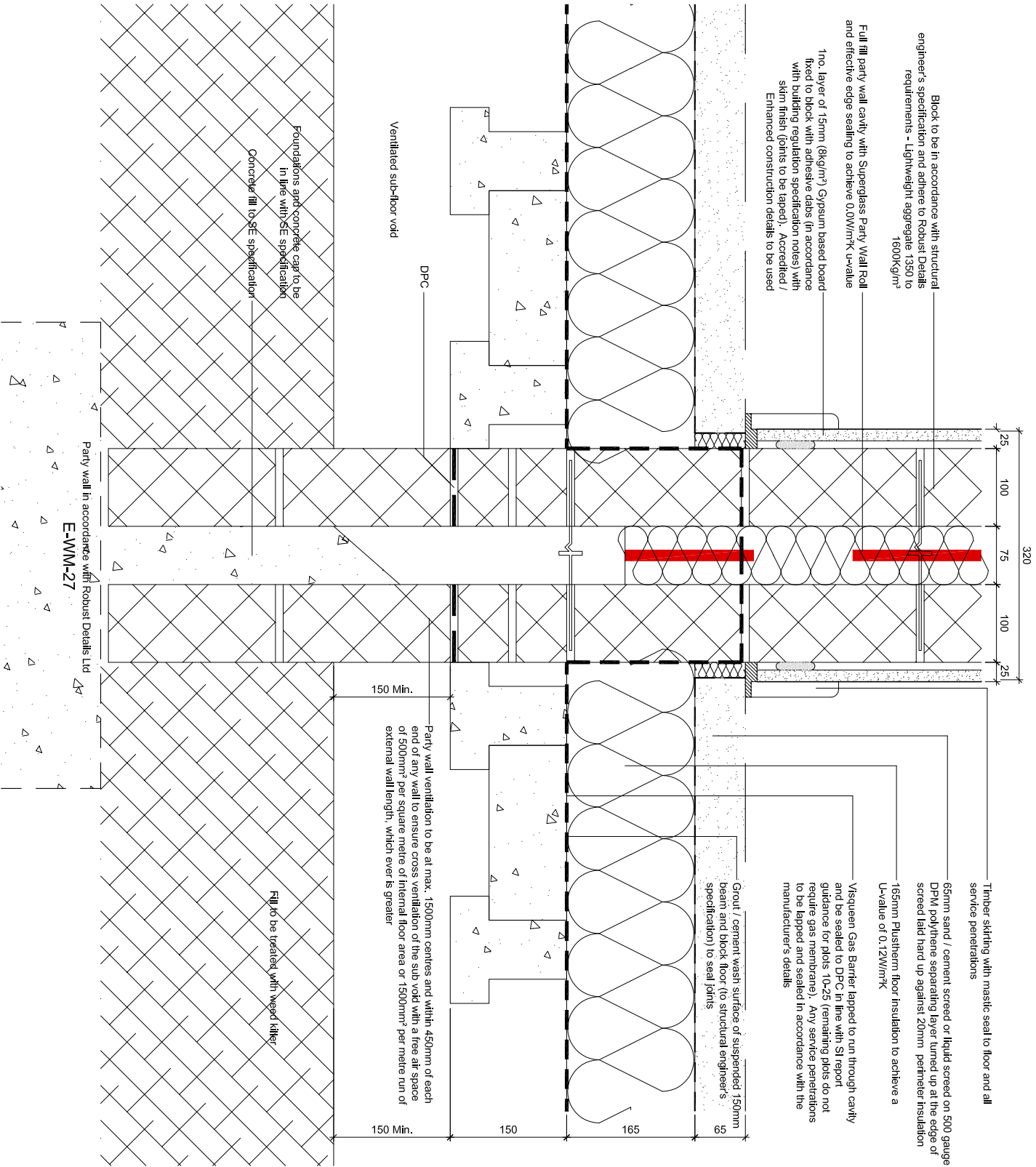
Client: Watson Homes Ltd / Iwerell Valley HA

Project: Morris Street, Radcliffe, Bury

Drawing Title: Proposed Detail: Ground Floor External Wall - Plots 10-25

Scale: 1:5 @ A3 Date: September 2021

Drawing No: 4560-350 Revision: B



All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.

This drawing is to be used in conjunction with all relevant consultation and coordination drawings / documents. Any discrepancies are to be reported to the Architect before work commences.

All structural components shown are to be checked by the Structural Engineer. Details / calculations of structural members are to be provided by the Structural Engineer.

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A. As indicated on drawings by client 15/09/2021

B. As indicated on drawings by client 15/10/2021

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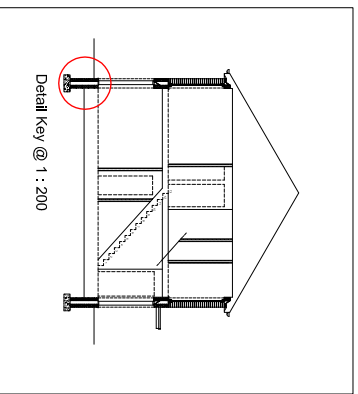
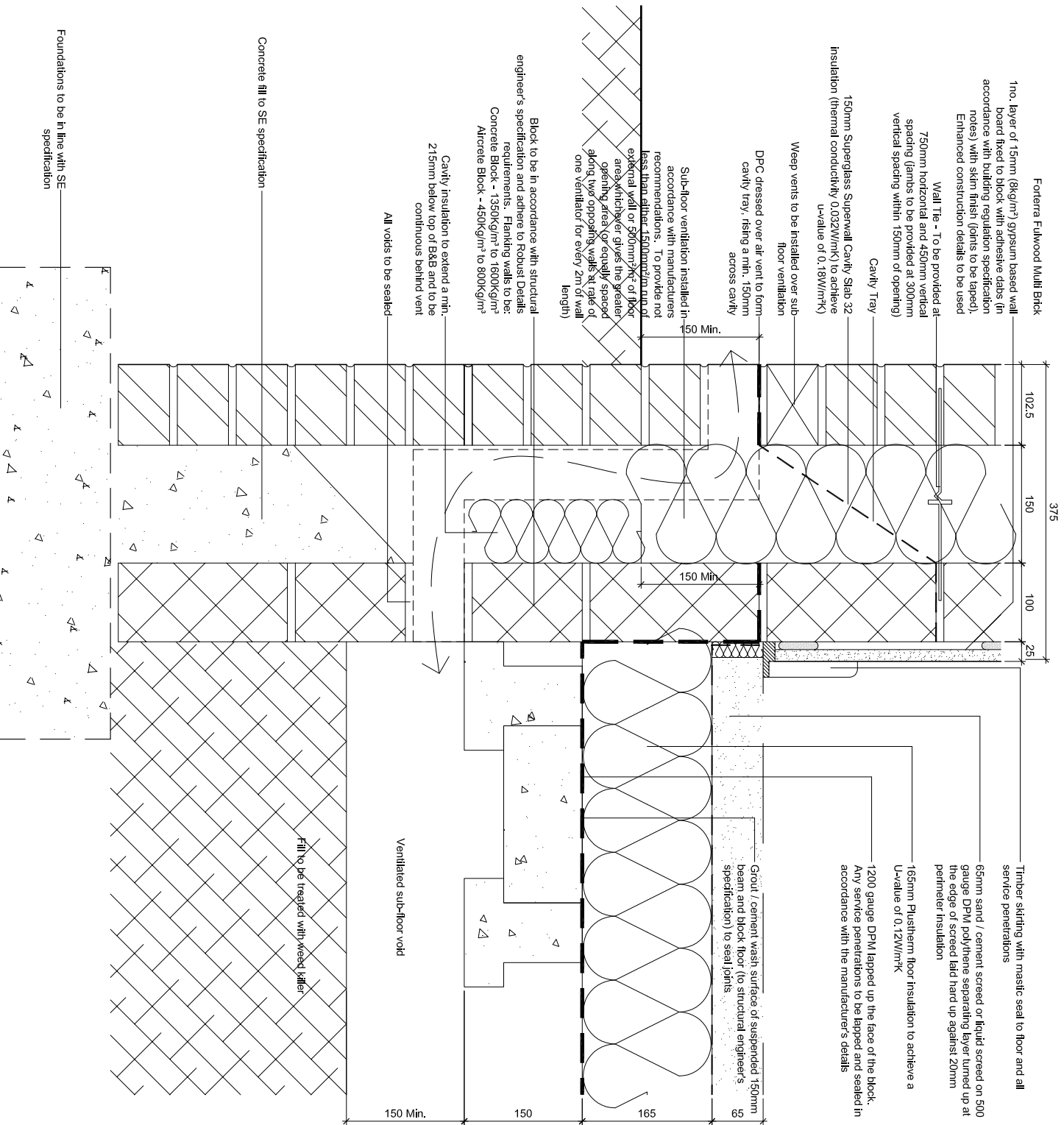
Client: Watson Homes Ltd / Iwail Valley HA

Project: Morris Street, Raddliffe, Bury

Drawing Title: Proposed Detail: Ground Floor Separating Wall Junction - Plots 10-25

Scale: 1:5 @ A3 Date: September 2021

Drawing No: 4560-355 Revision: B



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Client: Watson Homes Ltd / Iwale Valley HA

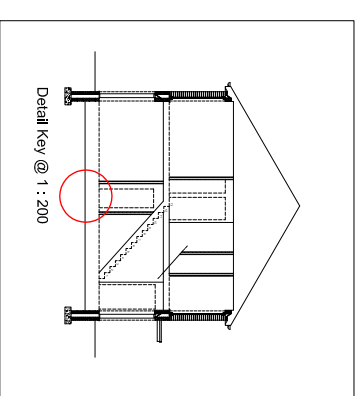
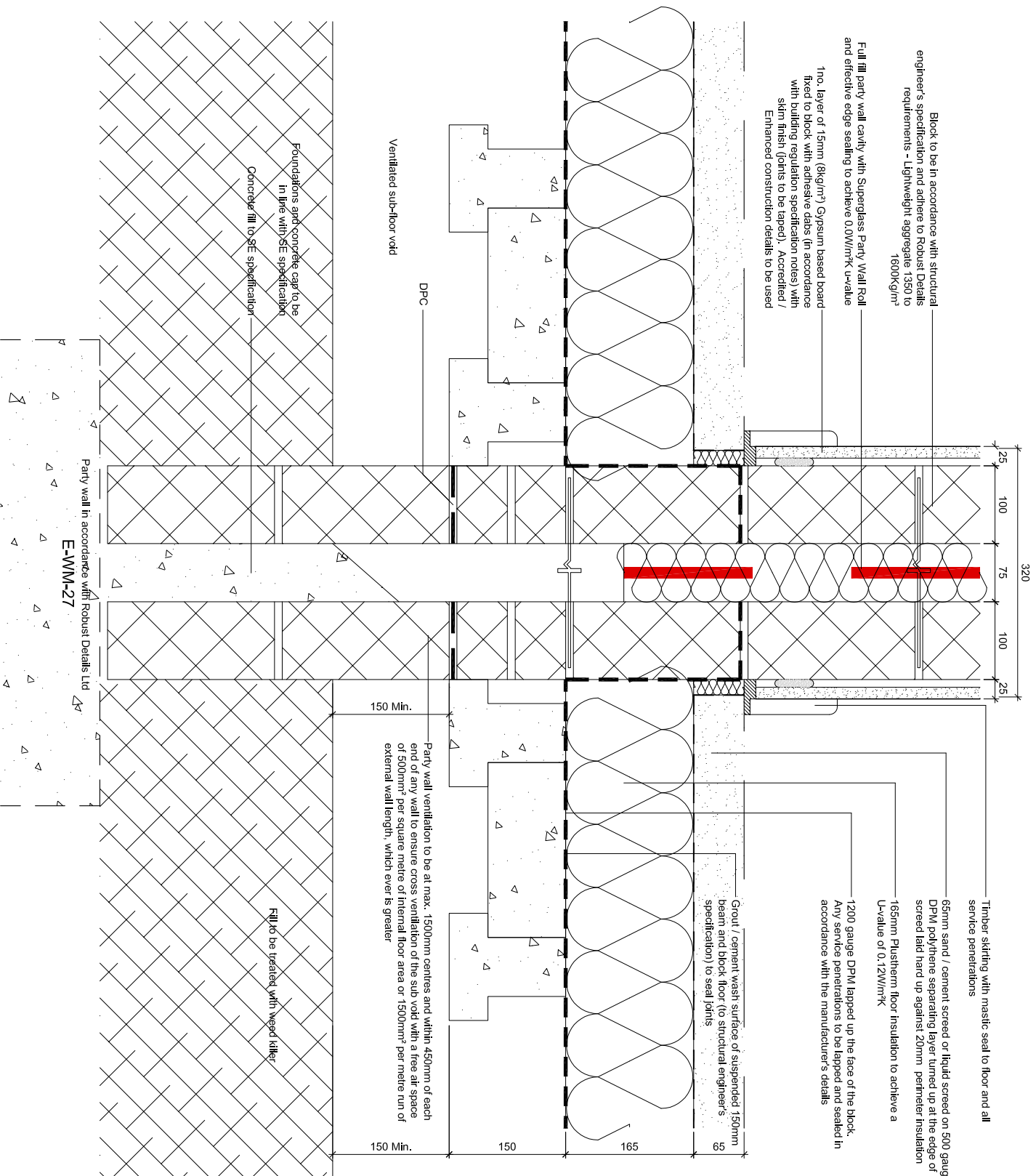
Project: Morris Street, Radcliffe, Bury

Drawing Title: Proposed Detail: Ground Floor External Wall - Plots 1-9

Scale: 1:5 @ A3 Date: September 2021

Drawing No: 4560-362 Revision:

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All structural dimensions shown are inclusive of 10mm. Details / calculations of structural members are to be provided by the Structural Engineer.



All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.
This drawing is to be used in conjunction with all relevant consultation and specification drawings / documents. Any discrepancy will be reported to the Architect before work commences.
All structural dimensions shown are inclusive of 10mm. Details / calculations of structural members are to be provided by the Structural Engineer.
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Northwood House (N1)
61 Northwood Road
Northwood, Leicestershire LE12 6DH

Client: Watson Homes Ltd / Iwell Valley HA

Project: Morris Street, Raddiffe, Bury

Drawing Title: Proposed Detail: Ground Floor Separating Wall - Plots 1-9

Scale: 1:5 @ A3 Date: September 2021

Drawing No: 4560-363 Revision: -

Visqueen Gas Barrier

Features and benefits

- BBA certified - third party accreditation
- Complies with BS 8485:2015 + A1:2019 - industry standard for methane and carbon dioxide protection
- Flexible - easy to detail and install on site
- Multi functional - also acts as a radon and damp proof membrane
- Dual jointing methods - lap joints can be taped or heat welded

Product description

Visqueen Gas Barrier is a multi-layer reinforced polyethylene gas barrier with a 20 micron aluminium foil. The barrier is coloured blue on the upper surface and silver on the reverse. The product is supplied in single wound rolls (not folded), 2m x 50m.

Approvals and standards

- Third party accreditation (BBA 13/5069)
- Conforms to the specification requirements of BS 8485:2015 + A1:2019
- Suitable for all Characteristic Gas Situation (CS) ground gas regimes
- Conforms to the specification requirements of NHBC Amber 1 and Amber 2 applications
- Conforms to the specification requirements of BR 211:2015
- CE Mark EN 13967:2017
- Quality Management System ISO 9001:2015
- Occupational Health and Safety System ISO 45001:2018
- Environmental Management System ISO 14001:2015

Usage

Visqueen Gas Barrier is suitable for use in all types of buildings to prevent the ingress of harmful levels of ground gases e.g. methane, carbon dioxide and radon.

The barrier can be positioned above or below a solid concrete ground floor slab or above a precast suspended segmental ground floor system, e.g. beam and block floor.

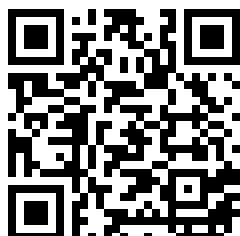
The barrier can also be used as a high performance radon membrane and/or damp proof membrane.

The product is not intended for use where there is a risk of hydrostatic pressure.

System components

- VisqueenPro Double Sided Jointing Tape, 50mm x 10m
- Visqueen Gas Resistant Foil Lap Tape, 75mm x 50m
- Visqueen GR Lap Tape, 150mm x 10m
- Visqueen Ultimate Top Hat Units
- Visqueen Preformed Units
- VisqueenPro Detailing Strip, 300mm x 10m, 500mm x 10m
- Visqueen TreadGUARD 300, 2m x 75m
- Visqueen TreadGUARD 1500, 1m x 2m

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Visqueen Gas Barrier

Storage and handling

Visqueen Gas Barrier should be stored horizontally, under cover in its original packaging.

Care should be taken when handling the product in line with current manual handling regulations.

Preparation

Visqueen Gas Barrier should be installed on a smooth continuous surface e.g. grouted beam and block floor, a compacted blinding layer e.g. 50mm thick sand blinding, or smooth concrete blinding. The substrate should be free from irregularities such as voids or protrusions.

The barrier can be cut with a sharp retractable safety knife or robust scissors.

When installing the membrane in demanding site conditions, use Visqueen GR Lap Tape in place of Visqueen Gas Resistant Foil Lap Tape.

Installation

Visqueen Gas Barrier should be loose laid on the substrate with the blue side up so as to avoid sunlight glare.

The barrier should be clean and dry at the time of jointing. It should be overlapped by at least 150mm, bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape.

Alternatively lap joints can be heat welded to achieve an effective seal. Welded lap joints can be less than 150mm provided the joint integrity is not compromised.

Airtight seals should be formed around all service entry points. Visqueen Preformed Top Hat Units should be used for sealing service entry pipes. The base of the top hat and the upstand should be bonded using Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape. The upstand should be secured with the supplied jubilee clip.

Forming an effective barrier to gases may give rise to complex three-dimensional detailing where, it is recommended Visqueen Preformed Units are used e.g. corners. Alternatively Visqueen Pro Detailing Strip can be used to seal awkward junctions.

If the barrier is punctured or perforated a patch of the same material should be lapped at least 150mm beyond the limits of the puncture and bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape. Alternatively a patch can be formed using Visqueen Pro Detailing Strip and lapped at least 150mm beyond the extents of the puncture.

Long periods of exposure to ultraviolet light will reduce the effectiveness of the membrane. The membrane should be covered by a protective layer immediately after installation to prevent damage from following trades, ultraviolet light, etc. Care should be taken to ensure that the membrane is not punctured, stretched or displaced when applying a screed or final floor covering. A minimum thickness of 50mm screed is recommended. When reinforced concrete is to be laid over the barrier the wire reinforcements and spacers must be prevented from puncturing the barrier. Where there is a high risk of potential damage, the barrier should be covered with Visqueen TreadGuard protection, screed, or other approved protection material before positioning the reinforcement.

Usable temperature range

It is recommended that Visqueen Gas Barrier and all associated system components should not be installed below 5°C.

Additional information

When used in accordance BS8485:2015 + A1:2019 a subfloor ventilation system or pressure relief maybe required
Where hydrocarbon or VOC contamination is present use Visqueen Ultimate VOC or HC Blok gas protection systems
To assist build sequencing, Visqueen GR DPC is available for gas protection through the wall constructions
For suspended beam and block floor detailing see GB-01
Visqueen Preformed Top Hat Units should be used at service pipe penetrations see GB-51
For internal and external corners Visqueen Ultimate Preformed Units should be used see PFU-553
To seal around steel columns use Visqueen Pro Detailing Strip see GB-52
For additional detailing information, contact Visqueen Technical Services +44 (0) 333 202 6800

The information in this datasheet was correct at the time of publication. It is the user's responsibility to obtain the latest version of the datasheet as it is updated on a regular basis. The information contained in the latest datasheet supersedes all previously published editions.

Visqueen Gas Barrier

Property	Test method	Units	Compliance criteria	Result
Dimensions	EN 1848-2	m		2 x 50
Overall thickness including scrim mesh	EN 1849-2	mm	+/-10%	0.52
Mass	EN 1849-2	g/m ²	-0%/+5%	400
Tensile strength - MD	EN 12311	N	MLV	350
Tensile strength - CD	EN 12311	N	MLV	350
Tensile elongation - MD	EN 12311	%	MLV	20
Tensile elongation - CD	EN 12311	%	MLV	21
Joint strength	EN 12317-2	N	MLV	332
Watertightness 2kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	MDV	150
Dart impact	BS 2782	g	MDV	731
Low temperature flexibility	EN 495-5	°C	MDV	-40
Durability against ageing	EN 1296 and EN 1928	-	Pass/Fail	Pass
Durability chemical resistance	EN 1847	-	Pass/Fail	Pass
Resistance to tearing (nail shank) CD	EN 12310-1	N	MDV	358
Resistance to tearing (nail shank) MD	EN 12310-1	N	MDV	368
Resistance to static loading	EN 12730	kg	MLV	20
Water vapour transmission - resistance	EN 1931	MNs/g	MDV	7000
Water vapour transmission - permeability	EN 1931	g/m ² /d	MDV	0.03
Visible defects	EN 1850 -2	-	Pass/Fail	Pass
Reaction to fire	EN 13501-1	Class	MDV	F
BS 8485:2015 + A1:2019 testing requirements				
Mass	EN 1849-2	g/m ²	Average >370	400
Methane permeability	ISO 15105-1	mls/m ² /d/atm	Pass/Fail	<0.15
Puncture CBR	BS EN ISO 12236	N	MDV	1114
Tensiles yield strength MD	ASTM D4885-01	kN/m	MDV	12.5
Tensiles yield strength CD	ASTM D4885-02	kN/m	MDV	7.3
Resistance to static loading	EN 12730	kg	>MLV	20
Yield elongation CD	ASTM D4885-04	%	MDV	19
Tear resistance - trouser method A - MD	BS ISO 34-1	kN/m	MDV	48.2
Tear resistance - trouser method A - CD	BS ISO 34-1	kN/m	MDV	44.8
Tear resistance - angle method B - MD	BS ISO 34-1	N	MDV	53.5
Tear resistance - angle method B - CD	BS ISO 34-1	N	MDV	60.6

Health and safety information

Refer to the Visqueen Gas Barrier material safety datasheet (MSDS).

Visqueen Gas Barrier

About Visqueen

The Visqueen name has long been recognised as one of the leading manufacturers of high quality advanced membrane technologies and design based solutions by specifiers, distributors, builders merchants and contractors throughout the UK and Europe.

For further guidance on the Visqueen services shown below, please refer to the relevant section of the Visqueen website (www.visqueen.com) or contact Visqueen Technical Services on +44 (0) 333 202 6800 or enquiries@visqueen.com

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Waterproofing



Gas
Protection



Damp Proof
Membrane



Tapes



Damp Proof
Course



Stormwater



Vapour
Control

Visqueen Technical Support

Visqueen combine an extensive product portfolio with industry leading levels of service and support which includes guidance over the phone, bespoke CAD drawings to help with complex detailing, electronic NBS specifications and access to a dedicated team of highly knowledgeable and experienced field based Technical Support Managers.

Visqueen Technical Support is available to all our customers including architects, specifiers, distributors, builders merchants, contractors and end users. All of our technical team have been awarded the industry recognised qualification Certificated Surveyor in Structural Waterproofing (CSSW).

Visqueen CPD Seminars

The Visqueen Continuing Professional Development (CPD) Seminars provide up-to-date information on changes within Building Regulations/Building Standards and nationally recognised industry guidance affecting damp proofing, water vapour control, hazardous ground gas protection and below ground structural waterproofing.

The one hour seminars have been produced for design specialists within the construction sector and are delivered by our team of Technical Support Managers.

Visqueen PI designs and special projects

From initial design to the completed project, Visqueen are with you every step of the way. Whether it be hazardous ground gas protection and/or below ground waterproofing protection employing barrier, structurally integral or drained systems, Visqueen can offer professional indemnity (PI) insurance for bespoke Visqueen design solutions.

Visqueen Technical Support Managers work with all stakeholders to provide cost effective Visqueen solutions offering complete peace of mind throughout the construction phase and beyond.

Visqueen Training Academy

Based at our manufacturing facility in Derbyshire, the Visqueen Training Academy is available to support Visqueen customers throughout the UK by providing a wide range of both theory and practical skills related training.

Courses include one day product awareness training for our distributors and builders merchants to help them in their day-to-day jobs, through to intensive three day courses giving detailed hands-on training in the practical skills required for safe and robust product installation.

APPENDIX C

GENERIC ASSESSMENT CRITERIA

CATEGORY 4 SCREENING LEVELS

Substance	Residential (with home- grown produce)	Residential (without home- grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37 mg/kg	40 mg/kg	49 mg/kg	640 mg/kg	79 mg/kg	170 mg/kg
Benzene	0.87 mg/kg	3.3 mg/kg	0.18 mg/kg	98 mg/kg	140 mg/kg	230 mg/kg
Benzo(a)pyrene	5.0 mg/kg	5.3 mg/kg	5.7 mg/kg	77 mg/kg	10 mg/kg	21 mg/kg
Cadmium	22 mg/kg	150 mg/kg	3.9 mg/kg	410 mg/kg	220 mg/kg	880 mg/kg
Chromium VI	21 mg/kg	21 mg/kg	170 mg/kg	49 mg/kg	21 mg/kg	250 mg/kg
Lead	200 mg/kg	310 mg/kg	80 mg/kg	2300 mg/kg	630 mg/kg	1300 mg/kg

Tetrachlorethene (PCE) – 1% SOM	0.31 mg/kg	0.32 mg/kg	2.0 mg/kg	24 mg/kg	3,200 mg/kg	1,400 mg/kg
Tetrachlorethene (PCE) – 2.5% SOM	0.70 mg/kg	0.71 mg/kg	4.8 mg/kg	55 mg/kg	3,300 mg/kg	1,900 mg/kg
Tetrachlorethene (PCE) – 6% SOM	1.6 mg/kg	1.6 mg/kg	11 mg/kg	130 mg/kg	3,400 mg/kg	2,500 mg/kg
Trichlorethene (TCE) – 1% SOM	0.0093 mg/kg	0.0097 mg/kg	0.032 mg/kg	0.73 mg/kg	76 mg/kg	41 mg/kg
Trichlorethene (TCE) – 2.5% SOM	0.020 mg/kg	0.020 mg/kg	0.072 mg/kg	1.5 mg/kg	78 mg/kg	54 mg/kg
Trichlorethene (TCE) – 6% SOM	0.043 mg/kg	0.045 mg/kg	0.16 mg/kg	3.4 mg/kg	79 mg/kg	69 mg/kg
Vinyl Chloride (VC) – 1%SOM	0.0064 mg/kg	0.015 mg/kg	0.0017 mg/kg	1.1 mg/kg	7.8 mg/kg	18 mg/kg
Vinyl Chloride (VC) – 2.5%SOM	0.010 mg/kg	0.019 mg/kg	0.0031 mg/kg	1.4 mg/kg	7.8 mg/kg	19 mg/kg
Vinyl Chloride (VC) – 6%SOM	0.017 mg/kg	0.029 mg/kg	0.0058 mg/kg	2.2 mg/kg	7.8 mg/kg	19 mg/kg

Summary Table for the Generic Assessment Criteria for Human Health Risk Assessment Land Quality Management (LQM) S4ULs.

All GAC are based on sandy loam soils with a pH 7.

			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Metals	Inorganic Arsenic	6%	37	40	43	640	79	170
	Beryllium	6%	1.7	1.7	35	12	2.2	63
	Boron	6%	290	11,000	45	240,000	21,000	46,000
	Cadmium	6%	11	85	1.9	190	120	532
	Chromium (III)	6%	910	910	18,000	8,600	1,500	33,000
	Chromium (VI)	6%	6.0	6.0	1.8	33	7.7	220
	Copper	6%	2,400	7,100	520	68,000	12,000	44,000
	Elemental Mercury	6%	1.2	1.2	21	58 (25.8) ^{vap}	16	30 (25.8) ^{vap}
	Inorganic Mercury	6%	40	56	19	1,100	120	240
	Methylmercury	6%	11	15	6.0	320	40	68
	Nickel (update 2015)	6%	126	181	53	983	231	804
	Selenium	6%	250	430	88	12,000	1,100	1,800
	Vanadium	6%	410	1,200	91	9,000	2,000	5,000
	Zinc	6%	3,700	40,000	620	730,000	81,000	170,000
BTEX Compounds	Benzene	1%	0.087	0.38	0.017	27	72	90
		2.5%	0.17	0.70	0.034	47	72	100
		6%	0.37	1.4	0.075	90	73	110
	Toluene	1%	130	880 (869) ^{vap}	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
		2.5%	290	1,900	51	110,000 (1,920) ^{vap}	56,000	95,000 (1,920) ^{vap}
		6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
	Ethylbenzene	1%	47	83	16	5,700 (518) ^{vap}	24,000	17,000 (518) ^{vap}
		2.5%	110	190	39	13,000 (1,220) ^{vap}	24,000	22,000 (1,220) ^{vap}
		6%	260	440	91	27,000 (2,840) ^{vap}	25,000	27,000 (2,840) ^{vap}
	o-xylene	1%	60	88	28	6,600 (478) ^{sol}	41,000	17,000 (478) ^{sol}
		2.5%	140	210	67	15,000 (1,120) ^{sol}	42,000	24,000 (1,120) ^{sol}
		6%	330	480	160	33,000 (2,620) ^{sol}	43,000	33,000 (2,620) ^{sol}
	m-xylene	1%	59	82	31	6,200 (625) ^{vap}	41,000	17,000 (625) ^{vap}
		2.5%	140	190	74	14,000 (1,470) ^{vap}	42,000	24,000 (1,470) ^{vap}
		6%	320	450	170	31,000 (3,460) ^{vap}	43,000	32,000 (3,460) ^{vap}
	p-xylene	1%	56	79	29	5,900 (576) ^{sol}	41,000	17,000 (576) ^{sol}
		2.5%	130	180	69	14,000 (1,350) ^{sol}	42,000	23,000 (1,350) ^{sol}
		6%	310	430	160	30,000 (3,170) ^{sol}	43,000	31,000 (3,170) ^{sol}

NOTES

^{Sol / vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	1%	210	3,000 (57.1) ^{sol}	34	84,000 (57.0) ^{sol}	15,000	29,000
		2.5%	510	4,700 (141) ^{sol}	85	97,000 (141) ^{sol}	15,000	30,000
		6%	1,100	6,000 (336) ^{sol}	200	100,000	15,000	30,000
	Acenaphthylene	1%	170	2,900 (86.1) ^{sol}	28	83,000 (86.1) ^{sol}	15,000	29,000
		2.5%	420	4,600 (212) ^{sol}	69	97,000 (212) ^{sol}	15,000	30,000
		6%	920	6,000 (506) ^{sol}	160	100,000	15,000	30,000
	Anthracene	1%	2,400	31,000 (1.17) ^{vap}	380	520,000	74,000	150,000
		2.5%	5,400	35,000	950	540,000	74,000	150,000
		6%	11,000	37,000	2,200	540,000	74,000	150,000
	Benz(a)anthracene	1%	7.2	11	2.9	170	29	49
		2.5%	11	14	6.5	170	29	56
		6%	13	15	13	180	29	62
	Benzo(a)pyrene (only)	1%	2.2	3.2	0.97	35	5.7	11
		2.5%	2.7	3.2	2.0	35	5.7	12
		6%	3.0	3.2	3.5	36	5.7	13
	Benzo(b)fluoranthene	1%	2.6	3.9	0.99	44	7.1	13
		2.5%	3.3	4.0	2.1	44	7.2	15
		6%	3.7	4.0	3.9	45	7.2	16
	Benzo(ghi)perylene	1%	320	360	290	3,900	640	1,400
		2.5%	340	360	470	4,000	640	1,500
		6%	350	360	640	4,000	640	1,600
	Benzo(k)fluoranthene	1%	77	110	37	1,200	190	370
		2.5%	93	110	75	1,200	190	410
		6%	100	110	130	1,200	190	440
	Chrysene	1%	15	30	4.1	350	57	93
		2.5%	22	31	9.4	350	57	110
		6%	27	32	19	350	57	120
	Dibenzo(ah)anthracene	1%	0.24	0.31	0.14	3.5	0.57	1.1
		2.5%	0.28	0.32	0.27	3.6	0.58	1.3
		6%	0.3	0.32	0.43	3.6	0.58	1.4
	Fluoranthene	1%	280	1,500	52	23,000	3,100	6,300
		2.5%	560	1,600	130	23,000	3,100	6,300
		6%	890	1,600	290	23,000	3,100	6,400
	Fluorene	1%	170	2,800 (36.0) ^{sol}	27	63,000 (30.9) ^{sol}	9,900	20,000
		2.5%	400	3,800 (76.5) ^{sol}	67	68,000	9,900	20,000
		6%	860	4,500 (183) ^{sol}	160	71,000	9,900	20,000
	Indeno(123-cd)pyrene	1%	27	45	9.5	500	82	150
		2.5%	36	46	21	510	82	170
		6%	41	46	39	510	82	180
	Naphthalene	1%	2.3 ^f	2.3 ^f	4.1 ^f	190 ^f (76.4) ^{sol}	4,900 ^f	1,200 ^f (76.4) ^{sol}
		2.5%	5.6 ^f	5.6 ^f	10 ^f	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}
		6%	13 ^f	13 ^f	24 ^f	1,100 ^f (432) ^{sol}	4,900 ^f	3,000
	Phenanthrene	1%	95	1,300 (36.0) ^{sol}	15	22,000	3,100	6,200
		2.5%	220	1,500	38	22,000	3,100	6,200
		6%	440	1,500	90	22,000	3,100	6,300
	Pyrene	1%	620	3,700	110	54,000	7,400	15,000
		2.5%	1,200	3,800	270	54,000	7,400	15,000
		6%	2,000	3,800	620	54,000	7,400	15,000
	Coal Tar (B(a)P as surrogate marker)	1%	0.79	1.2	0.32	15	2.2	4.4
		2.5%	0.98	1.2	0.67	15	2.2	4.7
		6%	1.1	1.2	1.2	15	2.2	4.8

NOTES

^{Sol / vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^f = naphthalene is based on comparison of inhalation exposure with TDI_{Inhal} for localised effect.

All GAC are based on sandy loam soils with a pH 7.

LQM Generic Assessment Criteria (mg/kg) Dry weight soil

Contaminant	SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Aliphatic							
EC 5-6	1%	42	42	730	3,200 (304) ^{sol}	570,000(304) ^{sol}	95,000 (304) ^{sol}
EC>6-8	1%	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}
EC>8-10	1%	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{vap}
EC>10-12	1%	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{vap}
EC>12-16	1%	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}
EC>16-35	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
EC>35-44	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
Aliphatic							
EC 5-6	2.5%	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}
EC>6-8	2.5%	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}
EC>8-10	2.5%	65	65	770	4,800 (190) ^{vap}	13,000	18,000 (190) ^{vap}
EC>10-12	2.5%	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}
EC>12-16	2.5%	2,400 (59) ^{sol}	2,400 (59) ^{sol}	13,000	82,000 (59) ^{sol}	13,000	25,000 (59) ^{sol}
EC>16-35	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
EC>35-44	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
Aliphatic							
EC 5-6	6%	160	160	3,900	12,000 (1,150) ^{sol}	600,000	180,000 (1,150) ^{sol}
EC>6-8	6%	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}
EC>8-10	6%	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}
EC>10-12	6%	760 (283) ^{vap}	760 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}
EC>12-16	6%	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}
EC>16-35	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
EC>35-44	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
Aromatic							
EC5-7(benzene as non-threshold)	1%	70	370	13	26,000 (1,220) ^{sol}	56,000	76,000 (1,220) ^{sol}
EC>7-8(toluene)	1%	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
EC>8-10	1%	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}
EC>10-12	1%	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}
EC>12-16	1%	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000
EC>16-21	1%	260 ^f	1,900 ^f	46 ^f	28,000 ^f	3,800 ^f	7,600 ^f
EC>21-35	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	2.5%	140	690	27	46,000 (2,260) ^{sol}	56,000	84,000 (2,260) ^{sol}
EC>7-8(toluene)	2.5%	290	1,800	51	110,000 (1,920) ^{sol}	56,000	95,000 (1,920) ^{sol}
EC>8-10	2.5%	83	110	21	8,100 (1,500) ^{vap}	5,000	8,500 (1,500) ^{vap}
EC>10-12	2.5%	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (899) ^{sol}
EC>12-16	2.5%	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000
EC>16-21	2.5%	540 ^f	1,900 ^f	110 ^f	28,000 ^f	3,800 ^f	7,700 ^f
EC>21-35	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	6%	300	1,400	57	86,000 (4,710) ^{sol}	56,000	92,000 (4,710) ^{sol}
EC>7-8(toluene)	6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
EC>8-10	6%	190	270	51	17,000 (3,580) ^{vap}	5,000	9,300 (3,580) ^{vap}
EC>10-12	6%	380	1,200	74	34,000 (2,150) ^{sol}	5,000	10,000
EC>12-16	6%	660	2,500	130	38,000	5,100	10,000
EC>16-21	6%	930 ^f	1,900 ^f	260 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>21-35	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
EC>35-44	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
Aliphatic	1%	1,600 ^f	1,900 ^f	1,200 ^f	28,000 ^f	3,800 ^f	7,800 ^f
+Aromatic	2.5%	1,800 ^f	1,900 ^f	2,100 ^f	28,000 ^f	3,800 ^f	7,800 ^f
>EC44	6%	1,900 ^f	1,900 ^f	3,000 ^f	28,000 ^f	3,800 ^f	7,900 ^f

NOTES

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f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

		LQM Generic Assessment Criteria (mg/kg) Dry weight soil						
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chloalkanes and Alkenes & Explosives	1,2 Dichloroethane (DCA)	1%	7.1E-03	9.2E-03	4.6E-03	0.67	29	21
		2.5%	1.1E-02	1.3E-02	8.3E-03	0.97	29	24
		6%	1.9E-02	2.3E-02	1.6E-02	1.7	29	28
	1,1,1 Trichloroethane (TCA)	1%	8.8	9.0	48	660	140,000	57,000 (1,425) ^{vap}
		2.5%	18	18	110	1,300	140,000	76,000 (2,915) ^{vap}
		6%	39	40	240	3,000	140,000	100,000 (6,392) ^{vap}
	1,1,2,2-Tetrachloroethanes (PCA)	1%	1.6	3.9	0.41	270	1,400	1,800
		2.5%	3.4	8.0	0.89	550	1,400	2,100
		6%	7.5	17	2.0	1,100	1,400	2,300
	1,1,1,2-Tetrachloroethanes (PCA)	1%	1.2	1.5	0.79	110	1,400	1,500
		2.5%	2.8	3.5	1.9	250	1,400	1,800
		6%	6.4	8.2	4.4	560	1,400	2,100
	Tetrachloroethene (PCE)	1%	0.18	0.18	0.65	19	1,400	810 (424) ^{sol}
		2.5%	0.39	0.40	1.5	42	1,400	1,100 (951) ^{sol}
		6%	0.90	0.92	3.6	95	1,400	1,500
	Tetrachloromethane (carbon tetrachloride)	1%	2.6E-02	2.6E-02	0.45	2.9	890	190
		2.5%	5.6E-02	5.6E-02	1.0	6.3	920	270
		6%	0.13	0.13	2.4	14	950	400
	Trichloroethene (TCE)	1%	1.6E-02	1.7E-02	4.1E-02	1.2	120	70
		2.5%	3.4E-02	3.6E-02	9.1E-02	2.6	120	91
		6%	7.5E-02	8.0E-02	0.21	5.7	120	120
	Trichloromethane (chloroform)	1%	0.91	1.2	0.42	99	2,500	2,600
		2.5%	1.7	2.1	0.83	170	2,500	2,800
		6%	3.4	4.2	1.7	350	2,500	3,100
	Chloroethene (vinyl chloride)	1%	6.4E-04	7.7E-04	5.5E-04	5.9E-02	3.5	4.8
		2.5%	8.7E-04	1.0E-03	1.0E-03	7.7E-02	3.5	5.0
		6%	1.4E-03	1.5E-03	1.8E-03	0.12	3.5	5.4
	2,4,6-Trinitrotoluene (TNT)	1%	1.6	65	0.24	1,000	130	260
		2.5%	3.7	66	0.58	1,000	130	270
		6%	8.1	66	1.4	1,000	130	270
	RDX	1%	120	13,000	17	210,000	26,000	49,000 (18.7) ^{sol}
		2.5%	250	13,000	38	210,000	26,000	51,000
		6%	540	13,000	85	210,000	27,000	53,000
	HMX	1%	5.7	6,700	0.86	110,000	13,000	23,000 (0.35) ^{vap}
		2.5%	13	6,700	1.9	110,000	13,000	23,000 (0.39) ^{vap}
		6%	26	6,700	3.9	110,000	13,000	24,000 (0.48) ^{vap}
Pesticides	Aldrin	1%	5.7	7.3	3.2	170	18	30
		2.5%	6.6	7.4	6.1	170	18	31
		6%	7.1	7.5	9.8	170	18	31
	Dieldrin	1%	0.97	7.0	0.17	170	18	30
		2.5%	2.0	7.3	0.41	170	18	30
		6%	3.5	7.4	0.96	170	18	31
	Atrazine	1%	3.3	610	0.5	9,300	1,200	2,300
		2.5%	7.8	620	1.2	9,400	1,200	2,400
		6%	17.4	620	2.7	9,400	1,200	2,400
	Dichlorvos	1%	3.2E-02	6.4	4.9E-03	140	16	26
		2.5%	6.6E-02	6.5	1.0E-02	140	16	26
		6%	0.14	6.6	2.2E-02	140	16	27
	Endosulfans (2 isomers)	1%	7.4	160 (3.0E-03) ^{vap}	1.2	5,600 (3.0E-03) ^{vap}	1,200	2,300
		2.5%	18	280 (7.0E-03) ^{vap}	2.9	7,400 (7.0E-03) ^{vap}	1,200	2,400
		6%	41	410 (1.6E-02) ^{vap}	6.8	8,400 (1.6E-02) ^{vap}	1,200	2,500
	Hexachlorocyclohexane (3 isomers), inc Lindane	1%	8.5E-02	3.7	1.3E-02	65	8.1	15
		2.5%	0.2	3.8	3.2E-02	65	8.1	15
		6%	0.46	3.8	7.7E-02	65	8.1	16

NOTES

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All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chlorobenzenes	Chlorobenzene	1%	0.46	0.46	5.9	56	11,000	1,300 (675) ^{sol}
		2.5%	1.0	1.0	14	130	13,000	2,000 (1,520) ^{sol}
		6%	2.4	2.4	32	290	14,000	2,900
	Dichlorobenzenes (3 isomers)	1%	23	24	94	2,000 (571) ^{sol}	90,000	24,000 (571) ^{sol}
		2.5%	55	57	230	4,800 (1,370) ^{sol}	95,000	36,000 (1,370) ^{sol}
		6%	130	130	540	11,000 (3,240) ^{sol}	98,000	51,000 (3,270) ^{sol}
	Trichlorobenzenes (3 isomers)	1%	2.6	2.6	55	220	15,000	1,700 (318) ^{vap}
		2.5%	6.4	6.4	140	530	17,000	2,600 (786) ^{vap}
		6%	15	15	320	1,300	19,000	4,000 (1,880) ^{vap}
	Tetrachlorobenzenes (3 isomers)	1%	0.66	0.75	0.38	49 (39.4) ^{vap}	78	110 (39) ^{vap}
		2.5%	1.6	1.9	0.90	120 (98.1) ^{vap}	79	120
		6%	3.7	4.3	2.2	240 (235) ^{vap}	79	130
	Pentachlorobenzene	1%	5.8	19	1.2	640 (43.0) ^{sol}	100	190
		2.5%	12	30	3.1	770 (107) ^{sol}	100	190
		6%	22	38	7.0	830	100	190
	Hexachlorobenzene	1%	1.8 (0.20) ^{vap}	4.1 (0.20) ^{vap}	0.47	110 (0.20) ^{vap}	16	30
		2.5%	3.3 (0.50) ^{vap}	5.7 (0.50) ^{vap}	1.1	120	16	30
		6%	4.9	6.7 (1.2) ^{vap}	2.5	120	16	30
Chlorophenol	Chlorophenols (4 congeners)	1%	0.87 ^g	94	0.13 ^g	3,500	620	1,100
		2.5%	2.0	150	0.30	4,000	620	1,100
		6%	4.5	210	0.70	4,300	620	1,100
	Pentachlorophenol	1%	0.22	27 (16.4) ^{vap}	3.0E-02	400	60	110
		2.5%	0.52	29	8.0E-02	400	60	120
		6%	1.2	31	0.19	400	60	120
Others	Carbon Disulphide	1%	0.14	0.14	4.8	11	11,000	1,300
		2.5%	0.29	0.29	10	22	11,000	1,900
		6%	0.62	0.62	23	47	11,000	2,700
	Hexachlorobutadiene	1%	0.29	0.32	0.25	31	25	48
		2.5%	0.7	0.78	0.61	66	25	50
		6%	1.6	1.8	1.4	120	25	51
	Phenol	1%	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)
		2.5%	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir} (11,000)	1,500 ^{dir} (9,700)
		6%	1,100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir} (11,000)	3,200 ^{dir} (11,000)

NOTES

^{Sol / vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^{dir} = S4uls based on threshold protective of direct skin contact with phenol (brackets long term exposure for illustration purposes).

^g = derived based on 2,3,4,6-tetrachlorophenol.

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