CLC3: Contaminated land planning guidance

Small-scale ground gas and vapour protection

1. Introduction

This guidance has been written to help developers and consultants discharge the small-scale ground gas and vapour protection condition that the Council may apply. It is important that the requirements of the condition and this guidance are adhered to during development. Failure to discharge a planning condition may result in enforcement action, additional expenditure and delay the sale of a property.

"CLC3: Small-scale ground gas and vapour condition:

A. No development shall commence (other than demolition above ground level) until an appropriate ground gas and vapour investigation (GVI) [incorporating the results of environmental and historical searches] is undertaken and a ground gas and vapour assessment report (GVAR) [where necessary incorporating a Remediation Strategy (RS)], is submitted to, and approved in writing by, the local planning authority.

B. No occupation or use of the development shall commence until the approved RS is implemented and a Verification Report (VR) and evidence of any unexpected contamination identified during the development is submitted to, and approved in writing by, the local planning authority.

Where remedial measures are implemented to protect end-users of the development they shall be maintained. The GVI, GVAR, RS, VR and any unexpected contamination identified during the GVI and development shall be addressed in line with the Royal Borough's informative and contaminated land guidance for small-scale ground gas and vapour protection."

This condition applies to developments which include a new or existing basement, for example:

- Construction of a new basement beneath an existing property;
- Extension of an existing basement beneath a property; and
- Refurbishment of an existing basement.

The guidance sets out situations where developers may opt to enhance ground gas protection measures to negate the need for ground gas monitoring and allows minimum requirements where risks are demonstrated to be lower. It also sets out ongoing maintenance considerations which apply even after parts of the condition are discharged. Wherever possible, ground gas issues will be addressed at the application stage, through planned site investigation work or alternatively through the application of simple conditions or informatives.

We would recommend that an appropriate environmental professional undertakes the work described below.

This is guidance only and is intended to provide an indication of what will normally enable the Council to make decisions under planning legislation. Other relevant industry guidance and standards should also be consulted where appropriate.

It is the responsibility of the developer to ensure that they comply with the requirements of Contaminated Land, Health & Safety, Waste Management, Environmental Damage and the

Control of Asbestos Regulations. The responsibility to properly address contaminated land issues, including safe development and secure occupancy, and irrespective of any involvement by this Authority, lies with the owner/developer of the site. Whilst all reasonable care has been taken to ensure the accuracy of the information and data provided within this guidance, the Council accepts no liability for any loss or damage howsoever caused arising from any reliance placed by any other person upon the information and data contained herein.

2. Why action is needed

Like other urban areas most of the Royal Borough of Kensington and Chelsea (RBKC) is covered by Made Ground, which is usually a mixture of soil and demolition, household and industrial sourced waste products and in some cases may be deep (e.g. 2m-10m). Historical contamination from chemical/fuel storage and industry may also result in soils and groundwater being contaminated by hydrocarbons. Land and groundwater may therefore contain contaminants with the potential to generate or be associated with ground gases and vapours (see **Box 1**).

Basements are more susceptible to ground gas and vapours as they are set within the ground and are often less well ventilated than ground and first floor levels.

Box 1: Common Ground Gases and Vapours

Methane: Methane is a colourless, odourless, flammable gas, formed via anaerobic degradation of organic material. Methane is a risk between its lower and upper explosive limits (LEL and UEL) of 5% volume in air (v/v) LEL and 15% v/v UEL respectively.

Carbon dioxide: Carbon dioxide is a colourless, odourless, toxic gas, which can be formed by aerobic and anaerobic degradation of organic material, action of acid water in carbonated rocks and respiration of soil bacteria. It is an asphyxiant which causes headaches and shortness of breath at 3% v/v and is severe at 5% v/v, resulting in the loss of consciousness at 10% v/v and being fatal at 22% v/v.

Radon: Radon is a colourless, odourless radioactive gas formed by the decay of small amounts of uranium that occur naturally in all rocks and soils. It poses a chronic rather than acute risk because as it accumulates in a building at unacceptably high concentrations it will increase the risk of lung cancer. Public Health England has published reports containing radon affected area maps for the UK and the Building Research Establishment (BRE) has reports available with advice for protective measures for new and existing buildings.

Vapours: Vapours can comprise volatile hydrocarbon compounds such as benzene, toluene, ethyl benzene, xylene and naphthalene and chlorinated solvents including tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride. Several vapours are carcinogenic and can enter the ground through fuel and chemical spills and migrate significant distances via groundwater.

Other less common toxic gases may also need to be considered depending on the site setting and history. These include carbon monoxide, ammonia, hydrogen sulphide and hydrogen cyanide. The depletion and displacement of oxygen by other inert and toxic gases is an important health and safety consideration within excavations and confined spaces.

3. Information needed to satisfy the planning condition

The Planning Authority requires the information identified in Table 1 to discharge the small-scale ground gas and vapour condition.

Table 1: Information required for small-scale ground gas and vapour condition

Information	Part of condition	Scenario?		
		GGV[1] is mitigated through building design[2]	GVI[1] required/ undertaken	GVI[1] and mitigation not required[2]
Environmental and historical information	A	Yes	Yes	Yes
Limited ground gas and vapour investigation	A	No	Yes	No
Ground gas and vapour assessment report[3]	A	Yes[4]	Yes	Yes[4]
Remediation strategy[3]	A	Yes[6]	Yes[6]	No[5]
Watching brief for unexpected contamination during development	B	Yes	Yes	Yes
Evidence of unexpected contamination	B	Yes	Yes	Yes
Verification Report	B	Yes[6]	Yes[6]	No[5]

1. GVI = Ground gas and vapour investigation; GGV = Ground gas and vapour.;.
2. Based on an assessment, by the Pollution Regulatory Team, of information made available to the Planning Authority during the planning application process.
3. The Ground Gas and Vapour Assessment Report (GVAR) and Remediation Strategy (RS) may be provided as a single document
4. Where further GVI is not needed the GVAR report is still required to consider environmental and historical information (EHI), any existing intrusive site investigation, radon gas and details of the building design.
5. Where significant unexpected contamination is found during development, a remediation strategy and a verification report will be required.
6. Where the GVI/GVAR identifies that there are no significant risks, no remediation strategy or verification report are required unless unexpected contamination is identified during the development.

Addressing water ingress into basements will often provide the required level of protection against ground gases and vapours. For some scenarios within **Table 2**, further GVI may not be required or the specified enhanced level of ground gas and vapour protection may be used instead. This approach may enable development work to start sooner but may increase construction costs and carry the risk of a ground gas and vapour investigation being required at a later stage of development if, for example, significant unexpected contamination is identified during development works. It is therefore recommended that a sufficient level of intrusive site investigation is collected before development starts.

Where a satisfactory level of information is provided at the planning application stage, the small-scale ground gas and vapour condition will be adapted to, for example, only require the implementation of a remediation strategy and a verification report or address land contamination issues through the application of an unexpected contaminated land condition. It is therefore important to check the final wording of the GGV condition attached to the decision notice.

4. Environmental and historical information

Before an intrusive site investigation or development work takes place, environmental and historical information (EHI) must be collected to check for possible sources of contamination. This should include:

- An environmental search collating available sources of information such as historical mapping, geology and hydrogeology, statutory registers, records of historical contaminating uses, unexploded ordnance, etc. Several commercially available EHI searches are available;
- Available intrusive site investigation information on, and in the vicinity of, the site
- Searches of British Geological Survey ‘Onshore Borehole Records’ available at http://www.bgs.ac.uk/data/boreholescans/home.html;

- Environmental Search Enquires with the Pollution Regulatory Team (PRT) at the RBKC - contact EH-Pollution@rbkc.gov.uk;
- Searches of planning records on RBKC's website - https://www.rbkc.gov.uk/planning/searches/default.aspx.
- Anecdotal information from current owners and occupiers of the site.

Searches of the planning records for the address should include:

- A simple or advanced search
- Planning history of individual properties from 1948-2009
- Microfiche records for 1948-1996

Should the EHI identify more significant past or present uses, a more detailed preliminary risk assessment for ground gas and vapours will be required in line with the Environment Agency's Land Contamination: Risk Management Guidance and RBKC's Main Contaminated Land Guidance.

The EHI should be reported within the GVAR.

5. Ground gas and vapour investigation

Where **Table 2** identifies that GVI is required, the following guidance should be followed or, where identified as an alternative, the indicated level of enhanced ground gas, radon and vapour protection must be achieved. The developer should not be limited by this guidance and may decide to undertake a more extensive investigation in order to provide greater confidence.

Where historical GVI is to be used, it should conform to this guidance and typically be recent (i.e. within 5-10 years). The use of older GVI should be agreed with the Pollution Regulatory Team.

5.1 Intrusive site investigation positions

- The depth of Made Ground should be proven at four or more exploratory investigation holes, suitably distributed to be representative of the conditions across the site.
- At least one borehole location should prove the depth to the London Clay Formation and be fitted with a combined ground gas and groundwater monitoring well to the London Clay. Larger basements (greater than 50m^2) should have two or more borehole monitoring locations. See **Appendix 1**.
- The response zone (i.e. section of monitoring well open to the soil and groundwater) should be carefully selected to ensure it is representative of the soil and groundwater conditions, for example, by it:
    - Being installed where ground gases and vapours are likely to be found
    - Not being confined to groundwater
    - Extending to the London Clay Formation
- Where multiple response zones are needed, for example where deeper Made Ground is underlain by a confined aquifer, a greater number of monitoring wells may be required.
- In some circumstances it will be acceptable to use intrusive site investigation information from adjoining sites (i.e. within 10m-20m).

5.2 Soil and groundwater

- A description of the soil and groundwater conditions and any contamination encountered in each exploratory hole should be provided, in line with BS5930. This should include the presence and where possible the proportion of degradable materials such as wood, vegetation, cloth and oil.
- Where there is evidence that a source of ground gas and vapours may be present in the soil (for example landfilling, underground storage tanks and hydrocarbon odours/staining), representative soil sampling and laboratory analyses should be undertaken. The analyses may be limited to relevant compounds, for example, for evidence of hydrocarbon contamination this may include speciated TPH (total petroleum hydrocarbons) and suites of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).
- Soil samples may be analysed for total organic content (TOC) to aid in the assessment of the potential risks associated with ground gas from on-site Made Ground (see **Table 3**).
- Where soil is to be reused on site over a new basement extending into a garden area, sufficient soil sampling and analyses should be undertaken to characterise the soil. For each distinct soil type, there should be a sample rate of 1 sample per 50m^3, with a minimum of three samples being taken (see **Appendix 2**).
- Monitoring should be undertaken to establish the presence of and depth to groundwater and whether free product is present at the surface or base of groundwater.
- Where enough groundwater is encountered, a minimum of one groundwater sample should be taken per monitoring location and analysed for speciated TPH, suites of VOCs and SVOCs and other pollutants suspected from environmental and historical researches and observations during site investigation work.
- Sampling and monitoring should be undertaken in line with current best practice (including BS5930, BS10175, BS ISO 18400, BS ISO 5667, BS 10176) and the requirements of the laboratory undertaking the analyses.
- Soil and groundwater analyses must be UKAS and MCERTS accredited where an accredited method is available and achieve suitable limits of detection compared to relevant generic screening criteria.

5.3 Ground gas and vapour

- For sites with a low ground gas/vapour generating potential (see **Table 2**), a minimum of three monitoring visits will usually be acceptable.
- For sites potentially associated with a medium and high gas/vapour generating potential (see **Table 2**), best practice guidance, such as CIRIA C665, BS8576 and BS8485, should be referred to.
- Ideally at least one ground gas/vapour visit should be undertaken during low and falling pressure.
- As a minimum the following parameters must be monitored:
    - Carbon dioxide, methane, oxygen
    - VOCs and SVOCs using a photo ionisation detector (PID)
    - Flow rate and atmospheric pressure and weather conditions (i.e. if falling/rising)
    - Ground water level (including any evidence of free product)

- Should PID readings exceed 5ppm, further vapour sampling and laboratory analysis should be considered to target relevant compounds such as TPH, VOCs and SVOCs or other contaminants of concern identified from the EHI or from soil analysis.
- A suitable PID lamp should be used; which may depend on the specific volatile compounds of concern. Where necessary advice should be sought from the PID manufacturer or hire company.

5.4 Radon gas

Where part of an existing basement is to be used as a living area (e.g. bedroom, living room, kitchen diner, etc.), and the construction of the basement does not specifically mitigate against the ingress of radon gas, the measurement of radon gas is required. Monitoring should include at least 1 monitor within each living area with a minimum of 2 monitors being installed within the basement area. If part of an existing basement is to be used as a non-living area (e.g. store/plant room, pool, etc.) monitoring in the basement would still be recommended, alongside monitoring living spaces immediately above. Measuring radon is inexpensive but takes 3-4 months to complete and so it is important to start the monitoring as early as possible. Further details are available on Public Health England's 'UKradon' webpages.

5.5 Mains gas

Mains gas leaking from the distribution network, may result in explosive levels of methane building up within a property and the risk from this should be considered. This will usually be the case where part of the basement is an older existing structure or where services enter at basement level and have not been appropriately sealed. As a result, when designing a basement structure, the proximity and age of the gas distribution network should be assessed in order to determine the likelihood of a gas leak occurring. If there is a risk of a gas leak occurring, where the basement structure is not already resistant to methane, mitigation is required.

5.6 Health and safety

It is essential that work is undertaken in line with the Health and Safety at Work Regulations. This will usually include wearing appropriate personal protective equipment, observing good hygiene and taking standard precautions when excavating in the ground and working in confined spaces. It is important to ensure that services are not damaged while undertaking investigation works.

Table 2: Actions that are needed for different ground conditions

Scenario	Description	Depth of Made Ground		
		None/shallow[1]	Medium[2]	Deep[3]
Evidence of contamination	Where environmental and historical searches identity the possible presence of contamination or contamination has been found during intrusive site investigation work[4]	Further intrusive site investigation required in line with the main body of this guidance, the Environment Agency's Land Contamination: Risk Management Guidance and the Council's Main Contaminated Land Guidance. **Medium to High**[6]		
London Clay Formation	London Clay Formation encountered beneath Made Ground	No further ground gas or vapour investigation required	See AN1 and AN3 in Table 2 (b) or achieve Characteristic Situation 2 with sufficient vapour and radon protection **Low to Medium**[6]	See main body of this guidance or achieve Characteristic Situation 3 with sufficient vapour and radon protection **Low to Medium**[6]
Shallow aquiclude	A shallow aquiclude encountered beneath Made Ground[5]	See AN1 and AN2 in Table 2 (b) or achieve Characteristic Situation 2 with sufficient vapour and radon protection **Low**[6]		
River Terrace Deposits	Where River Terrace Deposits[5] are encountered beneath Made Ground			

[1]Shallow Made Ground: the mean Made Ground depth is equal to or less than 1m bgl where the maximum depth of Made Ground does not exceed 1.5m bgl.
[2]Medium Made Ground: the mean Made Ground depth is between 1m bgl and 2m bgl and the maximum depth does not exceed 2.5m bgl.
[3]Deep Made Ground: the mean Made Ground depth exceeds 2m bgl and the maximum depth of Made Ground exceeds 2.5m bgl.
[4]For example a landfill site, industrial use or underground storage tank.
[5]A common example of a shallow aquiclude is where clays of the Langley Silt Member (unproductive strata) is underlain by the Kempton Park Gravel Member (Secondary A Aquifer). The Kempton Park Gravel Member is an example of a River Terrace Deposit.
[6]Potential to produce ground gases and vapours.

Table 3: Advice notes for Table 2

Advice Note	Description	Advice
AN1	General note	• *Where a sufficient level of ground gas and vapour investigation (GVI) information is available:* unless Table 2 (a) or the guidance provided in AN2-AN3 indicate that 'No further ground gas or vapour investigation or mitigation is required', an appropriate level of ground gas and sufficient vapour and radon protection[1] must be recommended. • *Where Made Ground is consolidated and clayey:* it may be treated as if it was London Clay where it overlies the London Clay Formation, or a shallow aquiclude where it overlies River Terrace Deposits.
AN2	Shallow Made Ground	• *No further ground gas or vapour investigation is needed:* where the formation level of the basement is demonstrated, through intrusive site investigation, to be founded within the clays of the aquiclude. • *Where the basement formation level is in contact with River Terrace Deposits:* either further intrusive site investigation work must be completed, or ground gas protection equivalent to CS2 with sufficient vapour and radon protection[1] must be achieved.
AN3	Medium Made Ground	• *No further ground gas or vapour investigation is needed where the:* ▪ Formation level of the basement is demonstrated to probably be founded within the clays of the aquiclude and is separated from the River Terrace Deposits by at least 0.5m of clay, and; ▪ The average result of Total Organic Carbon (TOC) analyses for medium Made Ground is below 1%. • *Where the basement formation level is separated from River Terrace Deposits by less than 0.5m of clay or the average TOC analyses result of the Made Ground is above 1%:* either further intrusive site investigation work must be completed, or ground gas protection equivalent to CS2 with sufficient vapour and radon protection[1] must be achieved. • *TOC analyses:* where undertaken, analyses should be completed on 3 Made Ground samples per exploratory hole for up to 2 locations, or otherwise on at least 6 samples.

[1] Ground gas protection in line with BS8485, vapour protection in line with CIRIA C716 and radon protection in line with **Box 2**.

6. Ground gas and vapour assessment report

Even where a GVI is not undertaken a GVAR will still be required to consider EHI, any past intrusive site investigation information, radon gas and details of the building design. This information may be included within a basement impact assessment.

Where a GVI has been undertaken, the GVAR must include the following information.

- Background information: A description of the current or recent use of the development site including a plan and photographs, the proposed development, findings of EHI searches and any past site investigation information relevant to the site.
- Soil, groundwater, ground gas and vapour results: Where a ground gas and vapour investigation is completed, a summary of the work undertaken, the information and data generated, observations of any contamination and tables summarising the results of analyses and monitoring are required. Attached to the report there must be a plan showing the location of the monitoring/sampling points, logs describing the ground conditions and monitoring well installation details, monitoring records, the laboratory analyses certificates and equipment calibration certificates (e.g. PID and gas analysers).
- Assessment: Available ground gas and vapour results should be assessed in accordance with current guidance. Currently this includes: BS8485 (2019) for ground gas; SOBRA's Development of Generic Assessment Criteria (GACs) for Assessing Vapour Risks to Human health from Volatile Contaminants in Groundwater (2017) for vapours, and; Public Health England guidance for radon - see 'UKradon' webpages. As part of the assessment any anomalous ground gas/vapour concentrations or gas flows should be fully explained.
- Assessment: Soil analyses results should be compared against current generic assessment criteria such as DEFRA Soil Guideline Values and Category 4 Screening Levels and LQM/CIEH Suitable 4 Use Levels. Groundwater analyses should be compared against relevant standards, such as SOBRA's groundwater vapour GACs (2017).
- Basement details: The report must demonstrate whether the proposed basement design is resistant to radon gas (see **Box 2**). Where the basement design is to be used to negate the need for further GVI, full details of the basement design and how it meets the minimum level of protection identified in **Table 3** is required.
- Conclusions and recommendations: Should be made in line with relevant generic quantitative risk assessment criteria or, where available, detailed quantitative risk assessment criteria. The report must conclude whether the development will be suitable for use and that it will not impact upon off site receptors once complete.

While addressed separately within the next section, the report may also incorporate a remediation strategy.

Box 2: Radon protection measures for basements

New developments
For new basement developments BR 211 (2015), "Guidance on protective measures for new development", or any subsequent guidance, should be adhered to. This guidance states that:

- ***"All basements are at increased risk of elevated levels of radon, regardless of geographic location"***.
- ***"Where a new basement is to be created, or an existing cellar converted, waterproofing will be required. A well-constructed waterproofing should be designed to protect against radon also."***
- ***"Guidance and recommendations on basement waterproofing are contained in BS 8102:2009, which also advises that radon be taken into account in the design and implementation of waterproofing schemes."***

Existing buildings
More detailed guidance on existing basements is available in BRE Report BR343 (1998); "BRE guide to radon remedial measures in existing dwellings: Dwellings with cellars and basements." This guidance, or any subsequent guidance, should be adhered to. Remedial measures for existing basements could include:

- Sealing gaps and cracks
- Increased ventilation (natural or mechanical)
- Positive pressurisation
- Sumps
- Replacement of or addition to the foundation slab

The construction of the basement and property above would dictate which solution is most appropriate and sometimes a combination of remedial measures may be required. Remedial measures for existing basements should be discussed with a suitably qualified specialist radon contractor/consultant.

Note:
In all cases Public Health England guidance for radon should be referred to - see 'UKradon' webpages.

Generally, the measures used in satisfying the waterproofing, in accordance with BS8102, should also satisfy radon protection requirements.

7. Remediation strategy

Where the GVAR identifies that further intrusive site investigation or remediation work is needed, a remediation strategy (RS) broadly in line with the Environment Agency's Land Contamination: Risk Management Guidance, must be provided to, and approved by, the Planning Authority. The remediation strategy may form part of the GVAR. The RS must set out how ground gas/vapour issues will be addressed so that the development is suitable for use and will normally include the following details:

- Further intrusive site investigation work that is needed to fully characterise the site.
- The basement construction and any proposed gas protection measures, demonstrating that they are fit for purpose and in line with best practice guidance.
- Plans, including cross sections, showing the gas protection measures.
- Verification of the installation of the gas/vapour protection measures in accordance with CIRIA C735.
- Verification testing of any imported or reused soil to be placed over portions of the basement extending into garden areas (see **Appendix 2**).

- Other measures to address significant land and groundwater contamination.

Other specific requirements include:

- For membranes, void forming sheets and waterproofing additives, proposals must comply with BS8485 and where necessary include evidence to demonstrate resistance to both permeation and degradation from gases and volatiles. Full manufacturer's details and recommendations for installation/use should be provided along with details of how the membrane will be fitted.
- For subfloor ventilation, provision of the dimensions of the subfloor void and evidence that the method of ventilation is fit for purpose. For the ventilation of the internal spaces, details of the method of ventilation demonstrating it is fit for purpose.
- Where radon remedial measures were required for an existing basement due to radon monitoring results being above the criteria, additional radon monitoring post completion of the remedial measures will be required.

Further borough specific guidance on the preparation of a remediation strategy is also available within the Main Contaminated Land Guidance.

8. Verification report

Once the RS is fully implemented a verification report (VR) must be provided to, and approved by, the Planning Authority. The verification report must include:

- Evidence to demonstrate that each of the remedial actions within the remediation strategy has been successfully implemented.
- As built drawings showing the protection measures that have been installed.
- A statement from the developer regarding evidence of unexpected contamination (see **Section 9**).
- Where unexpected contamination is encountered, full details of the contamination, risk assessment and how it was dealt with.
- Any ongoing maintenance that is required.

Regarding the ongoing maintenance of any measures implemented to protect end-users of the development, to ensure they remain effective, details should include:

- Maintaining the integrity of any gas or vapour resistant membranes for the lifetime of the development
- Ensuring that where a membrane is punctured for any reason it is appropriately fixed in line with manufactures guidelines
- Servicing and where necessary the replacement of parts of the passive/active ventilation measures to ensure they remain functional.
- For commercial and managed property, ensuring the VR forms part of the Health and Safety file for the property

The VR must be produced broadly in line with the Environment Agency's Land Contamination: Risk Management Guidance. Further borough specific guidance may also be available within the Main Contaminated Land Guidance.

9. Action and evidence relating to unexpected contamination

Where unexpected contamination is encountered the following actions must be taken by the developer:

- All development shall cease in the affected area;
- The Planning Authority and Pollution Regulatory Team must be contacted within 2 working days or sooner if the contamination poses a significant risk to health;
- Any additional or unforeseen contamination shall be dealt with as agreed with the Contaminated Land Officer, and;
- Where development has ceased in the affected area, it shall only recommence upon written notification of the Planning Authority or Contaminated Land Officer.

Examples of unexpected contaminated land include soils stained by oil/fuel, uncharacteristically coloured liquids/soils or groundwater, debris such as asbestos and pungent or pleasant odours arising from the soil or groundwater. It would also include where Made Ground is found to be consistently deeper than 2m below ground level across the property and where there is a high proportion of putrescible material found in the soil.

For every development, upon completion of all groundworks, the onsite manager/builder must provide a clear and unambiguous written and signed statement to the Planning Authority identifying whether any significant unexpected contamination was encountered during the development. Where significant unexpected contamination was encountered, full details of the contamination and how it was dealt with must be provided. Where a verification report (VR) is to be produced for a development, this information may be included within the VR.

Appendix 1
Illustrations of monitoring positions

Note: The following only includes examples of monitoring well locations. An investigation may also include trial pits placed for geotechnical purposes or to better understand the thickness of Made Ground across the site (see **Section 5.1**)

Figure 1: Monitoring wells should be positioned to target potential on-site sources

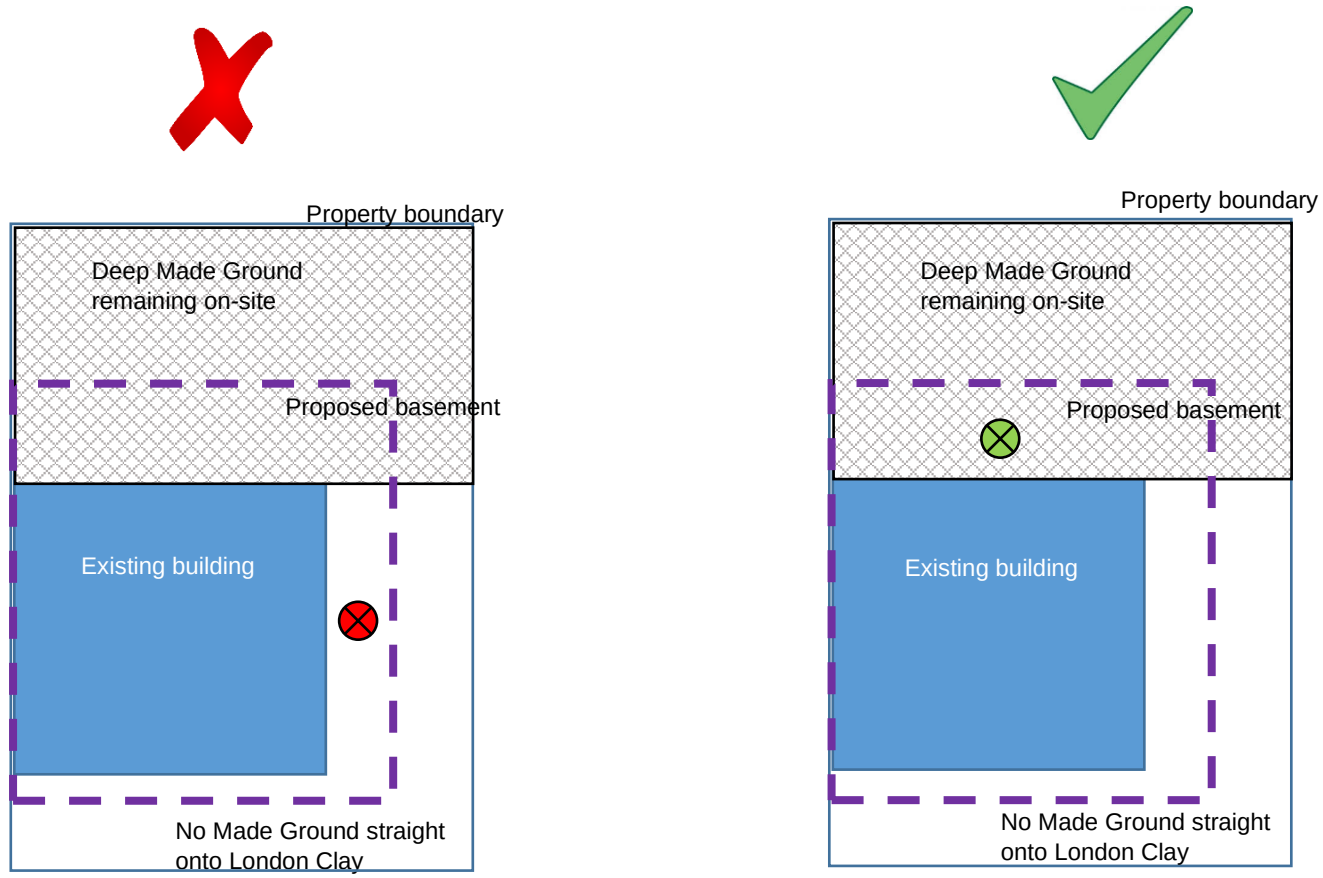


Figure 2: Monitoring wells should be positioned to target potential off-site sources (monitor source side of the basement)

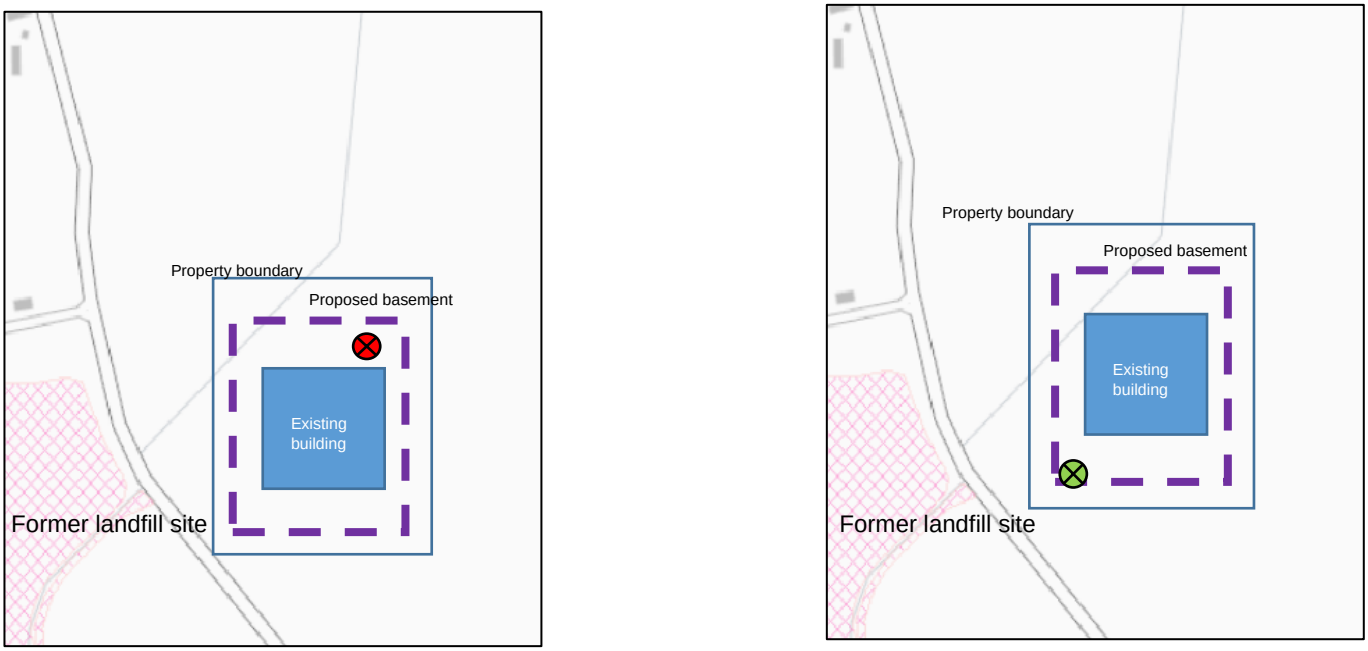


Figure 3: Minimum of one monitoring well recommended for basements <50m^2. However, depending on the ground conditions additional monitoring wells may be required.

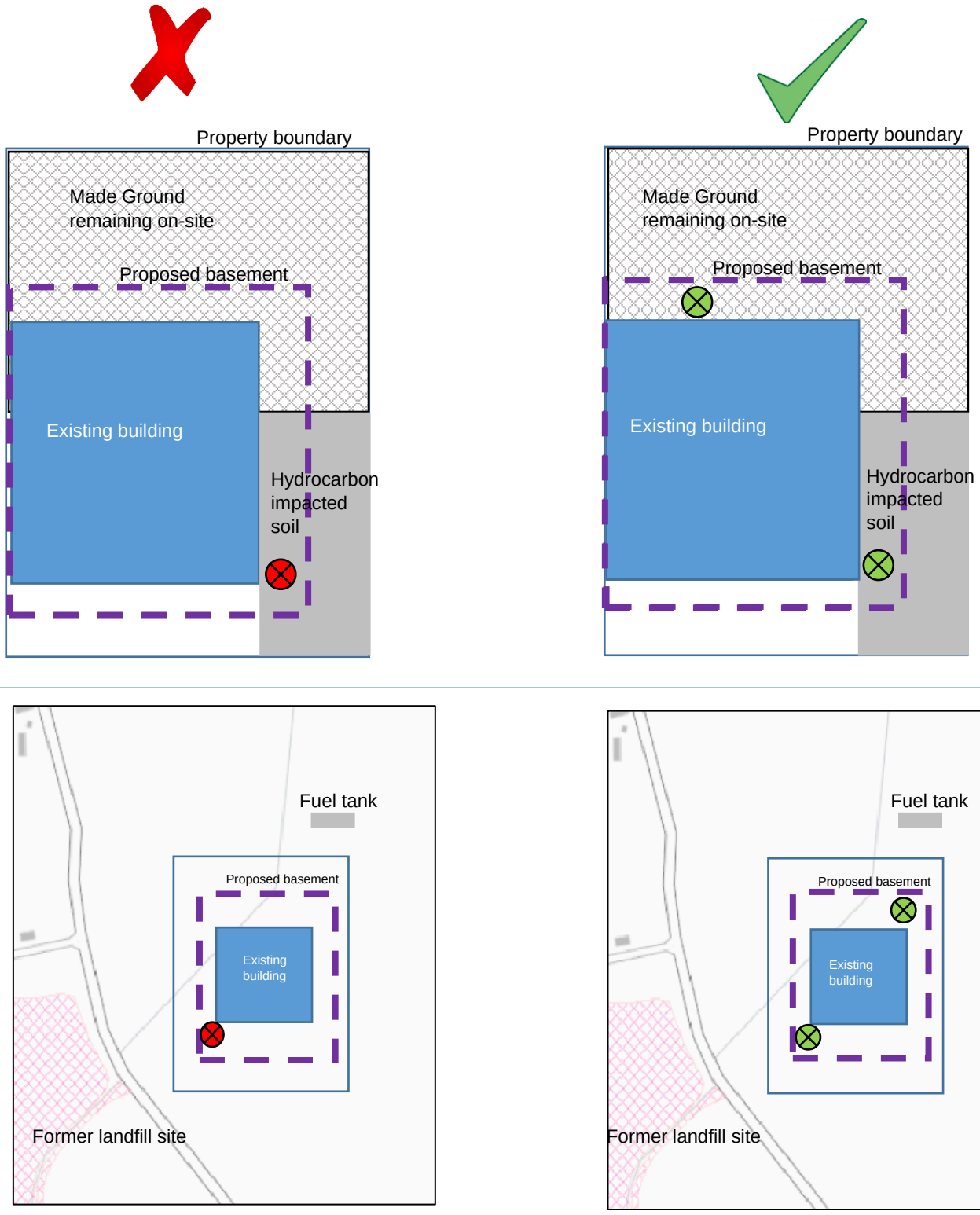


Figure 4: Existing basement is to be deepened. The exploratory holes within the basement may be appropriate for geotechnical purposes but other exploratory hole(s) should be positioned for ground gas monitoring purposes if Made Ground or impacted soils surround the basement or if deep Made Ground is present

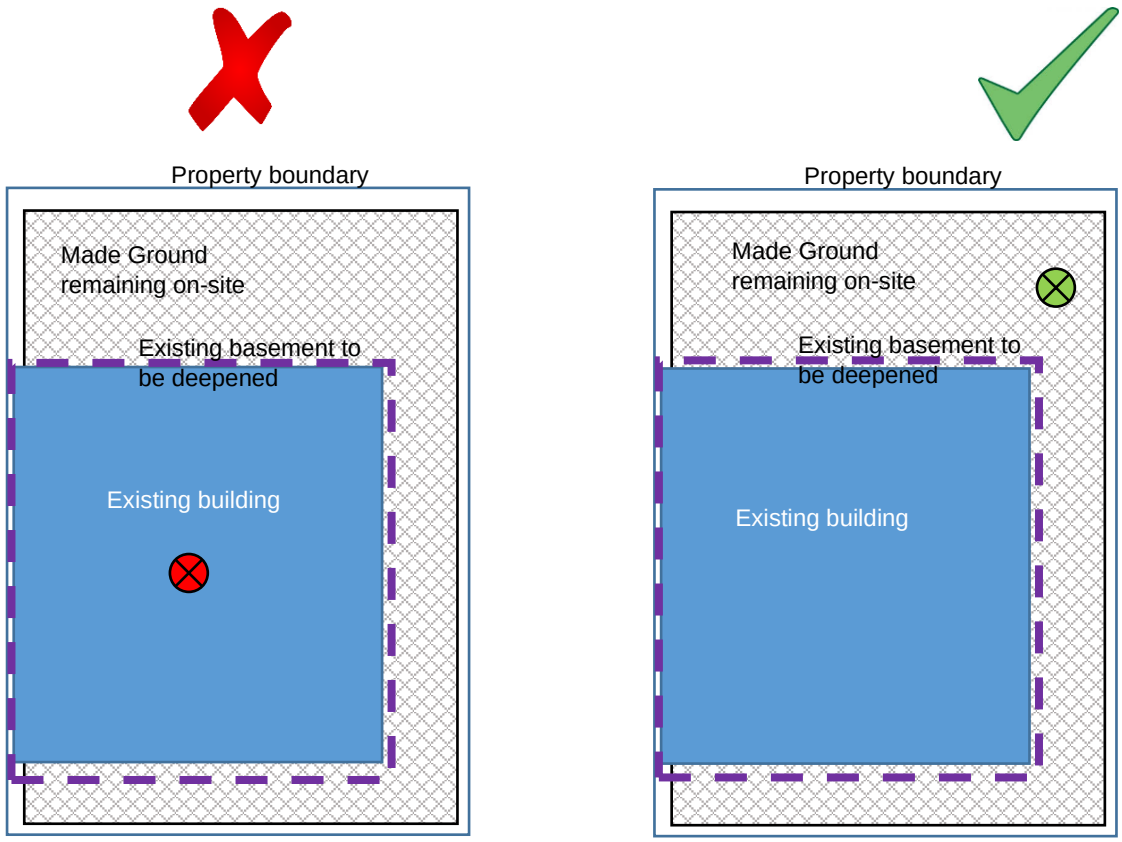
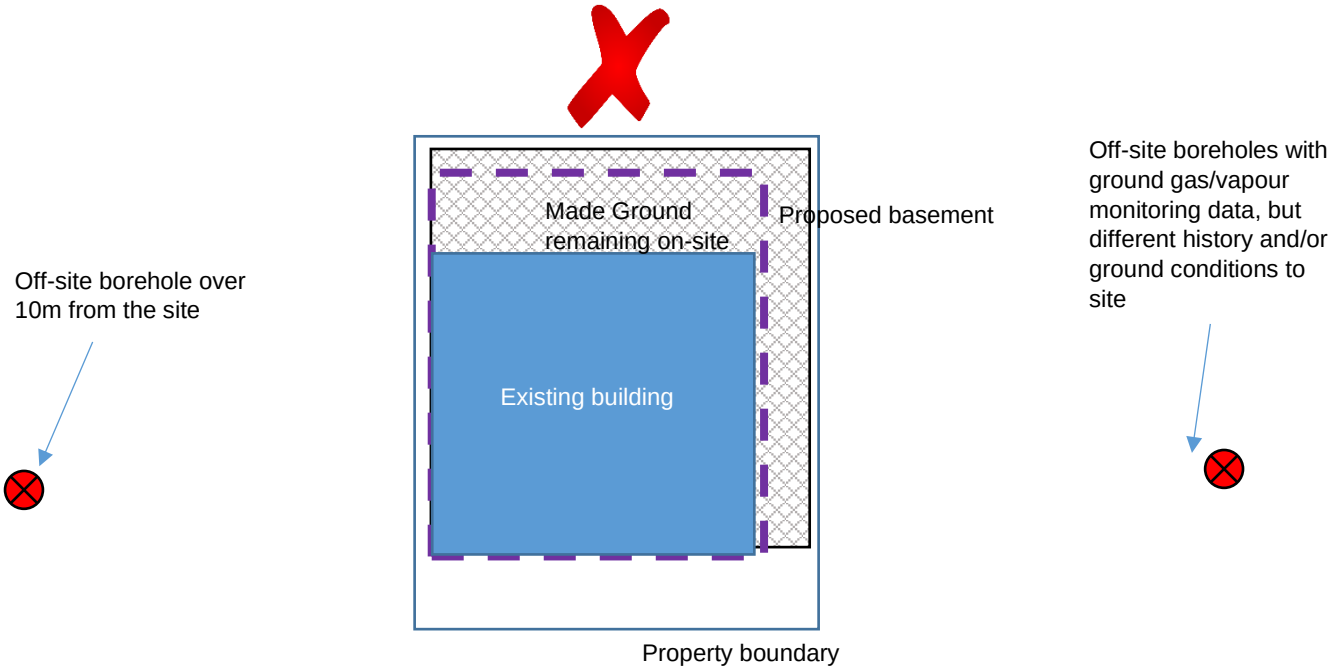
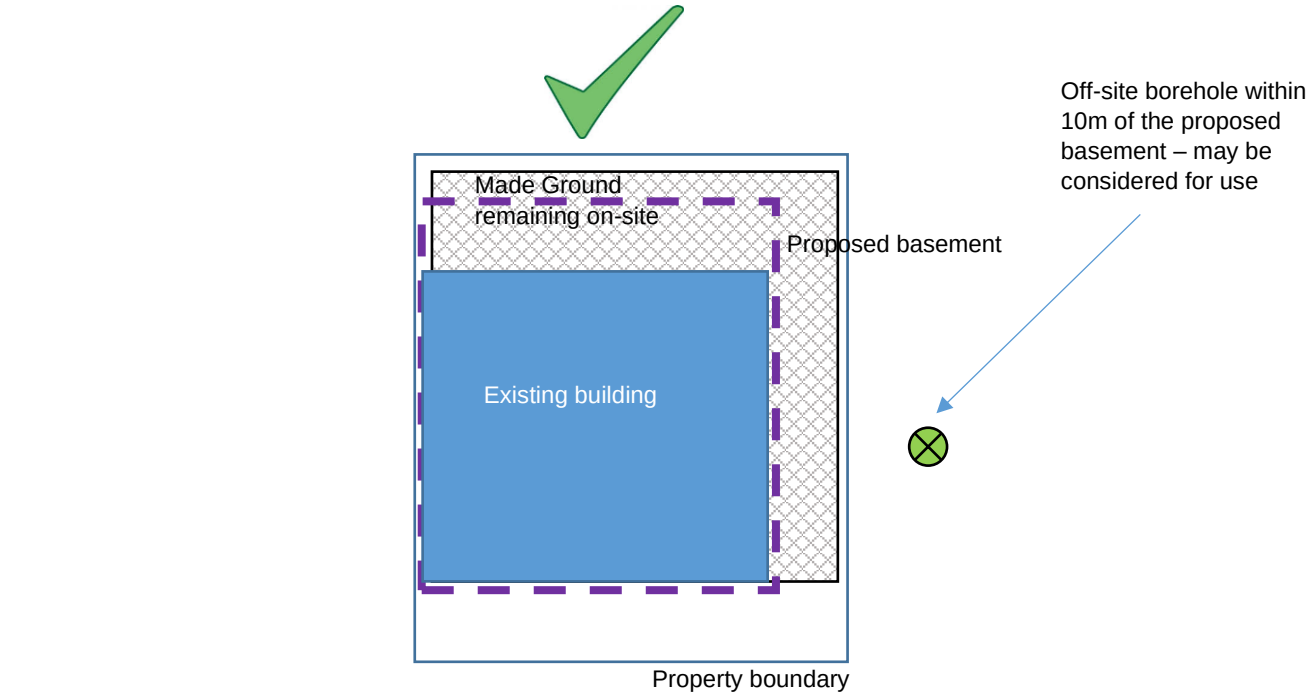


Figure 5: Off-site historical exploratory holes should be close to the proposed development and not be associated with a possible contaminating use





Appendix 2

Informative for soil contamination testing for imported or reused soils and fills

This informative provides guidance on how to test soil (for example within planting areas and beneath turf) and fills (used as sub-base beneath areas of hardstanding) imported on to or reused on the development site, to ensure they are suitable for their intended use. The guidance sole aim is to ensure soils and fills will not result in harm to people or planting. This work should be undertaken by an appropriately qualified and competent environmental professional.

Materials brought on to the development site should ideally have certification demonstrating that they are clean and suitable for their intended use. All imported materials must be described and confirmed as being clean without evidence of contamination. Soil imported on to the site or reused on site shall be sampled at a rate of 1 sample per $50m^3$ per source of soil. Where more than $10m^3$ of soil is imported a minimum of 3 samples must be taken. Analyses of soil samples must be to UKAS and MCERTs standards where they are available and should include pH, soil organic matter, a standard metals/inorganic suite, organic compounds (including polycyclic aromatic hydrocarbons (PAHs), aliphatic and aromatic petroleum hydrocarbon fractions, VOCs and SVOCs) and an asbestos screen. The results of analyses shall be compared to appropriate current generic screening criteria. The method detection limit for each chemical of concern analysed should be sufficiently below the appropriate generic screening criteria.

Where aggregate is primary virgin quarried material or is a coarse secondary aggregate with no fine portion or evidence of contamination (including for example oil or asbestos contamination) and this can be demonstrated, no sampling or analyses of the aggregate is required. Where aggregate is potentially contaminated, sampling will be undertaken at the same rate as for soil and an appropriate range of analyses will be undertaken. For general fills and demolition sourced materials as a minimum analysis should include a standard metals/inorganic suite and an asbestos screen, with other analyses being undertaken based on factors such as the source of the material and observations. For coarse aggregate, the fines portion should be sampled.

It is the responsibility of the developer to ensure that they comply with the requirements of Contaminated Land, Health & Safety, Waste Management and the Control of Asbestos Regulations. The responsibility to properly address contaminated land issues, including safe development and secure occupancy, and irrespective of any involvement by the Royal Borough, lies with the owner/developer of the site.