



Barratt Redrow Southern Counties

Rascals Farm, Shipley Road, Southwater, RH13 9BG

Remediation Method Statement

3751345 R01 (00)

RSK GENERAL NOTES

Project No.: 3751345 R01 (00)

Title: Remediation Method Statement: Rascals Farm, Shipley Road, Southwater, RH13 9BG

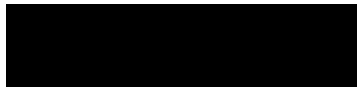
Client: Barratt Redrow Southern Counties

Date: September 2026

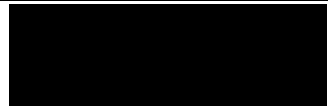
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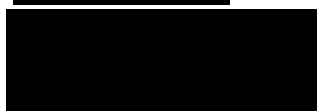
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Technical reviewer



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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION	3
2.1	Commissioning	3
2.2	Proposed Development	3
2.3	Objectives	3
2.4	Existing reports	4
2.5	Limitations	4
3	SITE DETAILS	5
3.1	Site location and Description	5
3.2	Site History	5
3.3	Geology, Hydrogeology and Hydrology	5
3.4	Summary of Previous Investigations	5
3.5	Proven Ground Conditions	6
3.6	Human Health	7
3.7	Controlled Waters	7
3.8	Ground Gas	7
4	REMEDIATION STRATEGY	9
4.1	Removal of Impacted Made Ground Soils	9
4.2	Clean Cover System	9
4.3	Discovery Strategy	10
4.4	Waste Disposal	10
5	VERIFICATION WORKS	12
5.1	Site Works	12
5.2	Verification Report	13

APPENDICES

Appendix A	Service constraints
Appendix B	Figures and Drawings
Appendix C	Imported Soil Specification

1 EXECUTIVE SUMMARY

Commissioning and purpose of assessment	RSK Environment Limited (RSK) was commissioned by Barratt Redrow Southern Counties to produce a Remediation Method Statement (RMS) for the site at Rascals Farm, Shipley Road, Southwater, RH13 9BG.
DESK-BASED ASSESSMENT	
Site description and proposed development	The site comprises agricultural/pasture land in the south, and woodland in the north, with a collection of buildings and structures in the centre. An above ground storage tank and stockpiles have been observed onsite. The site has planning permission with Horsham District Council under appeal decision reference APP/Z3825/W/20/3257700 for the construction of 96 No. residential dwellings with associated infrastructure and attenuation ponds.
History of site	The site remained predominantly agricultural and woodland until the 1950s with the start of construction of the buildings/structures in the centre of the site and continuing until the early 2000s. A number of ponds were also mapped onsite historically however appear to have been infilled, including one pond in the south of the site. A Phase I appraisal identified potential contamination risks associated with made ground/infilled ground as well as an above ground storage tank.
Geology and Hydrogeology	The site is mapped as underlain by Weald Clay Formation, with no superficial deposits. Intrusive investigations onsite generally encountered topsoil over sometimes sandy sometimes gravelly silty clay, becoming mudstone at depth. Made ground was encountered around the buildings in the centre of the site and in the location of the former infilled pond, generally to ~ 0.5 m but up to ~1.0 m to the south of the buildings, comprising reworked Weald Clay with anthropogenic material inclusions. No visual or olfactory evidence of contamination was noted in the made ground or natural soils. Groundwater was not encountered during drilling. During monitoring groundwater levels were variable between 2.64 and 7.72 mbgl and sometimes dry, indicating a lack of consistent groundwater body in the top 8 m of the site.
Remediation Strategy	Contamination testing detected lead exceedances to the west of the central-southern buildings in the shallow made ground, which was considered to be a hotspot given the lack of lead contamination in the surrounding made ground and underlying soils. No risks were identified with respect to controlled waters or ground gas. The main driver for remediation onsite is removal of the lead-impacted made ground, which poses a risk to future site users. Remediation will comprise excavation and removal of the lead-impacted made ground from Plots 81 and 82, followed by installation of a clean cover system comprising a minimum of 150 mm of suitable clean topsoil and sufficient subsoil to bring levels back up to requirements. Testing to date indicates all remaining made ground, the topsoil and natural soils are chemically suitable for reuse onsite. Excavated soils will need to be segregated, appropriately tested and classified in accordance with WM3 and WAC requirements. Any reuse on site will be managed under a DoWCoP Materials Management Plan, and

	a watching brief will be maintained during groundworks to address any unforeseen contamination.
Verification Works	The Environmental Consultant shall verify the removal of the lead-impacted made ground (inspection and testing), confirm the chemical suitability of clean cover soils, and verify their placement within soft landscaped areas. Site-won soils proposed for reuse within the clean cover system needs to be visually and olfactorily inspected and shall only be reused were confirmed suitable. Any imported soils shall be approved prior to placement, inspected on arrival, and subject to laboratory testing at the specified frequency to demonstrate compliance with the required specification. Any unsuitable materials shall be removed from site. All inspections, testing results, soil source information, delivery records and photographic evidence shall be compiled within a verification report for submission to Horsham District Council.
<i>The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.</i>	

2 INTRODUCTION

2.1 Commissioning

RSK Environment Limited (RSK) were engaged by Barratt Redrow Southern Counties (Compton House, The Guildway, Old Portsmouth Road, Guildford, Surrey, GU3 1LR) herein referred to as the 'Client' to produce a remediation method statement (RMS) for the site referred to as Rascals Farm, located on Shipley Lane, Southwater, RH13 9BG.

The works were undertaken by means of RSK proposal letter ref. 3751345 T01 dated 10 September 2026, including RSK Standard Terms and Conditions, which forms the appointment between ourselves and the Client.

References in this report to 'we', 'us', or 'our' shall mean RSK Geosciences as a trading name of RSK Environment Limited (company no.SC115530) at registered address 65 Sussex Street, Glasgow, G41 1DX.

The site location is provided in Drawing 11101, **Appendix B**.

The report should be read and used in accordance with the limitations and constraints identified in the report text, and at **Appendix A – Service Constraints**.

2.2 Proposed Development

RSK understands that it is proposed to redevelop the site with up to 96 No. two to three storey residential dwellings with associated access roads, public open space and attenuation ponds, as shown in Drawing No. CB_17_420_501 Rev0, **Appendix B**. It is also understood that the proposed development has been granted outline planning permission with all matters reserved by Horsham District Council in accordance with appeal decision reference APP/Z3825/W/20/3257700 for planning application DC/20/0695.

Condition 160 (and Schedule of Conditions No. 5) of the planning decision requires investigation and a detailed risk assessment to assess the degree and nature of the risk posed by any contamination present (Condition 5.a), details of any remediation measured required based on the results of the site investigation, and how they would be undertaken (Condition 5.b) and a verification plan to provide details of the data that will be collected in order to demonstrate that the works set out in the remediation plan are completed (Condition 5.c).

2.3 Objectives

The objective of this document is to provide a scheme of remediation based on the findings of previous contamination reports and investigations on site to ensure that no unacceptable risks exist to future site users and other identified receptors following redevelopment of the site, and details of how this remediation will be verified. It is also intended for this report to support approval and discharge of Planning Conditions 5.b and 5.c.

2.4 Existing reports

The following reports detailing previous works at the site which support this remediation method statement, and pertinent information from these reports has been summarised in Section 3.4:

- GRM, Phase I Site Appraisal, ref GRM/P9249/DS.1, dated February 2020.
- GRM, Phase II Site Appraisal, ref: GRM/P9249/PIISAR, dated September 2021.
- RSK Environment Ltd, Re: 3751105 Rascals Farm, Southwater – Winter Groundwater Monitoring Report, ref: 3751105 R01 (00), dated 16 June 2026.
- RSK Environment Ltd, Rascals Farm, Shipley Road, Southwater, RH13 9BG, Phase II Site Investigation Report, ref. 3751198 R01 (02), dated 04 September 2026.

2.5 Limitations

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described below and throughout this document.

This report was prepared in accordance with good practice guidance and available datasets at the time of issue. Consideration should be given to changes in legislation, statutory requirements, or industry practices after the date of issue.

The opinions expressed in this report, and the comments and recommendations given, are based on the information obtained from the desk assessment and the site reconnaissance survey. No intrusive investigations have been undertaken to confirm the actual ground conditions and hence the environmental status of the site.

The study aims to principally identify and assess the potential risks and liabilities associated with contamination of the ground, on and in the vicinity of the site. While this includes consideration of current operations and housekeeping on the site, the report does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

3 SITE DETAILS

3.1 Site location and Description

The site is located at Rascals Farm, Shipley Road, Southwater, RH13 9BG, as shown on Drawing 11101, **Appendix B**, with an approximate National Grid Reference TQ 154252.

The site comprised areas of pasture/paddock in the south and woodland in the north, with several buildings including stables, outbuildings and a residential dwelling with a garden in the centre of the site. A raised area with livestock was also present in the centre, along with a fenced sand menage to the west of the buildings. An above ground heating oil tank was also noted to be present in the centre of the site along with two stockpiles comprised of fencing in the centre and horse manure on the southern boundary of the site. The site was accessed from Shipley Road by an unbound gravel farm track leading to the centre. Between site walkovers in March and July 2026 the buildings and sand menage in the centre of the site had been demolished and removed, and replaced with a construction site compound including car parking and materials storage.

The site is bounded to the north by ancient woodland. To the northeast by residential properties, to the east by Shipley Road with residential properties beyond, to the west by woodland and orchards, and to the south by further areas of pasture/paddocks.

3.2 Site History

Historically the site comprised agricultural land in the south and centre, and woodland in the north. A structure was built in the centre of the site in the 1950s, with further buildings constructed between the 1960s and mid 1970s and the eastern portion of the site was labelled as orchards. Another structure was constructed in the early 2000s in the centre of the site, after which little changes occurred onsite to the present day. A number of historic ponds were noted to be present on site within the earlier GRM report, including in the centre and south of the site, however their exact locations aside from the southern pond were not reported.

3.3 Geology, Hydrogeology and Hydrology

The site is mapped as underlain by the Weald Clay Formation, which is classified as an Unproductive Strata based on Environment Agency groundwater vulnerability mapping.

The site is not located within a Groundwater Source Protection Zone (SPZ).

No surface water features are present onsite. The closest surface water feature recorded is an inland river located 70 m to the south of the site.

3.4 Summary of Previous Investigations

A summary of the investigations undertaken onsite are provided below, with the findings summarised in Sections 3.6 and 3.7. Drawing 11602 in **Appendix B** shows the exploratory location holes undertaken onsite by RSK over the proposed site plan.

3.4.1 GRM Reports

The information below is provided in more detail in the RSK report ref 3751198 R01 (00).

A Phase I site appraisal was undertaken by GRM for Catesby Estates Limited, based on redevelopment of the site for residential purposes, comprising a site walkover and preliminary risk assessment. The Conceptual Site Model (CSM) identified a very low to low human health risk associated with potential made ground/fill beneath buildings and within the former ponds onsite, as well as the above ground heating oil tank and asbestos within buildings. A low risk from ground gas was also identified, and a very low to negligible risk to controlled waters.

A Phase II investigation was undertaken in August 2021 to assess the risks identified in the CSM, comprising 25 No. exploratory holes to a maximum depth of 5 m bgl (WS01 to WS12, TP01 to TP09, HTP01 to HTP03) with a scheme of groundwater and ground gas monitoring. The extent of the investigation was restricted due to parts of the site being occupied at the time of works.

3.4.2 RSK Winter Groundwater Monitoring (ref 3751105 R01 (00))

A scheme of winter groundwater monitoring was undertaken onsite between October 2025 and May 2026 to provide information on groundwater levels. The previous wells installed by GRM had not encountered groundwater to a maximum depth of 4 m bgl, and therefore 3 No. rotary cored boreholes were excavated between October and December 2025 to 8 mbgl and groundwater monitoring wells installed (RC101 to RC103).

3.4.3 RSK Phase II Investigation (ref: 3751198 R01 (02))

A Phase II intrusive ground investigation was undertaken by RSK in 2026 to provide information on the ground conditions and assess the potential contaminative linkages identified in the GRM Phase I appraisal. The investigation was undertaken over two stages; Stage 1 undertaken in March 2026 to provide overall coverage and Stage 2 undertaken in July 2026 to target potential contaminative sources identified in Stage 1, to target areas requested by the Environmental Health Officer (EHO) at Horsham District Council, including areas that were previously inaccessible. In total 35 No. exploratory holes were excavated (WS101 to WS112, TP101 to TP108, TP201 to TP212, TP212A and TP212B), along with 4 No. combined ground gas monitoring wells installed to target potential sources of ground gases (made ground, infilled ponds).

3.5 Proven Ground Conditions

The ground conditions encountered onsite generally comprised topsoil of brown silty clay with rare fine brick and charcoal to between 0.15 and 0.35 m bgl underlain by stiff to very stiff orangish brown and light grey sometimes sandy sometimes gravelly silty clay with gravel of mudstone and rare shelly fragments and selenite crystals to depth (interpreted as Weald Clay). During the GRM investigation the deeper strata were logged as extremely weak mudstone.

Made ground was encountered around the buildings in the centre and in the vicinity of the infilled pond in the south of the site and comprised reworked Weald Clay soils with rare to frequent fragments of charcoal, brick, concrete, terracotta tile, whole bricks, glass and masonry wall. The made ground ranged between 0.15 and 1.1 m thick, with the greatest extent of made ground encountered in TP208 and TP209 (>1 m) around the central building, compared to a general thickness of ~ 0.5 m.

No visual or olfactory evidence of contamination aside from the presence of anthropogenic inclusions was noted in the soils in either the RSK or GRM investigations, in particular no evidence of hydrocarbon contamination was noted around the above ground oil tank.

Groundwater strikes were not generally recorded during excavation of the exploratory holes. Groundwater levels onsite were highly variable, between 2.64 and 7.72 m bgl, with all deep monitoring wells recording dry conditions at some point during the winter monitoring regime, and nearly all shallow monitoring wells recording dry conditions between March and May 2026 (to a maximum depth of 3 mbgl). A very shallow water level (0.75 m bgl) was recorded in RC101 in January 2026 however this was considered to be caused by water ponding at ground level and submerging the well cover.

3.6 Human Health

Soil samples were collected during both the RSK and GRM investigations for chemical laboratory analysis and assessment. Samples were scheduled based on the soils encountered and to provide lateral and vertical coverage. The suite of contaminants scheduled were based on the potential contaminants of concern identified in the CSM, including heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos and petroleum hydrocarbons. In accordance with LCRM¹ the chemical results were assessed against generic assessment criteria (GACs) based on the proposed land use, which in this instance was a residential setting where home grown produce would be consumed (resi HGP).

All samples of topsoil and natural soils, as well as all made ground samples in the vicinity of the former infilled pond in the south of the site and most of the made ground samples around the buildings in the centre, detected concentrations of contaminants below their respective GACs. However, 2 No. samples of made ground to the west of the central building detected lead above the resi HGP GAC of 200 mg/kg; WS110 at 0.1 m (223 mg/kg) and TP203 at 0.1 m (457 mg/kg). Samples collected from below the lead-impacted made ground (TP203 at 0.5 m) and from the made ground to the south (TP208) and to the west (TP209) didn't detect any lead exceedances, and it was considered that the lead encountered was localised as a 'hotspot' to the shallow made ground around WS110/TP203.

3.7 Controlled Waters

No samples were collected of the groundwater present beneath the site. However both RSK and GRM interpreted a low to negligible risk to groundwater based on the low concentrations of contaminants (particularly mobile contaminants) detected onsite, the lack of a consistent shallow groundwater table and the low permeability of the underlying Weald Clay Formation. Similarly the risk to surface water features via lateral migration of contaminants was considered to be negligible due to low contaminant concentrations and a lack of significant surface water features in close proximity to site.

3.8 Ground Gas

Ground gas monitoring was undertaken by both GRM in 2021 and RSK in 2026. Low concentrations of carbon dioxide (maximum concentration of 3.9 %) and negligible concentrations of methane (0

¹ Environment Agency (2025), Land contamination risk management, 2025

%) were recorded in both monitoring rounds, with flow rates also recorded at 0 l/hr in all monitoring wells. Assessment of the ground gas readings in accordance with BS8485² identified the site as Characteristic Situation 1 (CS1) with a very low risk from ground gases.

² British Standard Institution (BSI) (2019), 'BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'

4 REMEDIATION STRATEGY

The lead contamination encountered in the shallow made ground to the west of the central building is considered to pose a potentially unacceptable risk if left in places where there is a risk of exposure to the identified receptors e.g. where private gardens and soft landscaping areas are proposed. In these areas, contamination may impact human health through direct ingestion, inhalation, skin contact and/or plant uptake pathways that would be present in a residential setting.

Based on the assessment to date there is considered to be no risk to controlled waters, and no risk associated with ground gases, and thus no remedial measures are required to deal with these.

Based on the above, the following remedial activities are proposed for the site:

- Excavation and offsite disposal of the lead-impacted made ground.
- Verification of removal of the lead-impacted made ground.
- Application of a suitable clean cover system.
- Verification of the clean cover system (where required).

4.1 Removal of Impacted Made Ground Soils

Based on the position of the trial holes where the lead-impacted made ground was encountered (WS110 and TP203, see also Drawing 11602), the impacted soils are located where the gardens of residential dwellings Plot 81 and Plot 82 are proposed. As such, all made ground soils located within the extent of the gardens of Plots 81 and 82 should be excavated, with all soils removed vertically until natural soils are exposed at the base. Based on the trial hole logs the made ground in this area is anticipated to be ~0.5 m thick, however this depth should only be used as guidance and any made ground present > 0.5 m deep should also be removed.

Following excavation, an environmental engineer will be required to inspect and verify the removal of the impacted soils. Further details of the verification process can be found in Section 5.1.1.

It is anticipated that the lead-impacted soils will be removed from site as waste. However, if the made ground is required to be reused onsite then it should only be used in accordance with a materials management plan under the CL:AIRE DoWCoP (Section 4.4) which sets out suitability for use criteria.

The lead-impacted made ground should undergo any additional laboratory geochemical testing (such as waste acceptance criteria – WAC) to allow them to be classified and disposed of in accordance with the Duty of Care. Where possible, varying materials should be segregated to reduce disposal costs. Further details on waste disposal are provided in Section 4.4 below.

4.2 Clean Cover System

In the gardens where made ground soils have been excavated, the provision of a minimum of 150 mm of suitably clean topsoil will be required, with the remainder of the additional cover system required to bring levels up to required elevations comprising clean subsoil in areas of soft landscaping.

Requirements for testing and verification of the clean cover system are provided in Section 5 below.

4.3 Discovery Strategy

As with any development site there is the risk of hitherto undetected contamination. The groundworkers should be briefed regarding the potential presence of additional, undiscovered contamination and the need to contact their supervisor in the event of discovering odorous, coloured or stained soils or evidence of asbestos. This is especially applicable during the formation of excavations for new foundations.

Should any visual or olfactory evidence of previously undetected contamination be discovered then the works will cease and the groundworkers supervisor will contact the environmental consultant (EC) for guidance. All further remedial works will take place in the presence of an EC following prior consultation and agreement with Horsham District Council.

4.4 Waste Disposal

It is anticipated that the proposed development may generate waste soils and materials these may need to be removed from site as part of the construction process.

Waste soils awaiting testing, classification and disposal will be placed on plastic sheeting, segregated by fencing and labelled appropriately. Any potentially hazardous or inert soils will require waste acceptance criteria (WAC) testing.

In line with current European Commission Regulations including the Waste Framework Directive 2014 and The Waste (England and Wales) (Amendment) Regulations 2012, and Environment Agency Guidance (WM3 2015), waste holders and their advisors (producer, carrier or disposal facility) are required to make an assessment of waste materials and classify them as hazardous, non-hazardous waste or inert.

Once the waste has been classified as either hazardous or non-hazardous and prior to disposal, further analysis may be needed to confirm whether soils to be exported meet the proposed receiver landfill site's Waste Acceptance Criteria. Where a waste is classified as non-hazardous a Waste Acceptance Classification test (WAC) is required to determine whether the material can be accepted at either an inert or non-hazardous landfill. Where the WAC test results exceed hazardous waste WAC limits that waste cannot be accepted at a hazardous landfill site without prior treatment.

In accordance with WM3, wastes containing visible asbestos contamination or asbestos concentrations greater than 0.1% by volume are classified as Hazardous.

Where soils are to be disposed off-site, it is the duty of the waste producer, to ensure that all waste is disposed of appropriately and that any that is sent to landfill is sent to an appropriately licensed one.

Where made ground soil is to be re-used on site or natural clean soils may be suitable for re-use on another site, then it is recommended that this is carried out under the CL: AIRE Code of Practice for re-use of soils. The guidance presents key principals for demonstrating compliance with DoWCoP to reuse of soils as non-waste, this needs to be lines of evidence based to demonstrate that soils are not waste. Lines of evidence must be set out in the Material Management Plan (MMP). Key principals to be met when reusing soils as non-waste are as follows:

- Reuse of material will not create unacceptable risk to human health or other identified receptors – i.e. risk assessment confirming suitability for reuse.

- Suitability for reuse without further treatment – suitable chemically and geotechnically – must meet relevant specification – e.g. use as backfill beneath cover systems buildings or hardstanding or for site regrading.
- Certainty of Use – must demonstrate that material will actually be used and is not just a probability – i.e. there is planning for the scheme and that backfill is required to make up levels or clean soils required for cover systems.
- Quantities – materials used should only be in the quantities required – i.e. use of excessive material will = landfill on site as disposing waste soils that aren't required

An MMP should be submitted to a 'Qualified Person' (QP) for review and if appropriate the QP will sign a declaration that proposals within the MMP are in accordance with DoWCoP. The QP must be independent from and have had no prior involvement with the project.

On completion a verification report must be produced documenting whether proposals set out in MMP were implemented on site – confirming volumes of material reused, reuse locations, and compliance with specifications.

5 VERIFICATION WORKS

5.1 Site Works

During the re-development works, the EC will observe and verify the following:

- Verification of the removal of lead-impacted made ground from Plots 81 and 82.
- Verification of the chemical nature of suitability of proposed clean cover soils (where required).

The EC will also be available to visit site and provide guidance should any previously undiscovered contamination be encountered.

5.1.1 Verification of Made Ground Removal

The made ground 'hotspot' excavation will be inspected following removal of the lead-impacted made ground, and verification samples will be collected from formation levels to evidence the removal of the impacted ground. A minimum of 5 No. verification samples should be collected; 4 No. of the sides of the excavation and 1 No. of the base, and the samples tested for lead. The results should then be assessed against the lead resi HGP GAC of 200 mg/kg.

Where lead exceedances are recorded in the verification samples, further removal of the impacted soils should be undertaken under supervision of the EC and further verification samples collected, with the testing process detailed above repeated, until all lead-contaminated soils are removed. It is recommended that the excavation not be infilled until the verification process is completed.

Photographic records of the excavation works should also be maintained to further support the verification process.

5.1.2 Verification Testing of Clean Cover Soils

The site-won topsoil and subsoil tested to date have been shown to be free from significant contamination and chemically suitable for reuse within the clean cover system. However, in the event that soils are required to be imported for any reason, the EC will approve imported soil sources prior to use based on site investigation and/or test results.

5.1.2.1 *Site won clean cover soils*

Site won topsoil and subsoil (natural soils) proposed for reuse within clean cover soils should be inspected and confirmed visually and olfactorily uncontaminated. No further testing of these soils is considered necessary provided that they appear uncontaminated. Should inspection of these soils identify any potential impact then additional laboratory testing should be considered in line with the requirements for imported soils.

Photographic records should be kept of all site won materials used as part of clean cover systems to confirm that they have been appropriately inspected.

5.1.2.2 *Imported clean cover soils*

If natural soils are proposed to be imported from another construction site for reuse in the clean cover, an MMP will be required to be prepared and approved as outlined in Section 4.3 above.

Alternatively imported soils can be imported from a manufactured source without the requirement to prepare a MMP and make a declaration under DoWCoP. However, any at-source testing of the manufactured product should be checked prior to import to confirm suitability with respect to the import criteria.

Once a source has been approved for importation the EC will complete onsite inspection and verification testing. Imported topsoil and subsoil will be tested either in-situ or within stockpiles as/where required, and at a frequency of one sample per 150 m³ of imported soil **with a minimum of three samples per source material**. Testing will be undertaken at a UKAS and MCERTS accredited laboratory.

All imported soils will be required to meet the specification as given in **Appendix C** irrespective of the depth at which they are to be placed. Any unsuitable material will be removed from site by Barratt Redrow Southern Counties.

5.2 Verification Report

All verification works will be presented in a verification report upon completion. This report will comprise details of the verification visits and testing, as well as information related to imported soils (where required). On receipt, the verification report should be submitted to Horsham District Council to enable the discharge of Planning Conditions 5.b and 5.c. The below provides a further summary of the information required for the verification report:

- Records of inspections of the hotspot excavation to confirm the removal of the lead-impacted made ground.
- Laboratory certificates and assessment of the verification samples taken from formation level once lead impacted made ground soils have been removed.
- Confirmation of use of imported materials in clean cover, or where site won soils used as clean cover have been taken.
- Where required, details of any imported sources of topsoil and subsoil (at-source testing, volumes of imported soils, onsite testing, import transfer notes).
- Records of placed clean cover inspection.
- Details of any previously unencountered contamination found during works onsite, and where required assessment and review of the contamination.
- Photographs of the verification works.

APPENDICES

Appendix A

SERVICE CONSTRAINTS

APPENDIX A

SERVICE CONSTRAINTS

1. Service Constraints

1.1. This Report (the "Report") and any study, inspection, investigation, sampling, testing and or interpretation carried out in connection with the Report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) trading as RSK Geosciences, for the Client named in the first paragraph of the Report (the "Client") in accordance with the terms of an RSK Fee Proposal including RSK Environment Standard Terms and Conditions (the "Appointment") between RSK and the Client, unless otherwise stated in the first paragraph of the Report. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by a geo-environmental consultant at the time the Services were performed. Nothing in this Report shall be construed as imposing any fitness for purpose obligation. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the Client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.

1.2 Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services. RSK shall not be liable in respect of any action or proceedings arising out of or in connection with this Report whether in contract, in tort, for breach of statutory duty or otherwise after the expiry of six (6) years from either (i) the date of the Report or (ii) such earlier date as prescribed by law, unless varied in the terms of the Appointment.

1.3 Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent, or condone any party, other than the Client relying upon the Services. Should this Report or any part of this Report, or details of the Services or any part of the Services, be made known to any such party, and such party relies thereon, that party does so wholly at its own and sole risk, and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent geo-environmental consultant and/or lawyer.

1.4 The Client shall not, without the prior written consent of RSK, assign, transfer, charge, mortgage, subcontract, or deal in any other manner with all or any of the benefits provided in this Report. Unless specified in the Appointment, RSK shall not be obliged to assign the benefit of the Report whether by collateral warranty, third party rights pursuant to the Contracts (Rights of Third Parties) Act 1999, letter of reliance or otherwise. If RSK agrees to any assignment of the benefit of this Report, in whatever form, benefits to third parties through collateral warranties, third party rights or letters of reliance shall not be provided unless a fee for each right, warranty or letter is agreed. The form of wording used in the warranty or letter shall be provided by RSK for agreement by the Client. Any reasonable changes to the form of wording will be implemented by mutual agreement, however the terms in the warranty or letter cannot offer the third party any greater benefit than the Appointment offered to the Client.

1.5 It is the understanding of RSK that this Report is to be used for the purpose described in the introduction to the Report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the Report is used, or the proposed use of the site change, this Report may no longer be valid and any further use of or reliance upon the Report in those circumstances by the Client without the review and advice of RSK shall be at the Client's sole and own risk. RSK shall not be liable for any use of this Report for any purpose other than that for which it was provided.

1.6 The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the Report inaccurate or unreliable. The information and conclusions contained in this Report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the Report in the future shall be at the Client's own and sole risk.

1.7 The observations and conclusions described in this Report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out, or required by the Appointment between the Client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this Report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, fuel storage, persistent bio-accumulative or toxic chemicals (including PFAS and related compounds) or other radioactive or hazardous materials, unless specifically identified in the Services.

1.8 The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of desk based publicly available information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services and the limitations below:

- a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.
- b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.
- c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the Client or third parties, including laboratories and information services, during the performance of the Services.
- d. The Client has identified in writing to RSK, the information, reports, findings, surveys and preliminary works RSK may not rely upon when providing the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK, and including the doing of any independent investigation of the information provided to RSK, save as otherwise provided in the terms of the Appointment between the Client and RSK.

1.9 Any site drawing(s) provided in this Report is (are) not meant to be an accurate base plan for scale measurement but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for accurate setting out and should be considered indicative only.

1.10 Should RSK be requested to review the Report after the date of issue of this Report, RSK shall be entitled to additional payment at the existing rates, or such other terms as agreed between RSK and the Client.

2. Service Constraints where the Report provides an intrusive assessment of ground conditions:

2.1 The intrusive environmental ground investigation aspects of the Services are a limited sampling of soil from the site, at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this Report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent

of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope agreed between the Client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species (not tested) are not present.

2.2 The comments given in this Report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. The extent of the exploratory holes, laboratory testing and monitoring undertaken may have been restricted due to a number of factors including accessibility, the presence of buried or overhead services, current development, site usage, timescales or the Client's specification. The exploratory holes only assess a small proportion of the site area with respect to the site as a whole, and as such may only provide an indicative assessment of ground conditions on site. There may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised. The presence of hotspots of undisclosed contamination or exceptional and unforeseen ground conditions cannot be discounted.

2.3 Where the Services include Investigation of an exploratory nature or relating to physical ground works, any costings and prices provided in the Report are estimated and provided for guidance purposes only. The actual cost and time quantities shall be remeasured and shall be dependent upon the ground or other conditions, constraints present, and number and depth of the investigation locations, which shall influence the number of samples and tests required, and the quantities of soil being classified.

2.4 Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works. However, this Report does not constitute an asbestos survey. On this basis, the presence of asbestos on site cannot be discounted and a full asbestos survey should be undertaken.

2.5 Unless stated otherwise, only preliminary geotechnical recommendations are presented in this Report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed. Eurocode 7 gives guidance on the type of sampling, sample quality, number and spacing of intrusive investigations, and number of laboratory tests required. It is intended that the Geotechnical Information section of this Report will fulfil the general requirements of the Ground Investigation Report as set out in section 6 of Eurocode7, although this is subject to the restrictions imposed on the investigation, as listed above. For geotechnical design, Eurocode 7 requires the Geotechnical Design Report to address both the geotechnical and structural aspects of the geotechnical design for both the limit and serviceability states. The Geotechnical Appraisal section of this Report will not meet the requirements of a Geotechnical Design Report (GDR) and should therefore be used for preliminary guidance only.

3. Service Constraints where the Report relates to Surface Water Management:

3.1 The Surface Water Management Inspection (SWMI) Report, documents provided, observations, actions, and recommendations, with respect to the management of potential pollution issues to surface waters, made during the site Inspection visit, are those present at the time of the visit, and may not represent those recorded by others on the same day.

3.2 The comments given in this Report and the opinions expressed are based on the weather, ground and ground water conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the inspection and therefore could not be taken into account. In addition, groundwater levels and flows, may vary from those Reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

3.3 RSK places a degree of dependence upon oral information provided by site representatives, which is not readily verifiable through visual inspection, or supported by any available written documentation. RSK shall not be held responsible for conditions or consequences arising from relevant facts that were not fully disclosed by facility or site representatives at the time this Report was prepared.

3.4 This Report is a live document, to be continually reviewed and updated as the development progresses or other changes occur on site. RSK can only maintain the currency of this Report through the Client requesting support with supplementary site visits or attendance at meetings ahead of key stages of the development in relation to surface water management. Our risk rating assesses a number of risk factors in line with the source-pathway- receptor model and is therefore subject to constant change.

3.5 Standard design drawings are indicative. Material types, dimensions and construction details will need to be adjusted by the Client to suit the specific conditions / flows on Site.

3.6 The full responsibility for implementing the site-specific protection and maintenance measures to protect the surface water system as stated in this Report, remains with the Client and their site management team. Additional control measures may be required to achieve the objectives set out in the Surface Water Management Plan to be implemented and financed by the Client.

4. Service Constraints where the Report relates to Waste Management:

4.1 In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if re-used on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not necessarily become waste until the criteria above are met. Excavation arisings from the development may therefore be classified as waste if surplus to requirements and/or unsuitable for re-use.

4.2 It is the duty of the waste producer, to ensure that all waste is accurately classified prior to waste disposal. Technical Guidance WM3 (EA, 2018) sets out in its Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. Unless otherwise stated, the waste assessment presented in this Report should be considered as preliminary and further testing and assessment of the waste under the provisions of a Waste Sampling Plan may be required to obtain the necessary level of data required for basic characterisation of the waste in support of disposal.

4.3 Unless stated otherwise in the Report, information relating to historical operations at the site was not reviewed as part of the assessment by RSK. In addition, unless otherwise stated in the Services, RSK was not present during the collection of the samples nor had any input on the chemical testing suite. Therefore, the waste assessment and classification detailed in this Report are based solely on any information that were provided to RSK (e.g., laboratory chemical data, exploratory hole records) and were completed without prejudice for our Client.

4.4 RSK's assumes that any ground investigation data, chemical testing results etc., that were provided by the Client to inform the waste assessment and supporting review were carried out in accordance with current best practice and relevant guidance/ standards, where applicable. Thus, the

comments given in this Report and the opinions expressed are based solely on the information provided by the Client. However, it is noted that there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account as part of the RSK assessment.

5. Service Constraints for Construction Environmental Management Plan Reports:

5.1 This Report should be considered in the light of any changes in legislation, statutory requirement or industry practices that may have occurred subsequent to the date of issue.

5.2 The measures and comments outlined in this Report and any opinions expressed are based on the plans provided at the time and discussions with relevant parties. However, there may be conditions pertaining to the site that have not been disclosed by investigations and therefore could not be taken into account.

5.3 This CEMP is a live document and is subject to change throughout the project, as and when necessary, to ensure management of environmental aspects remains relevant, and to ensure continued compliance with legislation and commitments as they may change. RSK understands that this CEMP will be reviewed by the Client every six months and updated as and when necessary.

5.4 It is the full responsibility of the Principal Contractor/ Client to ensure that their works do not contravene legal requirements, and adherence to this CEMP alone cannot be a full defence regarding legal action against the Principal Contractor.

6. Service Constraints where the Report relates to Ground Gas Membrane Verification:

6.1 This Report is limited to the verification of the gas resistant membrane/vapour membrane/radon barrier after installation and no inspections were undertaken of the substrate (i.e. prepared ground). The Report therefore does not constitute as a full verification of ground gas protection system.

6.2 The comments given in this Report and the opinions expressed, are based on the condition of the ground gas membrane as encountered at the time of inspection by suitably qualified personnel. RSK cannot accept liability for any subsequent change to the status of the gas membrane by follow-on trades or other construction activity.

6.3 Where not designed by RSK, the verification of protection measures is carried out with reference to the gas protection design provided by the Client. RSK assume the scope of gas protection measures as determined by third parties to be correct and to have achieved any required approval from authorities.

6.4 The Ground Gas Design Report/Remediation Strategy and Verification Plan contains details of the procedures to be adopted for inspection and validation of the works. However, it should be noted that responsibility for the correct implementation of the strategy lies with the appointed contractor. RSK cannot be held responsible for any remedial works that are carried out without the agreed procedures involving either direct supervision by RSK, or inspection and validation of the works by a representative from RSK.

7. Service Constraints for Environmental Due Diligence (EDD) Reports:

7.1 The comments given in this Report and the opinions expressed are based on the information obtained and reviewed as part of the desk-based assessment. However, there may be conditions pertaining to the Site that have not been disclosed by the assessment and therefore could not be taken into account. Furthermore, no intrusive investigations, monitoring or sampling have been undertaken to confirm the environmental status of the site, therefore any comments relating to ground conditions and subsurface contamination are based solely on a review of desk-based information.

7.2 This Report describes the results of the EDD exercise. The scope of this EDD Report, where appropriate, covers legal or regulatory compliance with respect to UK or international regulations associated with environmental matters.

7.3 As with any EDD exercise, there is a certain degree of dependence upon information provided by the target company. The EDD does not include a site walkover / visit or liaison with site representatives unless identified in the Services. Therefore, the assessment is based on the available desk study information. Also, there is a certain degree of dependence upon oral information provided by site representatives, which is not readily verifiable through visual inspection, or supported by any available written documentation. RSK shall not be held responsible for conditions or consequences arising from relevant facts that were not fully disclosed by facility or site representatives at the time this EDD exercise was performed.

7.4 This Report, including all supporting data and notes (collectively referred to hereinafter as "information"), was prepared or collected by RSK for the benefit of its Client.

7.5 The comments given in this Report and the opinions expressed are based on the information obtained and reviewed as part of the desk-based assessment and the site inspection visit. However, there may be conditions pertaining to the Site that have not been disclosed by the assessment and therefore could not be taken into account. Furthermore, no intrusive investigations, monitoring or sampling have been undertaken to confirm the environmental status of the Site therefore any comments relating to ground conditions and subsurface contamination are based solely on a review of desk-based information and observations collected during the site inspection visit.

8. Service Constraints for Ground source heat energy Reports:

8.1 It is understood that this is a desktop survey only and that there are no requirements for a site walkover, service utility survey, or provision of service plans. These services can be provided upon request if required.

8.2 At a later stage, it is possible that a thermal response test (TRT) will need to be completed, for which a test borehole will have to be drilled, and these would be costed at the time. RSK can provide all aspects of subsequent site work for a GSHP system if required.

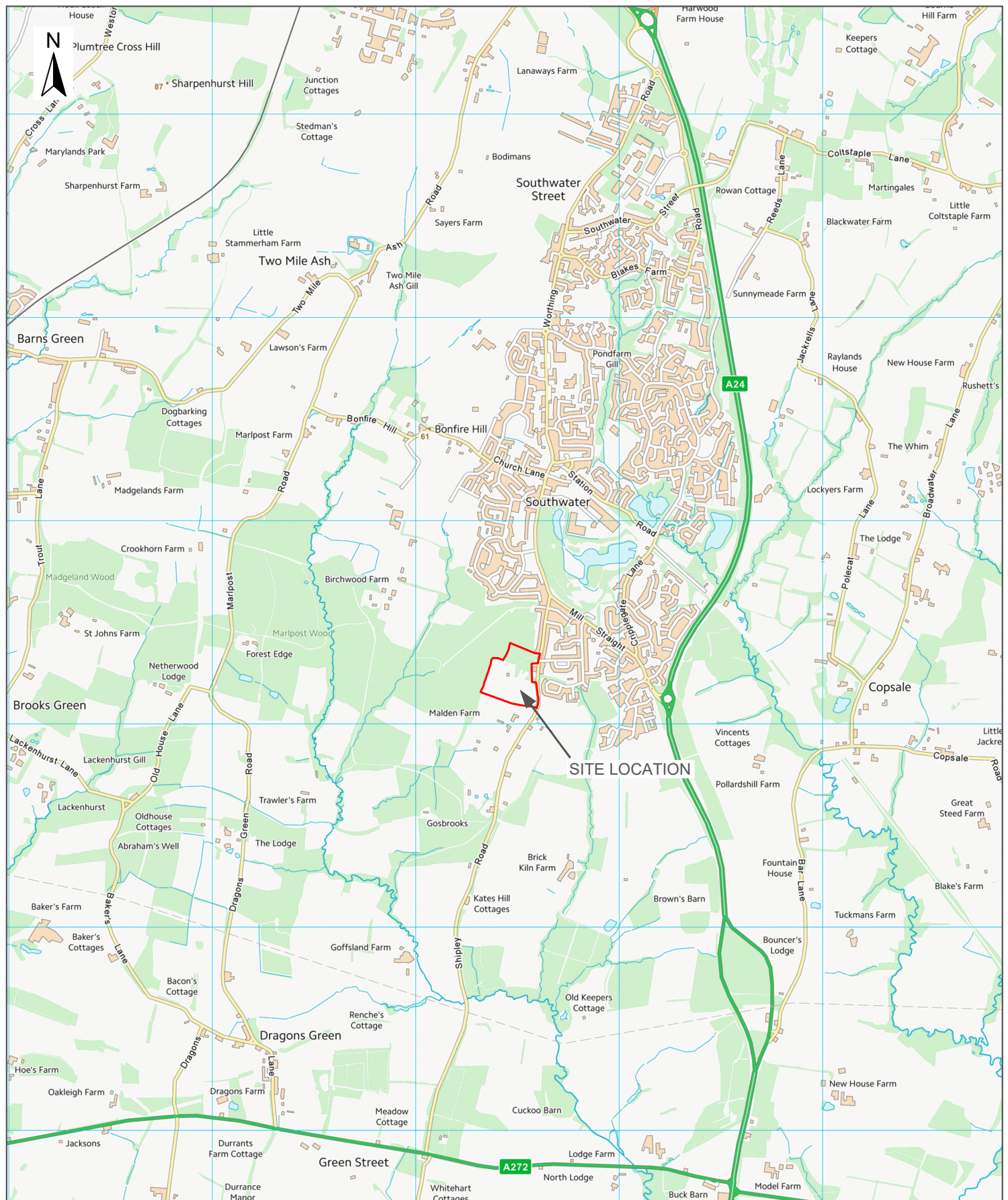
9. Service Constraints for Water Abstraction Borehole Reports:

9.1 The Report aims principally to only identify and assess the suitability of the site for a water abstraction borehole. This Report should be considered in the light of any changes in legislation, statutory requirements, and industry practices, that have occurred subsequent to the date of the Report.

9.2 Unless stated in the Report, the opinions expressed in this Report including all comments and recommendations provided are on the basis of the information obtained from a desk-based assessment.

Appendix B

FIGURES AND DRAWINGS



C01	26.04.2026	First Issue	OB	LK	LK
Rev	Date	Amendment	Drawn	Chkd	Appd

— Site boundary

Contains Ordnance Survey data © Crown copyright and database right 2025

			Client Barratt Redrow Southern Counties			
			Project Name Rascals Farm Phase II			
			Description Site Location Plan			
Dimension m	Size A4	Scale 1:25000	Geolocation 515496,124983	Project ID 1924028	Drawing no. 11101	Rev C01
			File name 3751198-LW-111-XX-D-G-11101-C01			

Blinks Wood

RASCALS FARM, SOUTHWATER

96

HOUSE TYPE NAME	REF	DESCRIPTION	HEIGHT	BEDS	FINISHED (NET)		NO	SQ.FT. TOT.
					SQ.FT.	SQ.M		(NET)
							65%	
2 BED							10	
BUXTON	BUX	2 BEDROOM HOUSE	2.0	2B4P	716	66.54	8	5728
BAKESWELL	BAK	2 BEDROOM HOUSE + STUDY	2.0	2B4P	832	77.32	2	1664
3 BED							31	
LETCHWORTH	LET	3 BEDROOM HOUSE	2.0	3B5P	983	91.36	8	7864
WARWICK	WAR	3 BEDROOM HOUSE	2.0	3B5P	1075	99.91	4	4300
AMBERLEY	AMB	3 BEDROOM HOUSE	2.0	3B6P	1144	106.32	6	6864
STRATFORD LIFESTYLE	STL	3 BEDROOM HOUSE	2.0	3B6P	1211	112.55	8	9688
OXFORD LIFESTYLE	OXL	3 BEDROOM HOUSE	2.0	3B6P	1316	122.30	5	6580
4 BED							19	
OVERTON	OVR	4 BEDROOM HOUSE	2.0	4B7P	1392	129.37	4	5568
HARBORCATE	HAR	4 BEDROOM HOUSE	2.0	4B8P	1353	144.33	3	4659
HENLEY	HEN	4 BEDROOM HOUSE	2.0	4B7P	1768	164.31	5	8840
LEDHAM	LED	4 BEDROOM HOUSE	2.0	4B7P	1841	171.10	2	3682
RICHMOND	RIC	4 BEDROOM HOUSE	2.0	4B8P	2030	188.66	5	10150
5 BED							2	
BLENHEIM	BLM	5 BEDROOM HOUSE	2.0	5B9P	2307	214.41	2	4614
SUB TOTAL							62	80201

AFFORDABLE RENT								25%
1 BED								6
1BF	1BF	1 BEDROOM FLAT	3.0	1B2P	539	50.10	6	3234
2 BED								14
2BF	2BF	2 BEDROOM FLAT	3.0	2B3P	672	62.50	6	4032
2BF	2BF	2 BEDROOM FLAT	3.0	2B3P	709	65.90	6	4254
2BCHA	2BCHA	2 BEDROOM COACH HOUSE	2.0	2B3P	777	72.19	2	1554
3 BED								4
3TOUR	3TOUR	3 BEDROOM HOUSE	2.0	3B5P	1017	94.48	4	4068
SUB TOTAL								24 17142

LOW COST OWNERSHIP								10%
2 BED								8
THIRLMERE	THR	2 BEDROOM HOUSE	2.0	2B3P	783	72.74	8	6264
3 BED								2
3TOUR	3TOUR	3 BEDROOM HOUSE	2.0	3B5P	1017	94.48	2	2034
SUB TOTAL								10 8298

GRAND TOTAL								96 105641
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KEY
CATESBY RESIDENTIAL
BOUNDARY

Scale @ A0:
0 5 10 15 20 25m
Scale 1:500
North

Rev Date Drawn Checked

Date: AUGUST 2025
Drawn by: KJM Checked by: BB
Dwg No: CB_17_430_601 Rev: 1

Project: RASCALS FARM, SHIPLEY ROAD,
SOUTHWATER, WEST SUSSEX
Title: PLANNING
LAYOUT
Client: Barratt
Redrow



Coopers & Lysons Limited, Coopers & Lysons House, 24 Gutterford Road, Bognor Regis, Sussex BN20 9BN. Telephone 01243 450031 - www.cooperslysons.co.uk
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Appendix C

IMPORTED SOIL SPECIFICATION

Generic assessment criteria for human health: residential scenario with home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009⁽¹⁾. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009⁽²⁾. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)^(3,4), as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)⁽⁵⁾ used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010⁽³⁾). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report⁽³⁾ and associated chemical specific reports⁽⁶⁾, and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications, with the exception of the “top two” produce type approach taken in the C4SL, have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) for residential land use, reducing exposure frequency for dermal contact outdoors for residential land use, and updated produce type consumption rates (90th percentile) based on recent data from the National Diet and Nutrition Survey.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015⁽⁷⁾ or by the USEPA⁽¹⁴⁾, where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance^(5,8,9) and revised exposure scenarios published for the C4SL⁽³⁾. The SAC are also termed GAC.

Conceptual model

In accordance with SR3⁽⁵⁾, the residential with home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3⁽⁵⁾, the pathways considered for production of the SAC in the residential with home-grown produce scenario are

- direct soil and dust ingestion
- consumption of home-grown produce
- consumption of soil attached to home-grown produce
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium⁽¹⁾, the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh} , are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁹⁾. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached⁽⁹⁾. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required⁽⁹⁾:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook⁽⁹⁾, this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁹⁾, which explains how to calculate an effective assessment criterion manually.

SR3⁽⁵⁾ states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7⁽¹⁰⁾, the EA TOX⁽¹⁾ reports, the C4SL SP1010 project report and associated appendices^(3,6), the 2015 LQM/CIEH report⁽⁷⁾ or the USEPA IRIS database⁽¹⁴⁾. Where a LLTC^(3,6) has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium, methyl tertiary-butyl ether (MTBE), 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, 2-chloronaphthalene, chloroethane, chloromethane, cis 1,2-dichloroethene, dichloromethane, hexachloroethane and trans 1,2-dichloroethene were obtained from the CL:AIRE Soil Generic Assessment Criteria report⁽¹¹⁾.

For TPH, aromatic hydrocarbons C₅–C₈ were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential with home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. The house is assumed to have a 100m² private garden consisting of lawn and flowerbeds, incorporating a 20m² plot for growing fruit and vegetables consumed by the residents. SR3⁽⁵⁾ notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3⁽³⁾, with a dust loading factor detailed in Section 9.3 of SR3⁽⁵⁾. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3⁽⁵⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3⁽⁵⁾ input parameters for residential with home-grown produce land-use scenario

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3⁽⁵⁾. Modifications to the default SR3⁽⁵⁾ exposure scenarios based on the C4SL exposure scenarios⁽³⁾ are presented in Tables 2 and 3 below.

The final selected GAC are presented by pathway in Table 4 and the combined GAC in Table 5.

Figure 1: Conceptual model for residential scenario with home-grown produce

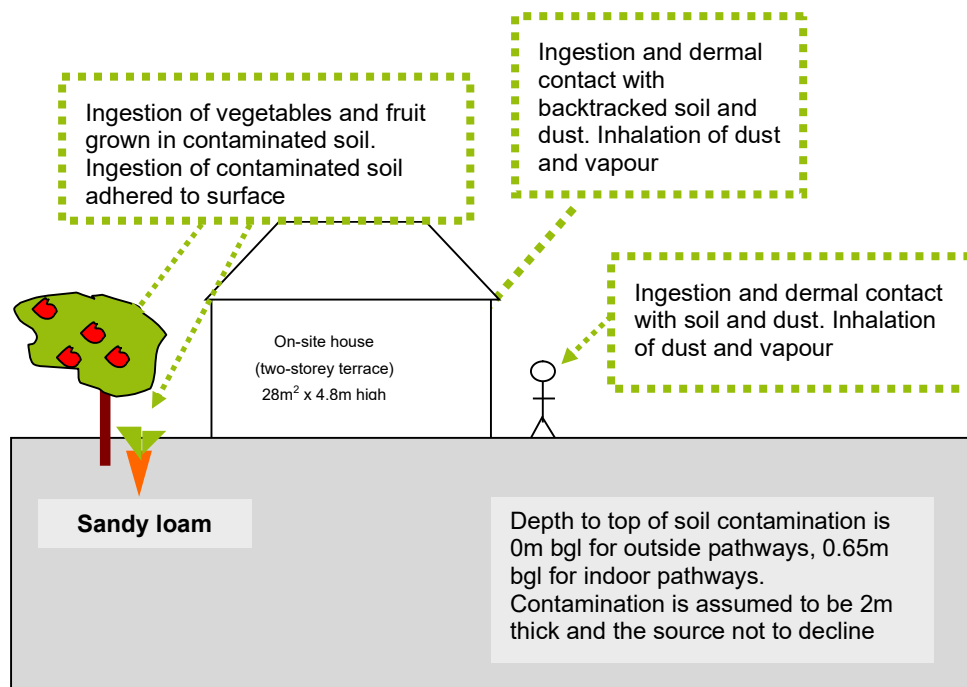


Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3) ⁽⁵⁾
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3) ⁽⁵⁾
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3 ⁽⁵⁾
End AC (age class)	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽¹³⁾
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential with home-grown produce – modified home-grown produce data

Name	Consumption rate 90 th percentile (g FW kg ⁻¹ BW day ⁻¹) by age class						Dry weight conversion factor (g DW g ⁻¹ FW)	Home-grown fraction (average)	Home-grown fraction (high end)	Soil loading factor (g g ⁻¹ DW)	Preparation correction factor
	1	2	3	4	5	6					
Green vegetables	7.12	5.87	5.87	5.87	4.53	4.53	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.7	2.83	2.83	2.83	2.14	2.14	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16	6.6	6.6	6.6	4.95	4.95	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.39	3.39	3.39	2.24	2.24	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.46	0.46	0.46	0.19	0.19	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	10.3	10.3	10.3	5.16	5.16	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 3.4, SP1010 ⁽³⁾						Table 6.3, SR3 ⁽⁵⁾	Table 4.19, SR3 ⁽⁵⁾		Table 6.3, SR3 ⁽⁵⁾	

Table 3: Residential with home-grown produce – modified use and receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr ⁻¹	180	365	365	365	365	365
EF (consumption of home-grown produce)	day yr ⁻¹	180	365	365	365	365	365
EF (skin contact, indoor)	day yr ⁻¹	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr ⁻¹	170	170	170	170	170	170
EF (inhalation of dust and vapour, indoor)	day yr ⁻¹	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr ⁻¹	365	365	365	365	365	365
Justification		Table 3.5, SP1010 ⁽³⁾ ; Table 3.1, SR3 ⁽⁵⁾					
Soil to skin adherence factor (outdoor)	mg cm ⁻² day ⁻¹	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010 ⁽³⁾					
Inhalation rate	m ³ day ⁻¹	5.4	8.0	8.9/f	10.1	10.1	10.1
Justification		Mean value USEPA, 2011 ⁽¹²⁾ ; Table 3.2, SP1010 ⁽³⁾					
Notes: For cadmium , the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI _{oral} and TDI _{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3 ⁽¹⁾ , Science Report SC050021/Cadmium SGV ⁽¹⁾ and the project report SP1010 ⁽³⁾ for more information.							

References

1. Environment Agency (2009), 'Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: <https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans> and <https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs> (accessed 4 February 2015)
2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).
3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.
4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.
5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).
6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Appendices C to H). DEFRA research project SP1010'. CL:AIRE (2021). Category 4 Screening Levels: Trichloroethene (TCE). CL:AIRE, London. ISBN 978-1-905046-38-6. CL:AIRE (2021). Category 4 Screening Levels: Vinyl Chloride. CL:AIRE, London. ISBN 978-1-905046-36-2. CL:AIRE (2021). Category 4 Screening Levels: Tetrachloroethene (PCE). CL:AIRE, London. ISBN 978-1-905046-37-9.
7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham: Land Quality Press).
8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).
9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).
10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).
11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).
12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington, DC: Office of Research and Development).
13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.



14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. <https://www.epa.gov/iris> (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE



Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR
Barium	(b)	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR
Beryllium		1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR
Boron		3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR
Cadmium	(a)	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR
Chromium (III) - trivalent	(c)	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR
Copper		2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR
Lead	(a)	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR
Elemental Mercury (Hg ⁰)	(d)	NR	2.35E-01	NR	4.31E+00	NR	5.60E-01	NR	1.07E+01	NR	1.22E+00	NR	2.58E+01
Inorganic Mercury (Hg ²⁺)		3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR
Methyl Mercury (Hg ⁴⁺)		1.26E+01	1.87E+01	7.52E+00	7.33E+01	1.26E+01	3.62E+01	9.34E+00	1.42E+02	1.26E+01	7.68E+01	1.08E+01	3.04E+02
Nickel	(d)	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR
Selenium	(b)	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR
Vanadium		4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR
Zinc	(b)	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR
Cyanide (free)		1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR
Volatile Organic Compounds													
Benzene	(a)	2.62E-01	9.01E-01	2.03E-01	1.22E+03	5.39E-01	1.68E+00	4.08E-01	2.26E+03	1.16E+00	3.48E+00	8.72E-01	4.71E+03
Toluene		1.53E+02	9.08E+02	1.31E+02	8.69E+02	3.49E+02	2.00E+03	2.97E+02	1.92E+03	7.95E+02	4.55E+03	6.77E+02	4.36E+03
Ethylbenzene		1.10E+02	8.34E+01	4.74E+01	5.18E+02	2.61E+02	1.96E+02	1.12E+02	1.22E+03	6.00E+02	4.58E+02	2.60E+02	2.84E+03
Xylene - m		2.10E+02	8.25E+01	5.92E+01	6.25E+02	5.01E+02	1.95E+02	1.40E+02	1.47E+03	1.15E+03	4.56E+02	3.27E+02	3.46E+03
Xylene - o		1.92E+02	8.87E+01	6.07E+01	4.78E+02	4.56E+02	2.08E+02	1.43E+02	1.12E+03	1.05E+03	4.86E+02	3.32E+02	2.62E+03
Xylene - p		1.98E+02	7.93E+01	5.66E+01	5.76E+02	4.70E+02	1.86E+02	1.33E+02	1.35E+03	1.08E+03	4.36E+02	3.10E+02	3.17E+03
Total xylene		1.92E+02	7.93E+01	5.66E+01	6.25E+02	4.56E+02	1.86E+02	1.33E+02	1.47E+03	1.05E+03	4.36E+02	3.10E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		1.54E+02	1.04E+02	6.22E+01	2.04E+04	2.97E+02	1.69E+02	1.08E+02	3.31E+04	6.03E+02	3.21E+02	2.10E+02	6.27E+04
1,1,1,2-Tetrachloroethane		5.39E+00	1.54E+00	1.20E+00	2.60E+03	1.27E+01	3.56E+00	2.78E+00	6.02E+03	2.92E+01	8.29E+00	6.46E+00	1.40E+04
1,1,2,2-Tetrachloroethane		2.81E+00	3.92E+00	1.64E+00	2.67E+03	6.10E+00	8.04E+00	3.47E+00	5.46E+03	1.36E+01	1.76E+01	7.67E+00	1.20E+04
1,1,1-Trichloroethane		3.33E+02	9.01E+00	8.77E+00	1.43E+03	7.26E+02	1.84E+01	1.80E+01	2.92E+03	1.62E+03	4.04E+01	3.94E+01	6.39E+03
1,1,2 Trichloroethane		1.95E+00	1.25E+00	7.62E-01	4.03E+03	4.21E+00	2.55E+00	1.59E+00	8.21E+03	9.35E+00	5.59E+00	3.50E+00	1.80E+04
1,1-Dichloroethene		1.93E+01	3.29E-01	3.23E-01	2.23E+03	3.85E+01	5.82E-01	5.74E-01	3.94E+03	8.15E+01	1.17E+00	1.16E+00	7.94E+03
1,2-Dichloroethane		3.17E-02	9.20E-03	7.13E-03	3.41E+03	5.73E-02	1.33E-02	1.08E-02	4.91E+03	1.09E-01	2.28E-02	1.88E-02	8.43E+03
1,2,4-Trimethylbenzene		NR	1.76E+00	NR	4.74E+02	NR	4.26E+00	NR	1.16E+03	NR	9.72E+00	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
1,2-Dichloropropane		4.28E+00	3.40E-02	3.37E-02	1.19E+03	8.44E+00	6.00E-02	5.96E-02	2.11E+03	1.77E+01	1.21E-01	1.20E-01	4.24E+03
Carbon Tetrachloride (tetrachloromethane)		3.10E+00	2.58E-02	2.57E-02	1.52E+03	7.11E+00	5.65E-02	5.62E-02	3.32E+03	1.62E+01	1.28E-01	1.27E-01	7.54E+03
Chloroethane		NR	1.17E+01	NR	2.61E+03	NR	1.59E+01	NR	3.54E+03	NR	2.57E+01	NR	5.71E+03
Chloromethane		NR	1.17E-02	NR	1.91E+03	NR	1.38E-02	NR	2.24E+03	NR	1.85E-02	NR	2.99E+03
Cis 1,2 Dichloroethene		1.56E-01	NR	NR	3.94E+03	2.66E-01	NR	NR	6.61E+03	5.18E-01	NR	NR	1.29E+04
Dichloromethane		7.04E-01	3.05E+00	6.24E-01	7.27E+03	1.27E+00	4.06E+00	1.08E+00	9.68E+03	2.33E+00	6.42E+00	1.92E+00	1.53E+04
Tetrachloroethene (PCE)		1.33E+01	3.19E-01	3.11E-01	4.24E+02	3.11E+01	7.15E-01	6.99E-01	9.51E+02	7.12E+01	1.64E+00	1.60E+00	2.18E+03
Trans 1,2 Dichloroethene		6.45E+00	2.76E-01	NR	3.42E+03	1.29E+01	4.99E-01	NR	6.17E+03	2.74E+01	1.02E+00	NR	1.26E+04
Trichloroethene (TCE)		9.30E-03	3.61E-02	NR	1.54E+03	1.95E-02	7.57E-02	NR	3.22E+03	4.34E-02	1.68E-01	NR	7.14E+03
Vinyl Chloride (chloroethene)		1.13E-02	1.47E-02	6.38E-03	1.36E+03	2.09E-02	1.90E-02	9.97E-03	1.76E+03	3.88E-02	2.91E-02	1.66E-02	2.69E+03
Semi-Volatile Organic Compounds													
2-Chloronaphthalene		2.76E+02	5.39E+00	5.29E+00	1.14E+02	6.59E+02	1.33E+01	1.30E+01	2.80E+02	1.45E+03	3.17E+01	3.10E+01	6.69E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE



Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Acenaphthene		2.27E+02	4.86E+04	2.26E+02	5.70E+01	5.41E+02	1.18E+05	5.38E+02	1.41E+02	1.18E+03	2.68E+05	1.17E+03	3.36E+02
Acenaphthylene		1.85E+02	4.59E+04	1.84E+02	8.61E+01	4.42E+02	1.11E+05	4.40E+02	2.12E+02	9.78E+02	2.53E+05	9.74E+02	5.06E+02
Anthracene		2.43E+03	1.53E+05	2.39E+03	1.17E+00	5.53E+03	3.77E+05	5.45E+03	2.91E+00	1.10E+04	8.76E+05	1.09E+04	6.96E+00
Benzo(a)anthracene		1.01E+01	2.47E+01	7.18E+00	1.71E+00	1.42E+01	4.37E+01	1.07E+01	4.28E+00	1.69E+01	6.26E+01	1.33E+01	1.03E+01
Benzo(a)pyrene	(a)	4.96E+00	3.51E+01	NR	9.11E-01	4.96E+00	3.77E+01	NR	2.28E+00	4.96E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		2.96E+00	1.93E+01	2.56E+00	1.22E+00	3.89E+00	2.13E+01	3.29E+00	3.04E+00	4.43E+00	2.22E+01	3.69E+00	7.29E+00
Benzo(g,h,i)perylene		3.77E+02	1.87E+03	3.14E+02	1.54E-02	4.09E+02	1.94E+03	3.38E+02	3.85E-02	4.23E+02	1.97E+03	3.48E+02	9.23E-02
Benzo(k)fluoranthene		8.92E+01	5.41E+02	7.66E+01	6.87E-01	1.10E+02	5.76E+02	9.22E+01	1.72E+00	1.21E+02	5.91E+02	1.00E+02	4.12E+00
Chrysene		1.66E+01	1.19E+02	1.46E+01	4.40E-01	2.54E+01	1.49E+02	2.17E+01	1.10E+00	3.19E+01	1.66E+02	2.67E+01	2.64E+00
Dibenzo(a,h)anthracene		2.90E-01	1.45E+00	2.41E-01	3.93E-03	3.43E-01	1.64E+00	2.84E-01	9.82E-03	3.69E-01	1.74E+00	3.04E-01	2.36E-02
Fluoranthene		2.87E+02	3.83E+04	2.85E+02	1.89E+01	5.63E+02	8.87E+04	5.60E+02	4.73E+01	9.00E+02	1.83E+05	8.96E+02	1.13E+02
Fluorene		1.77E+02	6.20E+03	1.72E+02	3.09E+01	4.19E+02	1.53E+04	4.07E+02	7.65E+01	8.98E+02	3.62E+04	8.77E+02	1.83E+02
Hexachloroethane		2.68E-01	NR	NR	8.17E+00	6.57E-01	NR	NR	2.01E+01	1.55E+00	NR	NR	4.81E+01
Indeno(1,2,3-cd)pyrene		3.09E+01	2.12E+02	2.70E+01	6.13E-02	4.22E+01	2.38E+02	3.59E+01	1.53E-01	4.92E+01	2.50E+02	4.11E+01	3.68E-01
Naphthalene		2.78E+01	2.33E+01	1.27E+01	7.64E+01	6.66E+01	5.58E+01	3.04E+01	1.83E+02	1.53E+02	1.31E+02	7.06E+01	4.32E+02
Phenanthrene		9.85E+01	7.17E+03	9.72E+01	3.60E+01	2.24E+02	1.76E+04	2.22E+02	8.96E+01	4.48E+02	4.07E+04	4.43E+02	2.14E+02
Pyrene		6.25E+02	8.79E+04	6.20E+02	2.20E+00	1.25E+03	2.04E+05	1.24E+03	5.49E+00	2.05E+03	4.23E+05	2.04E+03	1.32E+01
Phenol		1.60E+02	4.58E+02	1.20E+02	2.42E+04	2.96E+02	6.95E+02	2.09E+02	3.81E+04	5.86E+02	1.19E+03	3.93E+02	7.03E+04

Total Petroleum Hydrocarbons

Aliphatic hydrocarbons EC ₅ -EC ₆		4.99E+03	4.24E+01	4.23E+01	3.04E+02	1.13E+04	7.79E+01	7.78E+01	5.58E+02	2.50E+04	1.61E+02	1.60E+02	1.15E+03
Aliphatic hydrocarbons >EC ₅ -EC ₆		1.49E+04	1.04E+02	1.03E+02	1.44E+02	3.43E+04	2.31E+02	2.31E+02	3.22E+02	7.11E+04	5.29E+02	5.28E+02	7.36E+02
Aliphatic hydrocarbons >EC ₆ -EC ₁₀		1.61E+03	2.68E+01	2.67E+01	7.77E+01	2.91E+03	6.55E+01	6.51E+01	1.90E+02	4.26E+03	1.56E+02	1.54E+02	4.51E+02
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂		4.57E+03	1.33E+02	1.32E+02	4.75E+01	5.51E+03	3.31E+02	3.26E+02	1.18E+02	5.98E+03	7.93E+02	7.65E+02	2.83E+02
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆		6.27E+03	1.11E+03	1.06E+03	2.37E+01	6.34E+03	2.78E+03	2.41E+03	5.91E+01	6.36E+03	6.67E+03	4.34E+03	1.42E+02
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC ₈ -EC ₁₀		5.76E+01	4.74E+01	3.45E+01	6.13E+02	1.38E+02	1.16E+02	8.38E+01	1.50E+03	3.07E+02	2.77E+02	1.94E+02	3.58E+02
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂		8.29E+01	2.58E+02	7.52E+01	3.64E+02	1.96E+02	6.39E+02	1.79E+02	8.99E+02	4.25E+02	1.52E+03	3.91E+02	2.15E+03
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆		1.47E+02	2.85E+03	1.45E+02	1.69E+02	3.36E+02	7.07E+03	3.32E+02	4.19E+02	6.81E+02	1.68E+04	6.74E+02	1.00E+03
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	(b)	2.63E+02	NR	NR	5.37E+01	5.45E+02	NR	NR	1.34E+02	9.34E+02	NR	NR	3.21E+02
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

	Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.
	Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
	Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC₁₆ should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE



Table 5
Human Health Generic Assessment Criteria for Residential with home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	37	37	37
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	300	300	300
Cadmium	22	22	22
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	2,500	2,500	2,500
Lead	200	200	200
Elemental Mercury (Hg ⁰)	0.2	0.6	1.2
Inorganic Mercury (Hg ²⁺)	39	39	39
Methyl Mercury (Hg ⁴⁺)	10	10	10
Nickel	130	130	130
Selenium	258	258	258
Vanadium	410	410	410
Zinc	3,900	3,900	3,900
Cyanide (free)	1.4	1.4	1.4
Volatile Organic Compounds			
Benzene	0.20	0.41	0.87
Toluene	130	300	680
Ethylbenzene	50	110	260
Xylene - m	59	140	327
Xylene - o	61	143	332
Xylene - p	57	133	310
Total xylene	57	133	310
Methyl tertiary-Butyl ether (MTBE)	60	110	210
1,1,1,2-Tetrachloroethane	1.20	2.78	6.46
1,1,2,2-Tetrachloroethane	1.6	3.5	7.7
1,1,1-Trichloroethane	9	18	39
1,1,2 Trichloroethane	0.8	1.6	3.5
1,1-Dichloroethene	0.32	0.57	1.16
1,2-Dichloroethane	0.007	0.011	0.019
1,2,4-Trimethylbenzene	1.8	4.3	9.7
1,3,5-Trimethylbenzene	NR	NR	NR
1,2-Dichloropropane	0.034	0.060	0.120
Carbon Tetrachloride (tetrachloromethane)	0.026	0.056	0.127
Chloroethane	11.7	15.9	25.7
Chloromethane	0.012	0.014	0.019
Cis 1,2 Dichloroethene	0.16	0.27	0.52
Dichloromethane	0.62	1.08	1.92
Tetrachloroethene (PCE)	0.31	0.70	1.60
Trans 1,2 Dichloroethene	0.28	0.50	1.02
Trichloroethene (TCE)	0.009	0.020	0.043
Vinyl Chloride (chloroethene)	0.006	0.010	0.017
Semi-Volatile Organic Compounds			
2-Chloronaphthalene	5	13	31
Acenaphthene	230	540	1,170
Acenaphthylene	180	440	970
Anthracene	2,400	5,500	10,900
Benzo(a)anthracene	7	11	13
Benzo(a)pyrene	5	5	5
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(g,h,i)perylene	310	340	350
Benzo(k)fluoranthene	77	92	100
Chrysene	15	22	27
Dibenzo(a,h)anthracene	0.24	0.28	0.30
Fluoranthene	290	560	900
Fluorene	170	410	880
Hexachloroethane	0.27	0.66	1.55
Indeno(1,2,3-cd)pyrene	13	30	71
Naphthalene	13	30	71
Phenanthrene	100	220	440
Pyrene	620	1,240	2,040
Phenol	120	210	390
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC ₅ -EC ₆	42	78	160
Aliphatic hydrocarbons >EC ₆ -EC ₈	100	230	530
Aliphatic hydrocarbons >EC ₈ -EC ₁₀	27	65	154
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂	130 (48)	330 (118)	760 (283)
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆	1,100 (24)	2,400 (59)	4,300 (142)
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	65,000 (8)	92,000 (21)	110,000
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	65,000 (8)	92,000 (21)	110,000
Aromatic hydrocarbons >EC ₈ -EC ₁₀	30	80	190
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂	80	180	390
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆	140	330	670
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	260	540	930
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	1,100	1,500	1,700
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	1,100	1,500	1,700
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC) ¹		
Notes:			
* Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.			
NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used			
EC - equivalent carbon. SAC - soil assessment criteria.			
¹ LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.			
The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.			
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.			
SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.			
(VALUE IN BRACKETS)			
RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.			