London Borough of Camden

Hampden Close, Central Somers Town

Remediation Method Statement

1922663-R02 (00)

RSK GEOSCIENCES

MAY 2023

RSK GENERAL NOTES

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Client: London Borough of Camden

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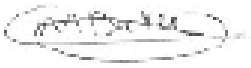
Signature		Signature	

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1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by Morgan Sindall, on behalf of the London Borough of Camden ('the client'), to provide a Remediation Method Statement (RMS) of the land at Hampden Close, Central Somers Town, London, NW1 1HW. The project was carried out to an agreed brief as set out in email correspondence (Dated 9th January 2023).

RSK's service constraints are shown in Appendix A.

The Site in question is being considered for development for residential use.

1.2 Contaminated Land Process

It is understood that the site is proposed for residential redevelopment as per the proposed development plans included in Appendix B. This report was commissioned to document the proposed redevelopment of the site and to mitigate any potential long-term environmental impacts associated with past operations or the construction phase at the site.

The assessment and development of "brownfield" sites follows a phased approach to managing the risks associated with land contamination. The following stages are defined in Land Contamination Risk Management (LCRM) (Environment Agency, 2021) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017):

Risk Assessment:

Comprises three tiers: a preliminary risk assessment (desk study and desk-based research); generic quantitative risk assessment (based on staged investigations); and detailed quantitative risk assessment. The risk assessment tiers identify potential sources of contamination, potential pathways for migration and potential receptors of concern, and then estimates or quantifies the risks associated with the identified pollutant linkages to determine if there are unacceptable risks requiring further action.

Options Appraisal:

The options appraisal also involves a staged approach, which commences with the identification of feasible remediation options for each relevant pollutant linkage. A detailed evaluation is then made of feasible remediation options to identify the most appropriate option for any particular linkage. Finally, a remediation strategy is developed that addresses all relevant pollutant linkages, where appropriate by combining and implementing remediation options into the proposed design.

Implementation of the Remediation Strategy:

There are three main stages in the implementation process: the preparation of the implementation plan; the design, implementation and verification of remediation; and (if required) long-term monitoring and maintenance.

This Remediation Method Statement combines the latter two phases, including a summary of the finding of the risk assessment. The remediation strategy defines the remedial measures required to break the pollutant linkages identified by the risk assessment process and conceptual model for the site, and the procedures to be adopted to enable verification of the correct implementation of those remedial measures.

1.3 Objectives

The objective of this report is to summarise the geo-environmental issues identified in preceding investigation reports and detail the proposed remedial works to be undertaken to address residual potential contaminant linkages.

1.4 Project background

Pell Frishmann undertook a Phase 1 geo-environmental desk study in May 2012 (ref. R12794/G001A).

ESG undertook a Phase 2 geo-environmental site investigation between November 2015 and January 2016 and produced a factual and an interpretive report (ref. D5061-15/1, D5061-15/2).

RSK undertook a Phase 2 geo-environmental site investigation in December 2022 and produced a Phase 2 geo-environmental and geotechnical site investigation in January 2023 (ref: 28802 R01 (00)).

All of the above reports should be referred to for further details, **Section 2** of this report summarises the relevant information extracted from the above reports.

As this RMS is based on previous reports carried out by others, we have assumed that the client has reliance upon the data presented within those reports.

1.5 Proposed development

The proposed layout of the site, at the time of preparing this report, is shown in Appendix B.

It is understood that the existing community building has been demolished and residential apartments will be constructed.

The site has been granted full planning permission under the application number 2015/2704/P. This is subject to a number of conditions of which this report is designed to satisfy Condition 60 (Part B), which states:

Site investigation and submission of a remediation scheme for land contamination - Plots 5 & 6

Before the development of Plots 5 & 6 commences, a site investigation shall be undertaken in accordance with the approved scheme of assessment and the written results provided to the planning authority for their approval. Laboratory results must be provided as numeric values in a formatted electronic spread sheet. Before development of these plots commences a remediation scheme shall be agreed in writing with the

planning authority and the scheme as approved shall be implemented before any part of the development hereby permitted is occupied.

Reason: To protect future occupiers of the development from the possible presence of ground contamination arising in connection with the previous industrial/storage use of the site in accordance with policy CS5 of the London Borough of Camden Local Development Framework Core Strategy and policy DP26 of the London Borough of Camden Local Development Framework Development Policies.

1.6 Scope

This report has been designed with consideration of CLR11 (Environment Agency, 2004a), BS 10175: 2011 (BSI, 2011+A2 2017), National Panning Policy Framework and guidance on land contamination reports issued by the Environment Agency (EA) (2010).

The scope of this report includes:

- A summary of the existing reports pertaining to the site;
- Identification of the complete pollutant linkages to be addressed by the remedial works;
- A summary of the remedial technique(s) to be implemented; and
- Details of the validation and verification works including reporting.

1.7 Definitions – Key Parties and responsibilities

The following parties have direct interest or involvement in the works described herein.

Landowner	London Borough of Camden
Groundworks Contractor	TBC
Local Authority	London Borough of Camden
Pollution Control and Waste Regulatory Authority	Environment Agency
Environmental Consultant	RSK Environment Ltd

1.8 Limitations

The Remediation Method Statement is based upon the previous investigation designed generally to meet the objectives of a main investigation, as defined by BS 10175:2011 +A2 2017 “Code of Practice for the Investigation of Potentially Contaminated Sites”. The remediation strategy is therefore based on the ground conditions encountered during these investigations, the results of field and laboratory testing and interpretation between exploratory holes. The material encountered and samples obtained represent a proportion of the materials present on-site, and therefore other conditions may be encountered during the remediation and ground works, which have not been revealed by these investigations.

The Remediation Method Statement 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 Principal 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 verification of the works by a representative from RSK, or if suspect materials are not notified to RSK.

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

2 SITE DETAILS

2.1 Site location and description

Site location details are presented in **Table 1** and a site location plan is provided on Figure 1. The Site boundary and current site layout are shown on Figure 2.

The site is roughly rectangular in shape with uneven topography and is navigated via footpaths. There is a play park located centrally and there are a substantial number of trees around the site. The site in enclosed by a metal fence, with access being gained via Purchase Street to the west or Brill Place to the south.

Table 1 Site location details

Site name	Hampden Close, Central Somers Town
Full site address	Hampden Close, London, NW1 1HW
National Grid reference (centre of site)	529818, 183234

The overall site, for which planning permission was granted under application number 2015/2704/P, includes a further area to the northwest. The site investigation undertaken by ESG between November 2015 and January 2016 included this northwestern area, however this area was not investigated by RSK. For the purposes of this remediation method statement only the results pertaining to the site area referred to as “Brill Place/eastern parcel of land” in the ESG report are relevant to this RMS. The RSK site investigation and this remediation method statement pertains only to the area shown in Figure 2, where plots 5 and 6 are to be constructed.

This RMS pulls together information from a desk study undertaken by Pell Frishmann in 2013, the aforementioned site investigation undertaken by ESG in 2016, and the site investigation undertaken by RSK undertaken in 2022.

2.2 Geology

2.2.1 Pell Frischmann desk study

Geological maps of the site indicate that the site is directly underlain by the London Clay Formation.

2.2.2 ESG site investigation

Made Ground was encountered at all locations and proven to a maximum thickness of 2.80m. The Made Ground was predominantly surfaced with topsoil or macadam and comprised a range of both fine and coarse grained materials including sandy gravelly clay, sandy silt, gravelly silty sand and sandy clayey gravel. The Made Ground included anthropogenic materials such as ceramic, brick, black ash, shell, concrete, wood, metal, glass, asbestos and macadam.

London Clay was encountered beneath the Made Ground between 0.85m and 2.70m below ground level, and generally comprised firm to stiff grey and brown mottled silty clay,

becoming stiff to very stiff with depth. Selenite/gypsum crystals were noted as well as black organic fragments, pyrite nodules and claystone.

The Lambeth Group was encountered underlying the London Clay Formation between 19.00m and 19.80m. The Lambeth soils encountered beneath the site (plots 5 and 6) primarily comprised fine grained material of very stiff, fissured mottled silty clays, occasionally gravelly with some lenses of silt.

2.2.3 RSK site investigation

Made Ground was encountered at all locations, proven to a thickness of at least 2.10m, although the base of the Made Ground was not encountered at one location, and it may therefore extend to further depth. The Made Ground generally comprised either a brown gravelly sand or a gravelly slightly sandy clay with a significant proportion of anthropogenic material, primarily fragments and cobbles of red brick, also with frequent concrete and occasional ceramic and asphalt.

The London Clay was encountered beneath the Made Ground from between 0.6m and in excess of 2.10m and comprised stiff to very stiff brownish grey and light grey mottled clay.

2.3 Hydrogeology

2.3.1 Pell Frischmann desk study

The aquifer designations based on the Environment Agency interactive aquifer designation map shows that the underlying London Clay is classified as unproductive strata.

2.3.2 ESG site investigation

ESG progressed cable percussive boreholes into the Lambeth Group, where groundwater was struck in BH7 at 22.75m and 25.30m in a layer of sand. Water was also struck in BH9 at 2.10m within Made Ground and at 7.10m within the London Clay.

2.3.3 RSK Site Investigation

Water was encountered in a single exploratory location during the site investigation undertaken by RSK, but due to the unproductive nature of the underlying bedrock and the absence of any superficial deposits on the site, this is considered to be perched water.

2.4 Hydrology

2.4.1 Pell Frischmann desk study

Regents Canal is present within a culvert beneath the northern parcel of land which does not constitute part of this RMS and therefore will not be mentioned further.

The desk-study states that the consideration of watercourses for drainage purposes was beyond the scope of the report, and therefore they will not be discussed further as a potential receptor.

There are three licensed surface water abstractions located within 1000m of the site, the nearest two of which relate to the abstraction of water from 'Thames surface water – non tidal' for make-up and top-up purposes at Camley Street Nature Park. The remaining license relates to abstraction of water from Regents Canal for 'non-evaporative cooling' purposes.

2.5 Conceptual site model

2.5.1 Pell Frischmann

The desk-study concluded that the following contamination risks have been identified as moderate to high, and therefore require further investigation:

- Moderate risk of inorganic contaminants being present across the site associated with any uncontrolled Made Ground associated with the previous development of the site;
- High risk of organic contaminants being present in the eastern part of the site associated with the historic use as a coal depot;
- High risk of asbestos associated with any uncontrolled Made Ground or possibility of use within the building fabric of the existing buildings on site.

The overall risk from land contamination at the site is considered to be **moderate** for the current development and **low to moderate** for a redeveloped site, although this would need to be confirmed by an intrusive investigation, testing and assessment of results.

2.5.2 ESG Investigation

The results of the intrusive site investigation were used to refine the initial conceptual site model from the Pell Frischmann desk-study report, and the following complete linkages have been specified:

- Current and future site users/workers – Direct contact (ingestion and dust/fibre inhalation) with lead, TPH, PAH and asbestos impacted soil.
- Surface waters – Leaching, surface run-off and base-flow from contaminated groundwater.

The ESG report identifies surface waters as a receptor due to the presence of the Regents Canal which is culverted beneath the northern parcel of land. As discussed in **Section 2.1**, this RMS is only applicable to the eastern parcel of land, which the canal does not pass through. Due to the absence of Regents Canal beneath the site, it is not considered that there is a complete contaminant linkage associated with surface waters on this site.

2.6 Contamination Status

2.6.1 Human health

2.6.1.1 ESG Site Investigation

A human health GQRA assessment of the results obtained from the ESG site investigation undertaken in November 2015 confirmed exceedances of the adopted Generic

Assessment Criteria (GAC) for lead (BH6), benzo(a)anthracene (WS28), benzo(a)pyrene (WS28, HP5), dibenzo(ah)anthracene (WS28) and asbestos (WS29, HP5).

2.6.1.2 RSK Site Investigation

A human health GQRA assessment of the results obtained from the RSK site investigation undertaken in December 2022 confirmed exceedances of the adopted Generic Assessment Criteria (GAC) for lead (HP2 & HP4), benzo(b)fluoranthene (HP1) and dibenzo(ah)anthracene (HP1).

The exceedances of the GAC in various locations around the site means that the existing Made Ground would not be suitable for retention in areas of communal soft landscaping and remedial measures are necessary to mitigate the risk to the future site users.

3 REMEDIATION STRATEGY

3.1 Introduction

This Remediation Method Statement has been designed to break or remove potentially complete pollutant linkages identified on site from preceding investigation works. Essentially these comprise:

- Current and future site users – Direct contact (dermal contact, ingestion and inhalation) with lead, asbestos, TPH and PAH within shallow made ground in proposed soft landscaping.
- Direct contact and permeation of plastic potable water supply pipes by organic contamination within shallow made ground.

3.2 Remedial objectives

The objectives of the remediation are to produce a site that is suitable for its intended end use whilst providing a safe working environment with respect to site workers and adjacent users. This will involve the following measures:

- The placement of a 600 mm clean cover layer in private gardens (reducing to 450 mm thickness for communal soft landscaping).
- Installation of a geo-membrane visual marker layer at the base of the required clean capping.
- Placement of contaminant resistant potable water supply pipes, should they lie within shallow made ground.

3.3 Construction phase

The principal objectives of the remedial strategy for the Construction phase are to break pathways via which end users of the site may be exposed to contaminants within the shallow made ground deposits identified on site. Essentially this will relate to the encapsulation of any residual contamination beneath the proposed structures, roads or clean cover soils plus provide a suitable growing medium in all areas of proposed gardens and soft landscaping.

3.3.1 Placement of clean cover soils

Given the identified presence of soil-bound contamination, it will be necessary to place a clean cover soil layer through areas of proposed soft landscaping to break the identified pollutant linkages relating to end users of the site.

In such areas the clean cover system should comprise a 600 mm thickness of verified soils in private gardens (reducing to 450 mm thick for communal soft landscaping), which should consist of:

- Minimum 150 mm imported topsoil; and
- remainder clean imported (or site-derived subsoil).

The clean cover layer should include a minimum of 150 mm of certified clean topsoil, which may be required to extend to a greater depth (at the discretion of the landscape architect) where planting beds or shrubs / tree pits are to be included. In all areas of soft landscaping, a geo-membrane visual marker layer will need to be placed at the base of the cover layer to mark the presence of potentially contaminated soils.

Made Ground excavated during the construction of the clean cover horizon should be removed off-site to a suitably licensed or exempt facility, as per the waste recommendations made in **Section 4.4**.

All imported material should be from a known source, preferably 'Greenfield' or from a reputable source with haulage certification provided to confirm collection and delivery addresses. Before importing to site, the materials should be provided with a current certificate of analysis which meets the validation assessment criteria set out in **Section 5.1.3.**

BS8601:2013 and BS3882:2015 detail the specifications of subsoil and topsoil, respectively, and these should be referred to when determining the suitability of material for use as a subsoil or topsoil growing medium.

Site derived natural soils are likely to be suitable for use as subsoil within the clean cover layer, subject to confirmatory testing.

Where existing trees are to be retained, consideration will need to be taken of any cover layer beneath the canopy so as not to affect the roots. It is not proposed to include a cover layer beneath the canopy.

Any re-used site-won soils (not clean and natural) and soils that are not purchased and imported from other sites (clean and natural) will need to be approved, tracked, validated and managed under the Contaminated Land: Applications in the Real Environment (CL:AiRE) Definition of Waste (DoW) Code of Practice (CoP) Materials Management Plan (MMP) which should incorporate and align with the relevant aspects of this remediation method statement.

Details of all approvals associated with the imported material, the results of *in-situ* verification testing and subsequent assessments will be compiled into the Final Validation Report. Copies of consignment notes confirming the provenance of each load of imported material shall also be included in the final Validation Report.

3.3.2 Contamination resistant pipes

Elevated concentrations of organic contaminants with respect to water supply pipes were encountered onsite. As a result, it is considered that polyvinyl chloride pipes, or other contaminant resistant pipes such as ductile iron, will be required for the proposed development, should new pipes be laid within the made ground.

Underground water supply pipes placed on the site will be laid within trenches. Clean granular fill shall be used as a bedding material for all services and as backfill material for service trenches. The specification of upgraded materials or multi-layer barrier pipes for potable water supply on site will be subject to confirmation by the water supply provider.

3.4 Discovery strategy

Whilst the investigations undertaken to date have been thorough, it remains possible that previously unexpected soil conditions may be encountered during the enabling and construction process (e.g. the presence of discrete/visually identifiable asbestos, soils exhibiting strong odours, black ash silty deposits, former structures of brickwork).

Where unexpected ground conditions or potentially suspect materials are encountered, the following course of action should be adhered to:

- Works within the affected area should cease until assessed by the environmental consultant;
- At the earliest opportunity the Environment Agency and/or local authority should be notified of the presence of previously unidentified contamination;
- Soil samples should be collected from the affected area and verified against the criteria included in **Table 2** (see **Section 5.1.3**);
- Any excavated potentially contaminated material will be placed on impermeable membranes to ensure that there is no run-off. The excavated material should be covered to minimise infiltration of rainwater and the production of leachates;
- Upon completion of the remedial works the excavation will be verified with 1 sample collected from the base and sides of the excavation with at a minimum frequency of 1 sample per 10 m^2;
- Details should be kept of the extent of works that has been carried out;
- The results of all monitoring works and validation testing carried out during the works;
- Approvals, if appropriate, for imported materials, including test results and thickness of the clean topsoil cover; and
- Collation of all other relevant documents, including records of on-site soil movements and off-site waste movements; and a photographic record of the works.

Should disturbance of the Made Ground result in the identification of suspected asbestos-containing materials, any exposed materials/soils should be damped down and covered over with plastic sheeting and advice be sought from a suitably accredited asbestos surveyor or similar.

4 WORKING PRACTICE AND WASTE DISPOSAL

4.1 Securing the site against unauthorised access

Suitable fencing shall be erected around the site and shall be maintained to prevent members of the public and any other unauthorised personnel from entering the site. On the site, individual remedial excavations shall also be fenced off when being left unattended.

4.2 Health and safety of site personnel

It is the responsibility of the Principal Contractor and any appointed sub-contractors to enforce an appropriate health and safety regime for all site personnel. Full details regarding the proposed working practices in connection with the remediation works shall be agreed in advance of the commencement of the works with the Planning Supervisor and, if appropriate, with the Environmental Health Officer.

Measures will be necessary to protect the health and safety of site workers during the site works. The following measures are suggested to provide a minimum level of protection. All ground workers on-site should be issued with protective clothing, dust masks, footwear and gloves. These should not be removed from site, and advice should be given on when and how they are to be used.

Care should be taken to minimise the amount of dust and mud generated on-site, especially given the requirement to excavate and remove asbestos impacted soils.

Reference should also be made to CIRIA C733: Asbestos in soil and made ground: a guide to understanding and managing risks and the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Development of Contaminated Land”.

Where additional measures are required with respect to the presence of asbestos containing materials, these should be documented within the contractors working method statements and approved prior to the works being undertaken.

Good practices relating to personal hygiene should be adhered to on-site, i.e. food and drink should only be consumed within designated areas on the site and smoking should be prohibited in all working areas.

4.3 Prevention of pollution

4.3.1 General

The targets perceived to be potentially most at risk from pollution during the remediation of the site are the workers on-site together with nearby residents.

All contractors on-site shall adhere to environmental good practice as set out in CIRIA publication C650 (2005) and in particular those issues identified below.

4.3.2 Airborne pollution (dust and asbestos)

Care shall be taken by the contractor to minimise the amount of dust generated on-site during excavation, backfilling and trafficking. In the event that dry weather leads to excessive dust generation, exposed soils shall be damped down, but not flooded, with clean water.

The Contractor's method statement shall include a detailed dust control plan together with air monitoring procedures to be implemented during the removal of soils identified to contain asbestos fibres.

4.3.3 Surface runoff

The PC shall implement appropriate procedures to prevent surface run-off, including forming bunds around any temporary stockpiles of contaminated soils.

4.3.4 Vehicles

Wheel cleaning/washing facilities shall be provided on-site if operations are likely to result in vehicles leaving site with potentially contaminated soil/mud clinging to them. Contaminated water on-site, including water and other liquid collected from vehicle washing facilities, shall be disposed of off-site in an approved manner with full regard to current legislation and good practice.

All vehicles leaving the site shall be clear of contaminated materials other than that contained within the load container, which shall be sheeted to prevent the loss of dust and other materials.

4.3.5 Re-contamination

The programme of works and any subsequent modifications shall be designed to avoid the potential re-contamination of areas already worked, e.g. site traffic shall be routed to avoid passing from contaminated to clean areas and contaminated soils shall not be stockpiled on clean areas.

4.3.6 Discharge of pumped water

Any potentially contaminated perched groundwater, groundwater or surface water runoff encountered on site shall be contained or either treated onsite to permit disposal to the public sewer, subject to the approval of the sewerage authority, or tinkered offsite for appropriate disposal as dictated by the results of the chemical testing.

4.3.7 Migration pathways

During construction of the site, redundant services may be exposed. To prevent these acting as conduits for the movement of contamination, where encountered, these features should be sealed.

4.4 Waste disposal

All contaminated materials removed off-site shall:

- Be transported to an approved licensed waste management facility for treatment or final disposal; or
- Be disposed of to the foul sewers under an appropriate discharge consent.

The contractor shall provide a full documentary record of this operation in accordance with the Duty of Care. This should, where appropriate, include waste transfer notes, discharge consents, laboratory results and details of the receiving site. Copies of the relevant documents shall be provided to the Environmental Consultant for inclusion in the verification report.

4.5 Documentation

All contaminated materials removed off-site shall be transported to an approved licensed landfill for final disposal. The Principal Contractor shall provide a full documentary record of this operation in accordance with the Duty of Care. Copies of the landfill documents shall be provided to the Environmental Consultant for inclusion in the verification report.

5 VERIFICATION OF REMEDIATION

Verification of the remedial works will be provided by post remediation validation as outlined below:

5.1.1 Verification and chemical analyses

The installation of the cover system should be independently verified.

Imported soils should be tested for a standard suite of chemical determinants at a **ratio of one test per 250 m^3** (three tests minimum per material type).

The analytical suite for samples of soil (imported subsoil/topsoil) will include metals, PAH, TPH, BTEX and asbestos. The results of the analysis should meet the Validation Assessment Criteria (VAC) discussed in **Section 5.1.3**.

5.1.2 Validation of clean cover soils

The requirements for the validation of cover systems are outlined in NHBC Standards Chapter 4.1 'Land Quality – Managing Ground Conditions'. The two main aspects to consider when validating cover systems are:

a) Confirmation that the designed thickness of the material has been placed; and

b) Confirmation that the materials comprising the cover system are themselves not contaminated, i.e. suitable for residential use.

To assess the thickness of the cover layer, it will be necessary to dig through the cover layer at selected locations to verify the required thickness of topsoil and subsoil.

In addition, the topsoil and subsoil will be chemically validated by the collection and analysis of representative soil samples. The frequency of testing for any site-derived or imported materials stockpiled for re-use should be a minimum of one sample for every 250 m^3 (minimum three samples) for the following parameters:

- Metals: arsenic, cadmium, chromium, copper, nickel, lead, mercury, selenium and zinc and pH;
- Speciated TPH CWG (split into aliphatic and aromatic carbon bands) with BTEX compounds;
- Speciated 16 No. PAH; and
- Asbestos in soil (with ID where applicable).

It is acceptable to test stockpiled topsoil/subsoil intended for use in gardens and soft landscaped areas before placement, however the cover layer thickness will still require validation later.

The groundworks contractor shall provide details of the provenance of any imported soil and evidence of compliance (i.e. chemical testing certificates representative of the type and volume of material) to the Environmental Consultant whose written approval will be required **before** importation and use of the material.

5.1.3 Validation assessment criteria (VAC)

To assess human health risks via the soil ingestion, dermal contact and inhalation, results of validation sampling will be compared directly with the validation criteria detailed in **Table 2** and **Table 3** below. The validation criteria are a combination of RSK derived GAC's suitable for a residential with home-grown produce end land use, and recently published DEFRA C4SL. Assessment criteria suitable for 6% soil organic matter (SOM) have been selected since topsoil and subsoil are likely to be high in organic content. Should lower SOM be present, the RSK GAC appendix within Appendix D provides alternative criteria for 1% and 2% SOM.

The Category 4 Screening Levels (C4SLs) have recently been issued by DEFRA in March 2014 and are intended for use as a technical tool for defining which land is suitable for use and is definitely not contaminated land and therefore requires no further assessment with respect to Part 2a. C4SLs provide a more pragmatic approach than SGVs/GACs, yet are still strongly precautionary, and have been developed using the CLEA model, which is the same framework used for the development of the SGVs/GACs.

C4SL's have been derived using a newly termed 'Low Level of Toxicological Concern (LLTC)' which represents an intake of low concern that remains suitably protective of health, instead of the minimal risk Health Criteria Values (HCV) which have been used in the development of the SGV/GACs.

There is some debate within industry as to the applicability of C4SL's within the planning scenario, however RSK is of the opinion that they provide very pragmatic yet still strongly precautionary targets which demonstrate the site is suitable for use, therefore it is considered appropriate to use them, where available, as validation criteria.

The RSK GAC appendix which details the generation of the GAC's is presented as Appendix D. The proposed screening criteria for the site are shown in the following table.

Table 2 : Validation Assessment Criteria

Compound	Validation Assessment Criteria (VAC) 6% SOM (mg/kg)	Justification
Metals		
Arsenic	**37**	C4SL
Cadmium	**22**	C4SL
Chromium (III) - oxide	910	RSK GAC
Chromium (VI)	**21**	C4SL
Copper	2,500	RSK GAC
Lead	**200**	C4SL
Elemental Mercury (Hg0)	1.2	RSK GAC
Inorganic Mercury (Hg2+)	39	RSK GAC
Methyl Mercury (Hg4+)	10	RSK GAC
Nickel	130	RSK GAC
Selenium	258	RSK GAC
Zinc	3,900	RSK GAC
BTEX Compounds		

Compound	Validation Assessment Criteria (VAC) 6% SOM (mg/kg)	Justification
Benzene	**0.87**	C4SL
Toluene	680	RSK GAC
Ethylbenzene	260	RSK GAC
Xylene – m	327	RSK GAC
Xylene – o	332	RSK GAC
Xylene – p	310	RSK GAC
Total xylene	310	RSK GAC
Semi-volatile organic compounds (Polycyclic Aromatic Hydrocarbons)		
Acenaphthene	1,170	RSK GAC
Acenaphthylene	970	RSK GAC
Anthracene	10,900	RSK GAC
Benzo(a)anthracene	13	RSK GAC
Benzo(b)fluoranthene	3.7	RSK GAC
Benzo(g,h,i)perylene	350	RSK GAC
Benzo(k)fluoranthene	100	RSK GAC
Chrysene	27	RSK GAC
Dibenzo(a,h)anthracene	0.30	RSK GAC
Fluoranthene	900	RSK GAC
Fluorene	880	RSK GAC
Indeno(1,2,3-cd)pyrene	4.2	RSK GAC
Phenanthrene	440	RSK GAC
Pyrene	2,040	RSK GAC
Benzo(a)pyrene	**5.0**	C4SL
Naphthalene	71	RSK GAC
Total Petroleum Hydrocarbons		
Aliphatic hydrocarbons EC_5–EC_6	160	RSK GAC
Aliphatic hydrocarbons >EC_6–EC_8	530	RSK GAC
Aliphatic hydrocarbons >EC_8–EC_{10}	154	RSK GAC
Aliphatic hydrocarbons >EC_{10}–EC_{12}	760	RSK GAC
Aliphatic hydrocarbons >EC_{12}–EC_{16}	4,300	RSK GAC
Aliphatic hydrocarbons >EC_{16}–EC_{35}	110,000	RSK GAC
Aromatic hydrocarbons >EC_8–EC_9	190	RSK GAC
Aromatic hydrocarbons >EC_9–EC_{10}	190	RSK GAC
Aromatic hydrocarbons >EC_{10}–EC_{12}	390	RSK GAC
Aromatic hydrocarbons >EC_{12}–EC_{16}	670	RSK GAC
Aromatic hydrocarbons >EC_{16}–EC_{21}	930	RSK GAC
Aromatic hydrocarbons >EC_{21}–EC_{35}	1,700	RSK GAC
Other		

Compound	Validation Assessment Criteria (VAC) 6% SOM (mg/kg)	Justification
Asbestos	Not observed in asbestos in soil with ID analysis	Laboratory analysis LOD
Highlighted cells indicate where C4SL values are being used for validation.		

In addition, where deeper tree/shrub pits are dug, the following validation criteria protective of phytotoxic risks presented within **Table 3** should be used as a supplement to the VAC's outlined above.

Table 3: Phytotoxic Validation Assessment Criteria

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110
Note: Only compounds within BS3882:2015 and BS8601:2013 for topsoil and subsoil specification have been included. There are additional criteria regarding the suitability of a subsoil and topsoil which should be referred to in these documents.				

5.1.4 Utilities

New utilities will generally be placed at shallow depths in the final development and it is recommended that all utilities are placed in trenches with 'clean' arisings, such as pea shingle or sand to protect future site workers from potential contaminants during maintenance.

It is recommended that PVC pipe is used for potable water supply pipes. These recommendations should be confirmed with the necessary utility provider, i.e. Thames Water.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) is known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

5.1.5 Inspection and testing

Responsibility for the correct implementation of the remediation strategy lies with the Principal Contractor (PC). However, the remedial works shall be monitored, inspected and validated by the Environmental Consultant's experienced Geo-environmental Engineers with attendance on-site dependent on the operations being undertaken.

During periods of part time supervision, it will be the PC's responsibility to provide adequate notice (at least three days) of any key activities that will require the attendance of the Environmental Consultant.

Validation testing shall be conducted as specified in the relevant sections. Laboratory analysis shall be carried out at an MCERTS and UKAS-accredited laboratory.

5.1.6 Any unexpected areas of contamination

Chemical testing of samples for validation purposes, e.g. where unexpected contamination is discovered, shall be at the discretion of the Environmental Consultant. However, as a general guideline, soil samples will be obtained from the sides and base of any excavated hotspot at appropriate intervals, dependent on the results of visual inspection of the work on-site and tested in the laboratory. Should the test results on these samples not comply with the soil contamination objectives set for residential end use given in Appendix D, the excavation will be extended, and further soil samples obtained for verification, until the contaminated area has been completely removed.

5.2 Validation statement/ report

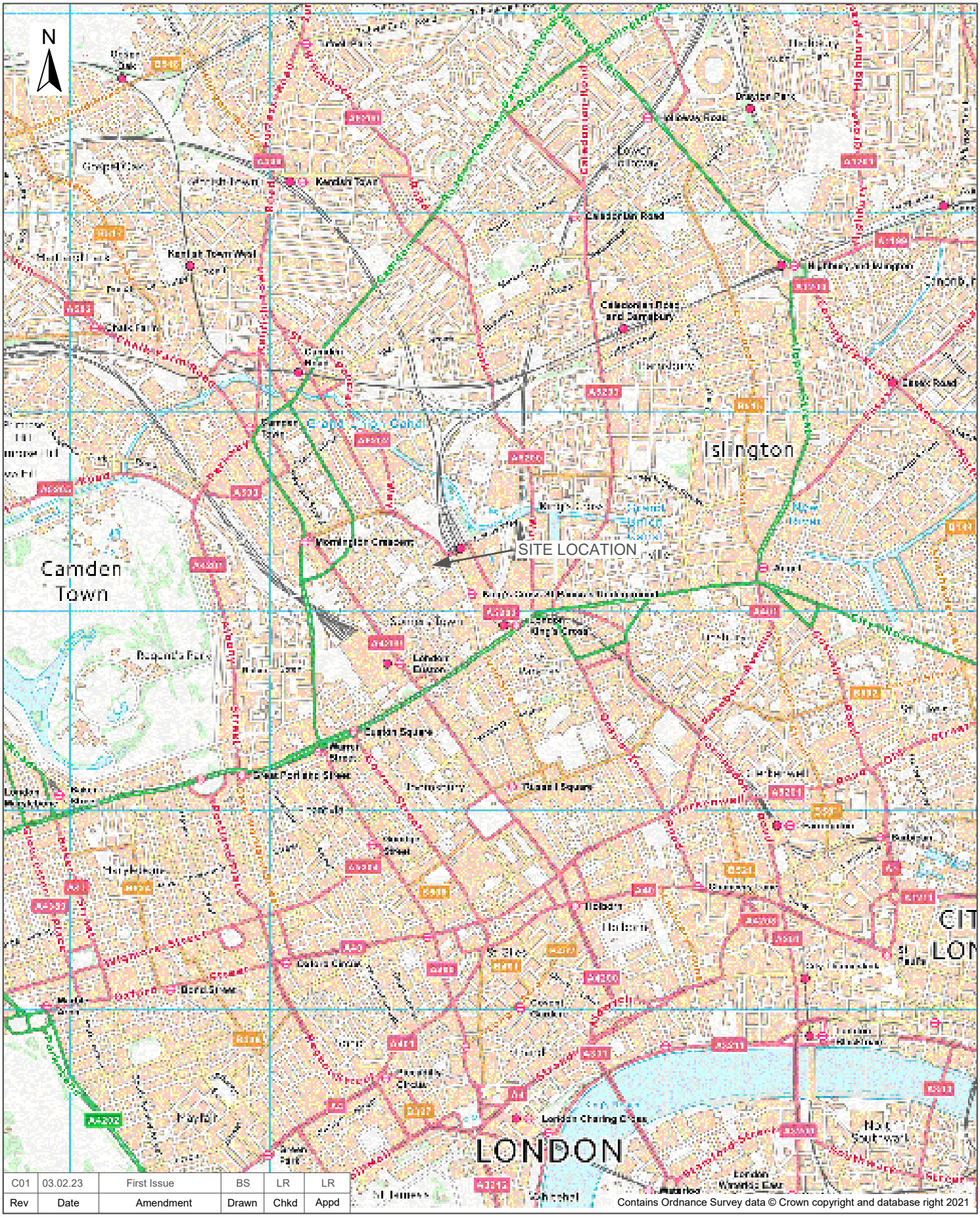
A verification report shall be produced by the Environmental Consultant following the completion of the remediation works. This will include the following elements:

- Detailed timeline and descriptions of the works carried out on site;
- Confirmation of the imported soil capping layer thickness. The thickness shall be validated by excavating a trial hole in treated areas once the cover system has been installed;
- Soil sampling and subsequent chemical analysis of all imported soils (stockpiles/capping). The results shall be assessed against the criteria set out in Appendix D;
- Testing of the cover shall be conducted at a sufficient rate to provide an adequate confidence regarding the depth and quality of the material used;
- Provision of verification report detailing the following:
    - The source and volume of material imported, including test certificates provided by the supplier;
    - The results of laboratory testing carried out during the remedial works (stockpiled/in-situ/excavations);
    - A photographic record of the excavated areas and subsequent trial hole validation of cover soil application with measurement of trial holes with a tape/staff clearly displaying hole depth included placement of geo-marker layer;
    - Locations and number of trial holes; and
    - Collation of all other relevant documents, including consignment notes/waste movements from the licensed waste carrier.

A copy of the report shall be forwarded to London Borough of Camden for approval of the remediation works.

FIGURES

FIGURE 1 SITE LOCATION PLAN



Rev	Date	Amendment	Drawn	Chkd	Appd
C01	03.02.23	First Issue	BS	LR	LR

RSK GEOSCIENCES
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
Tel: +44(0)1442 437500
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client: Camden London Borough Council

Project Name: Central Somers Town

Description: Site Location Plan

Dimension	Size	Scale	Geolocation	Project ID	Drawing no.	Rev	File name
m	A4	1:25,000	529818,183234	1922663	11101	C01	1922663-HH-111-SS-D-C-11101-C01

FIGURE 2 SITE LAYOUT PLAN

LEGEND

Site boundary

Rev	Date	Amendment	Drawn	Chkd	Appd
C01	03.02.23	First Issue	BS	LR	LR

RSK GEOSCIENCES
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
Tel: +44(0)1442 437500
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
Camden London Borough Council

Project Name
Central Somers Town

Description
Site Layout Plan

Project ID	Drawing no.	Revision
1922663	11201	C01

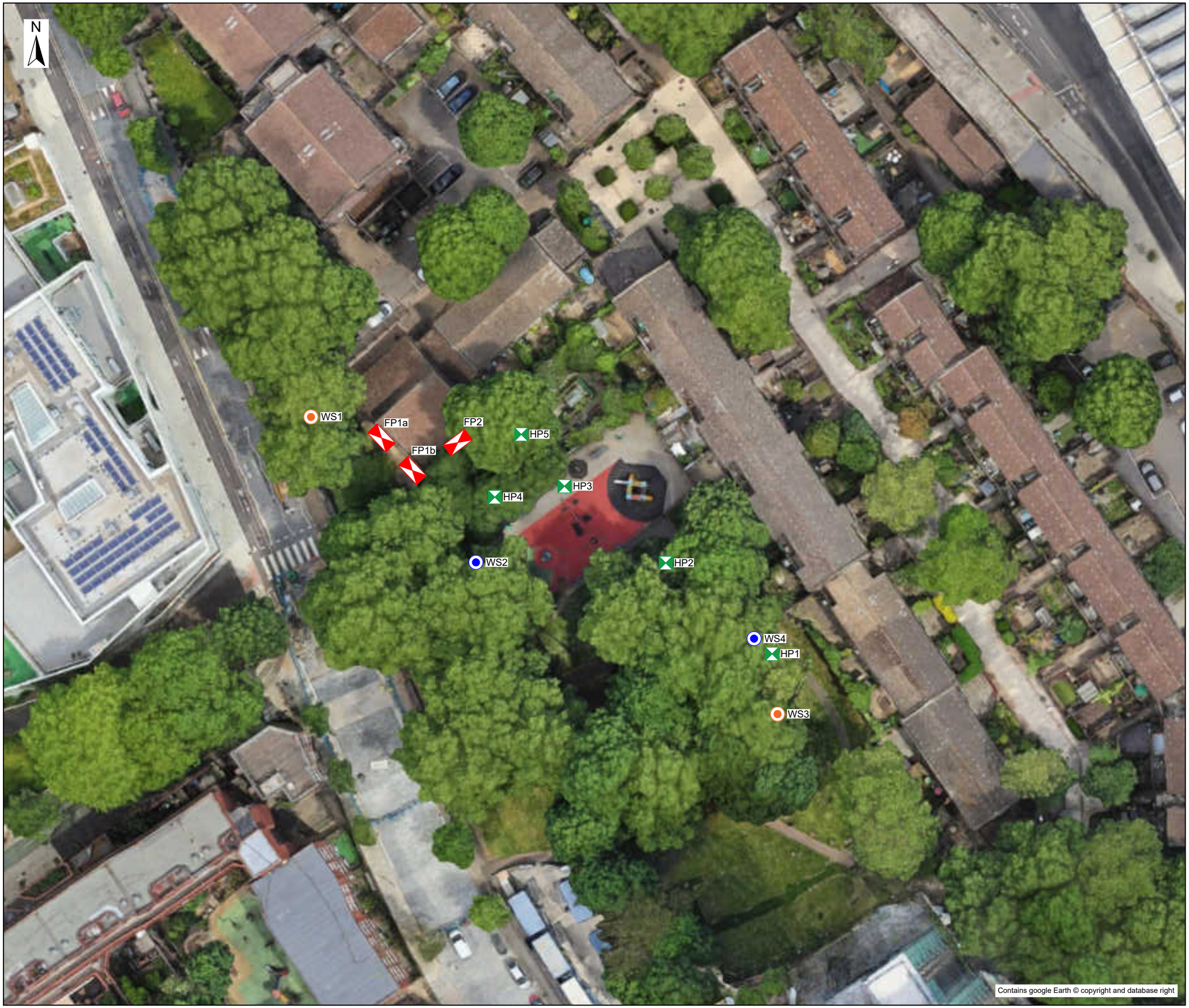
File name
1922663-HH-112-SS-D-C-11201-C01

Dimensions	Scale	Size
m	1:500	A3

0 5 10 15 20 25m

FIGURE 3 REMEDIATION PLAN

APPENDICES



LEGEND

- Hand Pit Location
- Foundation Inspection Pit Location
- Unfeasible Window Sample Location
- Window Sample Location

Rev	Date	Amendment	Drawn	Chkd	Appd
C01	03.02.23	First Issue	AE	LR	LR

RSK GEOSCIENCES
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
Tel: +44(0)1442 437500
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
Camden London Borough Council

Project Name
Central Somers Town

Description
Exploratory Hole Location Plan

Project ID	Drawing no.	Revision
1922663	22201	C01

File name
1922663-HH-222-SS-D-C-22201-C01

Dimensions	Scale	Size
m	1:500	A3

0 5 10 15 20 25m

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for London Borough of Camden (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client, dated 12th December 2022. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. 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.
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.
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 otherwise 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 environmental consultant and/or lawyer.**
4. It is RSK's understanding 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 RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. 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. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. 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 contract 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, persistent, bioaccumulative or toxic chemicals (including PFAS compounds) or other radioactive or hazardous materials, unless specifically identified in the Services.
7. 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 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 or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

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.

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 contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of 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 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 are not present.

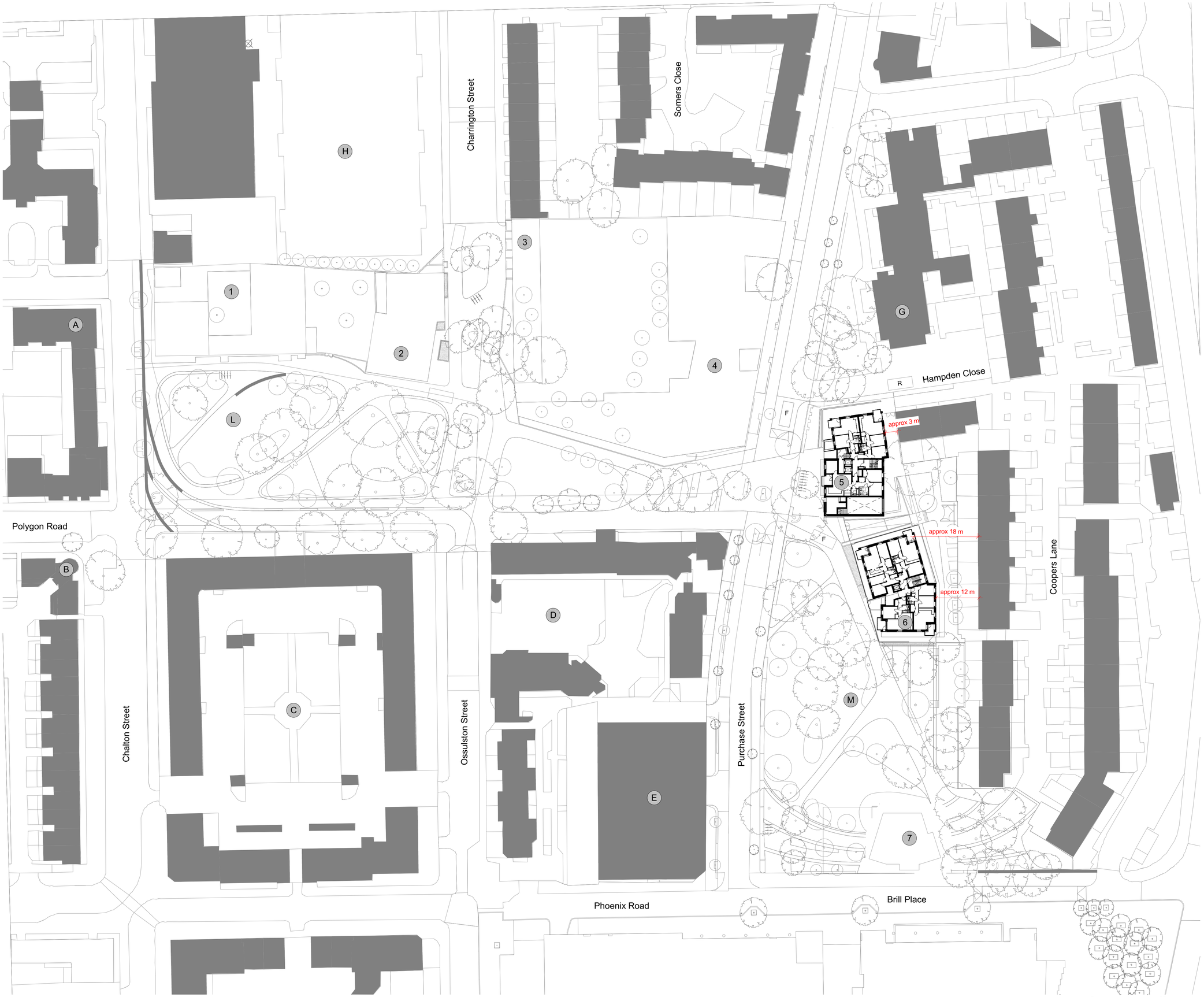
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred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

10. 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. However, 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.

11. 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.

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.

APPENDIX B
DEVELOPMENT DRAWINGS



Notes

1. Do not scale this drawing.
2. All dimensions must be checked on site and any discrepancies verified with the architect.
3. Unless shown otherwise, all dimensions are to structural surfaces.
4. Drawing to be read with all other issued information. Any discrepancies to be brought to the attention of the architect.
5. This drawing is the copyright of Levitt Bernstein and may not be copied, altered or reproduced in any form, or passed to a third party without license or written consent.
6. This document is prepared for the sole use of London Borough of Camden and no liability to any other persons is accepted by Levitt Bernstein. Levitt Bernstein accepts no liability for use of this drawing by parties other than the party for whom it was prepared or for purposes other than those for which it was prepared.

This is not a construction drawing, it is unsuitable for the purpose of construction and must on no account be used as such.

- 1 Community facilities by Adam Kahn Architects
- 2 Plot 2 Housing
- 3 Housing by Hayhurst & Co
- 4 Edith Neville Primary School by Hayhurst & Co
- 5 Plot 5 Housing by LBA
- 6 Plot 6 Housing by LBA
- 7 Housing by dRMM

- A Phyllis Hodges House
- B Oakshott Court
- C Walker House
- D Monica Shaw Court
- E Phoenix Court
- G Clyde Court
- H Regent High School
- L Polygon Road Open Space
- M Purchase Street Open Space

- F Fire Vehicle
- R Refuse Vehicle

Rev	Date	Description	Drawn / Checked
P01	2022/05/20	Stage 2 Issue	SH|RP

Project name

Central Somers Town, plot 5&6
Camden Residential Development

Drawing number — Rev

3873 - LBA - ZZ - ZZ - DR - A - 110500 **P01**

Drawing

Proposed Site Plan

Purpose of issue
Information

Scale — First issue date

1 : 500 @ A1 — xx/xx/xxxx

Client
London Borough of Camden

London
Thane Studios
2-4 Thane Villas
London N7 7PA
+44 (0)20 7275 7676

Manchester
Bonded Warehouse
18 Lower Byrom Street
Manchester M3 4AP
+44 (0)161 669 8740

Levitt Bernstein
levittbernstein.co.uk

C:\Revit Local\3873-Architecture-R22-Central_rebekka.perkins.rvt

notes

Site Boundary

Highways Boundary

0 10 20 50m

PLANNING

rev	date	check	comments

DSDHA
357 Kennington Lane, Vauxhall, SE11 5QY
T 020 7703 3555
F 020 7703 3890
E info@dsdha.co.uk
W www.dsdha.co.uk

project

Central Somers Town

drawing title

Central Somers Town - Lot 4
Proposed Rendered Site Masterplan

drawn	size	date	scale
EH	A1	27 11 15	1:500

drawing number	revision
246-110-P-51	-

APPENDIX C
SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Land contamination is often addressed via the planning process during redevelopment of sites. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, July 2021. For sites in Wales, reference should be made to Planning Policy Wales (Welsh Government. Edition 11, February 2021).

The new framework has limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water

- reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX D
GENERIC ASSESSMENT CRITIERIA

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-trichlorethane, 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 C_5–C_8 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 100m^2 private garden consisting of lawn and flowerbeds, incorporating a 20m^2 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

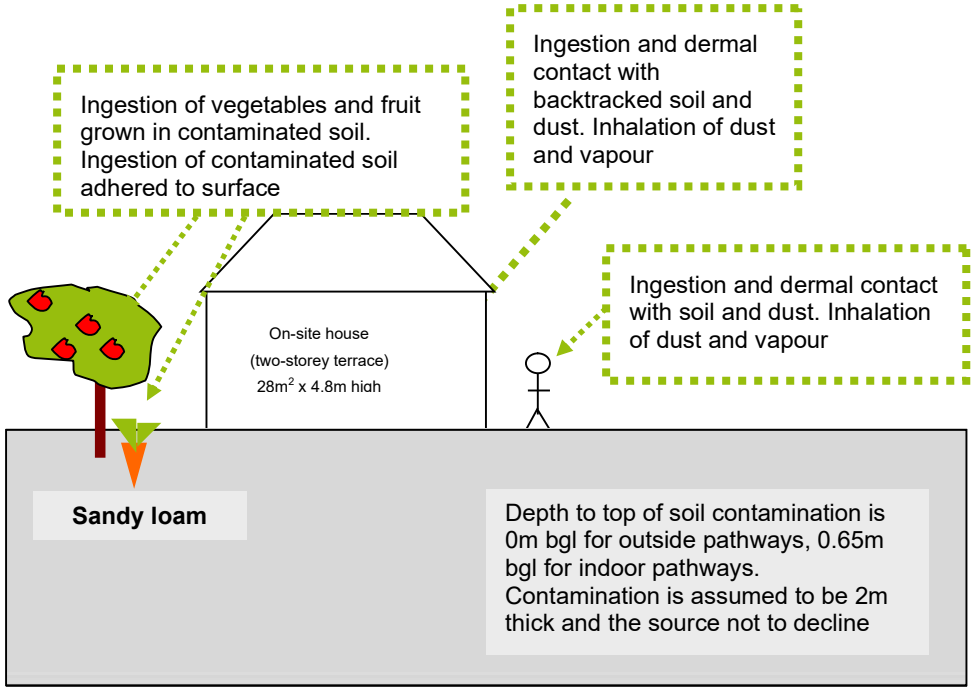


Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

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 90th 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 and 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.							

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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		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_6-EC_8		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_8-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 >EC8-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 napthalene, 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 napthalene, 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.