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Remediation Strategy and Verification Plan



Project Name: The Cobblers

Location: Slinfold, West Sussex. RH13 0SA

Client: Sunninghill Construction Co. Limited

Project ID: V0978

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SUMMARY

The site, which extends to around 0.3ha was previously occupied by a block of 17 No. flats, a Scout hut and lock-up garages. The site is currently undergoing redevelopment with 12No. residential properties, with 6No. of the ground floor units having private garden areas. There is also a parking area and areas of soft landscaping.

A Desk Study was carried out and indicates that the site has a history of agricultural fields with a building on the western boundary followed by development of The Cobblers (care home), with lock up garages and a Scout Hut in the mid 1970's.

A single phase of intrusive investigation was carried out by Southern Testing in October 2019.

Relevant pollutant linkages were identified in respect of PAH's in the Made Ground in one location. The potential for petroleum fuel hydrocarbon contamination to be present in the vicinity of the above ground tank (and to a lesser extent, the domestic garages), and the potential for asbestos containing materials beneath the buildings and in the Made Ground, was also identified.

A Remediation Strategy comprising the removal and/or capping of the Made Ground from all private garden and soft landscaped areas is proposed, subject to approval by regulatory authorities.

A Verification Plan and Discovery Strategy are also included.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

The recommendations contained in this report are made in respect of the particular development proposals as described in the report and may not be appropriate to alternative development schemes.

This report has been prepared for the sole internal use and reliance of Sunninghill Construction Co. Limited and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

This report should be considered in its entirety and Southern Testing Laboratories Ltd accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

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For and on behalf of Southern Testing Laboratories Limited

DOCUMENT HISTORY AND STATUS

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1	7.01.2025	Issue to client	SKT	PJS
2	30.01.2025	Revised to include details of remedial works within the tree root protection zones	SKT	

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A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a copy of our completed Project Order Form which was signed and returned on the 19th December 2024 by Colin Coulthard, on behalf of Sunninghill Construction Co. Limited.

2 Location

The site is located to the south of the junction between Lyons Road and Hayes Lane, in Slinfold, West Sussex, approximately 6km west of Horsham railway station. The site location is indicated on Figure 1 within Appendix A. The approximate National Grid Reference of the site is TQ 11853 31264.

3 Proposed Construction

The site is currently undergoing redevelopment with 12No. residential properties, with 6No. of the ground floor units having private garden areas. There is also a parking area, and areas of soft landscaping. The site layout is shown on Figure 2 within Appendix A.

For the purposes of the contamination risk assessment, the proposed development land use is classified as Residential with consumption of Homegrown Produce. CLEA Model Ref [1].

4 Scope

This report presents our Remediation Options Appraisal, Remediation Strategy, and Verification Plan for the proposed remedial works at the site.

As with any site there may be differences in soil conditions between exploratory hole positions.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

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The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

B BACKGROUND INFORMATION

5 Site Investigation Works

The site has been the subject of a series of site investigation reports, as listed below.

Ref.	Date	Author	Title	Subject
J14185	23 October 2019	Southern Testing	Desk Study and Preliminary Site Investigation Report	Combined Phase 1 Desk Study & Phase 2 Intrusive Site Investigation

These reports provide good coverage and characterisation of the site and information derived from these reports is discussed below. The reader is referred to the original reports for supporting detail if needed. These reports are referred to below by the number given in the left hand column of the above table.

6 Site History

The Desk Study, detailed in the above report indicates that the site has a history of agricultural use, comprising part of a large open field, with a small building being shown on the western edge of the site, since the earliest map extract dated 1876. The first change to the site were small buildings, thought to be the present day lock-up garages which south eastern area of the site, and a unspecified building in the north east corner (thought to be the current day Scout Hut) in the early 1970's.

By the 1975-1977 map edition the site was occupied by a building named The Cobblers within the central and western area of the site. The building in the north east had been demolished. No further changes were observed on site over further map editions.

7 Summary of Findings of the intrusive site investigation works

The intrusive site investigation works comprised 7No. windowless sampler boreholes to depths of 2.45 – 3.45m bgl. and 3No. hand-augured boreholes to depths of 1.0 – 1.35m bgl.

The soils found comprised surfacing of either topsoil, blacktop or concrete to depths of 0.1 – 0.3m bgl. This was underlain by Made Ground to depths of 0.4 – 1.3m+ bgl. The Made Ground was variable, consisting of clay/gravel with sub base, brick, glass, ceramic, clay pipe. Beneath the Made Ground the soils comprised Weald Clay.

With the exception of the Made Ground soils described above there was no further visual or olfactory evidence of significant contamination noted in any of the exploratory holes.

Laboratory analysis for potential contamination, including asbestos, metals, polyaromatic hydrocarbons (PAHs) and Petroleum Hydrocarbons was undertaken.

An elevated concentration of the PAH benzo(a)pyrene was found in a sample of Made Ground taken from BH9 at 0.35m, which was located on the south-east of the site.

Although on the basis of the laboratory testing undertaken, the Made Ground would not be considered to pose a risk to human health, the physical composition of these soils, which contains various anthropogenic material including glass, concrete and brick, means that they would not be considered suitable to be retained in private garden and soft landscaped areas post redevelopment.

The presence of existing buildings, hardstanding, parking areas, and services restricted the fieldwork. No access was available within the current buildings or garages on site. Therefore, further investigation was recommended following the demolition of the existing building. Further assessment was also recommended beneath the above ground fuel storage tank, following its removal.

8 Relevant Pollutant Linkages

The site investigation and risk assessment carried out identified the following Relevant Pollutant Linkages for the site:

Contaminant / Source	Pathways	Receptor
Isolated PAH's in Made Ground (within BH9 in SE corner of the site)	Soil/dust dermal exposure	Site/construction workers Future site residents
	Soil/dust ingestion	Site/construction workers Future site residents
	Direct contact	Structures/services
Above ground petroleum hydrocarbon fuel storage tank on the north of the site	Soil/dust dermal exposure Soil/dust ingestion	Site/construction workers
	Direct contact	Structures/services

It was recommended in the Desk Study and Preliminary Site Investigation Report (ref. J14185 dated 23 October 2019) that further investigation be undertaken following demolition and site clearance works. However, these works were not undertaken, the developer who was responsible for the site at that time having gone into liquidation, and the site having been left with the new development at ground/first floor level.

C REMEDIAL OBJECTIVES AND OPTIONS

9 Remedial Objectives

The site is to be developed for a residential end-use. In the absence of significant off-site risk, the principal objective of the remediation is to remove or reduce to an acceptable level the identified potential risks to end-users of the site. Additional objectives are to achieve the remediation goal in a cost effective and timely manner, whilst minimising impact from associated traffic movements, landfill and resource consumption.

10 Options Appraisal

Polyaromatic Hydrocarbons (PAHs) in the Made Ground

The risks to human health receptors from PAHs in the Made Ground could be dealt with by several methods.

In respect of construction and maintenance workers, the use of PPE and safe working practices (minimising disturbance of the soil, creation of dust and the extent and duration of contact with soils) can reduce risk by helping to break the exposure pathways. However, while use of these measures should be considered as part of good practice in construction and maintenance, they typically are looked upon as a measure of last resort and need to be used in combination with other measures. Neither are such measures appropriate for future site users (residents).

Breaking the exposure pathway prior to construction by emplacement of imported clean material and/or impermeable cover over the Made Ground could reduce risks to human health receptors including future site users. Buildings, access roads and car parking spaces constitute impermeable cover and therefore imported soils would only be needed for areas of the site proposed as gardens or soft landscaping.

Removing the source by careful selective excavation of affected soils and subsequent off-site disposal to an appropriately licensed facility is also capable of reducing/eliminating the risk to human health receptors. As with emplacement of a barrier of clean material, this would only be required for gardens & soft landscaping areas, as buildings, access roads and car parking spaces will break the pathway.

Off-site disposal of contaminated soils and importation of clean materials place additional demands on aggregate resources and waste disposal capacity, and both require significant road haulage. Use of these remediation methods therefore requires that the quantities involved be minimised to ensure the approach remains sustainable in respect of resources, energy and traffic impacts.

Additional options include removing the source by in-situ or ex-situ soil treatment. However, such soil treatment methods have knock-on impacts of their own in terms of energy use, traffic movements, dust/vapour, etc. Ex-situ methods such as bio-remediation by aeration of stockpiled soils require too much time and space to make them effective for this site. In-situ methods such as stabilisation/solidification or ozone treatment are considered 'over engineered' given the size of the site and the volumes of material concerned.

Given the significant cut and fill required across the site in order to achieve finished construction levels, it is proposed to strip the Made Ground from across the site and place it at depth (within the former slurry pit), with the placement of natural soils above.

Potential Petroleum Hydrocarbons Hotspots

The presence of an above ground petroleum hydrocarbon fuel tank on the north of the site may have led to the localised contamination of the shallow soils, due to spillages and leakages of fuel.

Should any such contamination be identified in the vicinity of this feature, localised source removal by excavation of Made Ground and affected natural soils and off-site disposal to an appropriately licensed facility is considered the most effective, practicable and efficient option for addressing the relevant pollutant linkages associated with this source.

D REMEDIATION STRATEGY

11 Remediation Methods

The Remediation Strategy will comprise the following:

Location	Details
Private Gardens	Excavation and removal of the Made Ground down to natural soils, and the placement of 600mm of certified clean soils, including a minimum depth of 150mm of topsoil; **or alternatively;** Excavation and removal of the Made Ground to sufficient depth to allow for the placement of a minimum depth of 600mm of certified clean soils, including a minimum depth of 150mm of topsoil, with the placement of a barrier membrane above the residual Made Ground.
Soft Landscaped Areas	Excavation and removal of the Made Ground down to natural soils, and the placement of 300mm of certified clean soils, including a minimum depth of 150mm of topsoil; **or alternatively;** Excavation and removal of the Made Ground to sufficient depth to allow for the placement of a minimum depth of 300mm of certified clean soils, including a minimum depth of 150mm of topsoil, with the placement of a barrier membrane above the residual Made Ground.

Location	Details
Tree Root Protection Zones on the northern and southern site boundaries	Site levels have previously been reduced to 300mm below finished level. A deter-to-dig membrane is to be installed, with the placement of clean subsoil and a minimum depth of 150mm of certified imported topsoil above this.
Zone A – Location of the former above ground fuel storage tank	Inspection and sampling of the residual soils, with confirmatory laboratory analysis for potential petroleum hydrocarbons. (Remedial measures may be required depending on the outcome of laboratory testing)
Buried Services	Guidance should be sought from the relevant companies regarding the specification of materials for proposed new services runs.

12 Assessment Criteria

The following assessment criteria values will be used in the verification process:

Imported soils shall be free from deleterious materials, weeds and contamination. The material to be used will be tested in accordance with the appropriate BS Specifications for Topsoil (BS 3882:2015) and Subsoil (BS 8601:2013) and the analysis shall also comply with the values given for Residential with Homegrown Produce Consumption in the table in Appendix B. These values are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

Certificates for imported soils must include details of the source, description of the material, and dates of sampling and analysis, as well as the test results for potential contaminants. The date of sampling and analysis must relate to the material imported. Associated consignment notes must clearly identify the source material, and must correspond to the certified material.

E VERIFICATION PLAN

13 Data Collection

Location	Data	Responsible Party
Private Gardens	Post strip inspection and sampling of residual soils (4 no. samples)	Southern Testing
	Post placement check of thickness of cover soils (1no. trial hole per plot)	Southern Testing
	Post placement soil samples for laboratory analysis (one per private garden area, topsoil & subsoil)	Southern Testing
	Provisional of Consignment Notes & suppliers test certificates for the imported subsoil and topsoil	Groundworker
Soft Landscaped Areas	Post strip inspection and sampling of residual soils (2 no. samples)	Southern Testing
	Post placement check of thickness of cover soils (4 no. trial hols)	Southern Testing
	Provisional of Consignment Notes & suppliers test certificates for the imported subsoil and topsoil	Groundworker

Location	Data	Responsible Party
Tree Root Protection Zones	Confirmation of the placement of a deter-to-dig membrane and 300mm of clean soils, including 150mm topsoil.	Southern Testing
	Provisional of Consignment Notes & suppliers test certificates for the imported subsoil and topsoil	Groundworker
Zone A	Inspection, sampling & laboratory analysis of the residual soils for petroleum hydrocarbons. (Remedial measures may be required depending on the outcome of laboratory testing)	Southern Testing

14 Reporting

At the end of the remediation, a verification report will be produced by Southern Testing Laboratories Limited.

15 Discovery Strategy

As with any site, areas of contamination not identified during site investigation works may come to light in the course of redevelopment. Accordingly, a discovery strategy will be adopted to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner, as follows:

- A close watch will be maintained during all demolition and excavation works.
- In the event that unexpected or malodorous soils or liquids are encountered, excavation work shall cease in the affected area.
- The affected area shall be made safe and fenced off to prevent unauthorised access.
- The Site Manager shall notify Southern Testing Laboratories Limited of the discovery, who will attend site to inspect the suspect materials, provide advice and take samples as necessary. Within Southern Testing Laboratories Limited, Sarah Toms shall be the first point of contact.
- The Site Manager shall notify Horsham District Council of the discovery. Within Horsham District Council, the Contaminated Land Officer shall be the first point of contact.

Any suspect excavated soil will be stockpiled separately on polythene sheeting, covered, and tested before being removed.

16 General Guidance

In general terms, the workforce and general public should be protected from contact with contaminated material. There is a range of relevant documents published by the Health and Safety Executive, and organisations such as CIRIA, and the BRE.

Some soils will require removal from site and disposal to suitably licensed landfills. Different guidelines and charges will apply to different waste classifications. As waste producers, the Developer holds responsibilities under the various governing regulations, including:-

- Ensuring that waste is characterised in accordance with current Technical Guidance.
- Ensuring that waste is disposed of at a facility appropriately licensed to receive the waste as classified.
- Keeping accurate records of all waste classification, transfer and a disposal log including information such as:
    - Date, Waste Classification, Carrier's Registration Number, Transfer Note Number, Ultimate Destination.
- Submitting full copies of those records for inclusion in validation/closure reports.

Maintaining those records for potential future regulatory inspection.

REFERENCES

[1] Environment Agency, “Updated technical background to the CLEA model,” 2009.

[2] Contaminated Land: Applications in Real Environments (CL:AIRE), “Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination,” 2014.

[3] CIRIA, “C665 Assessing risks posed by hazardous ground gases to buildings,” 2007.

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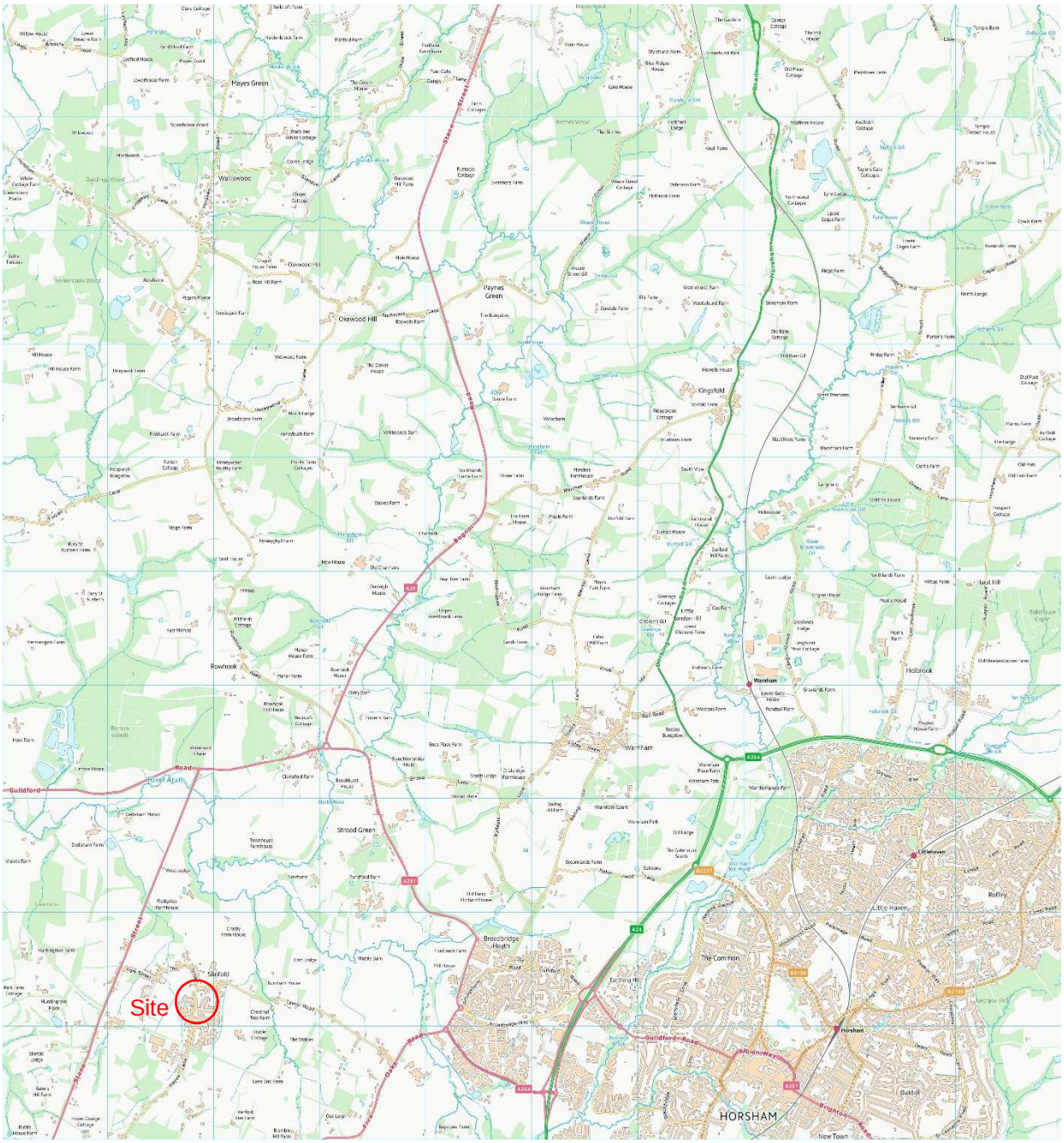


APPENDIX A

Site Plans

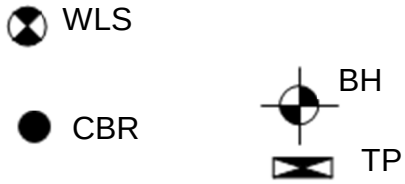


A



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Site:	The Cobblers, Hayes Lane, Slinfold, Horsham, West Sussex, RH13 0SA	Project ID	V0978
Figure 1	Site Location Plan	Date:	24/12/2024





Use this template for the SI layout plan. A landscape version is on the following page.

If you are using some other form of site plan (HBSI / CAD) leave these pages within word and just delete the individual pages when the pdf is created within Adobe. This will ensure background images / headers and footers remain correct.

Select and delete this text box and insert a background image.

Symbols are above.

Ensure you use the same location identifiers noted on the key sheet below

NB: Positions of exploratory holes / test positions are only indicative unless dimensioned.

Site:		Project ID	V……..
Figure 2	Site Investigation Layout Plan	Date:	dd/mm/yyyy

Private gardens

Soft landscaping

Tree Root Protection Zone

Zone A



Site:	The Cobblers, Hayes Lane, Slinfold, Horsham, West Sussex, RH13 0SA	Project ID	V0978
Figure 2	Site Layout & Remediation Plan	Date:	30/12/2024

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APPENDIX B

Verification Criteria



B

Contaminant Screening Values for Imported Soils

Contaminant	Units	Proposed Land Use					
		Residential with home grown produce consumption	Residential without home grown produce consumption	Open Space * (Residential)	Open Space * (Park)	Allotments	Commercial / Industrial
Arsenic (As) [2]	mg/kg	37	40	79	170	43	640
Cadmium (Cd) [2]	mg/kg	11	85	120	555	1.9	190
Trivalent Chromium (CrIII) [2]	mg/kg	910	910	1,500	33,000	18,000	8600
Hexavalent Chromium (CrVI) [2]	mg/kg	6	6	7.7	220	1.8	33
Lead (Pb) [3]	mg/kg	200	310	630	1300	80	2330
Mercury (Hg) [1,2,7]	mg/kg	7.6-11	9.2-15	40	68-71	6.0	29-320
Selenium (Se) [2]	mg/kg	250	430	1,100	1,800	88	12,000
Nickel (Ni) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	60 75 110		
Copper (Cu) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	100 135 200		
Zinc (Zn) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	200 200 300		
Phenol [1,2]	mg/kg	120-380	440-1200	440-1300	440-1300	23-83	440-1300
Benzo[a]pyrene [1,5]	mg/kg	1.7-2.4	2.6	4.9	10	0.67-2.7	36
Naphthalene [1,2]	mg/kg	2.3-13	2.3-13	77-430^{+}	77-430^{+}	4.1-24	77-430^{+}
Total Cyanide (CN) [6]	mg/kg	/	/	/	/	/	/
Free Cyanide [6]	mg/kg	/	/	/	/	/	/
Complex Cyanides [6]	mg/kg	/	/	/	/	/	/
Thiocyanate [6]	mg/kg	/	/	/	/	/	/

Notes:

* Open Space levels calculated on the basis of the exposure modelling developed in the C4SL research.

+ Screening values constrained to saturation limit. Higher values may be acceptable on a site specific basis.

[1] Where ranges of values are given for organic contaminants the screening value is dependent on the Soil +Organic Matter.

[2] LQM/CIEH S4UL (2014). Copyright Land Quality Management Ltd. reproduced with permission; Publication Number S4UL 3116. All rights reserved.

[3] C4SL (DEFRA 2014).

[4] Copper, Zinc and Nickel may have phototoxic effects at the given concentrations. Alternative criteria should be adopted for importation of Topsoil or other soils for cultivation. BS3882:2015 and BS8601:2013 suggest values of 200 to 300mg/kg for Zn, 100 to 200mg/kg for Cu, and 60 to 110mg/kg for Ni, for topsoil and subsoil, depending on pH.

[5] Based on the Surrogate Marker approach and modelled using the modified exposure parameters of C4SL but retaining 'minimal risk' HCV.

[6] Screening criteria derived on a site specific basis if test results indicate.

[7] S4UL for Methyl Mercury, higher concentrations may be tolerable if inorganic mercury is the only species present. Lower concentrations apply for elemental Mercury.

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APPENDIX C



C

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APPENDIX D



D

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