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Remediation Method Statement Report

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS

On behalf of Elivia Homes (Southern) Limited

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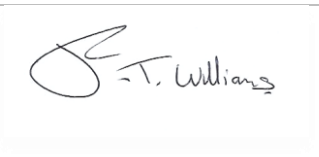
v.1.04			
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1. INTRODUCTION

1.1. General

Ground and Water Limited were instructed by Elivia Homes to conduct Remedial Method Statement on the site at Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS.

1.2. Aims of the Investigation

The aim of this report was to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

This Remediation Method Statement Report must be read in conjunction with the following reports referenced:

- Land Science, Phase I Geo-Environmental Investigation (LS5899, October 2021);
- Ground and Water Limited, Phase II Site Investigation Report (GWPR5374/SIR/June 2023);
- Ground and Water Limited, Updated Phase II Site Investigation Report (GWPR5759/GIR/January 2024);
- Ground and Water Limited, Contamination Assessment Report (GWPR6066/GIR/August 2024); and
- Ground and Water Limited, Phase II Site Investigation Report (GWPR6247/SIR/February 2025).

The techniques adopted for the investigation were chosen considering the requirements of the client, anticipated ground conditions, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3. Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

1.4. Technical Glossary

Generic technical terms and their description can be viewed within the glossary provided within Appendix B.

2. SITE SETTING

2.1. Site Location

The site comprised a ~23,873m^2 roughly rectangular-shaped plot of land, orientated in a north to south direction, along the southern side of Rectory Lane. The site was located to the west of the town centre of Ashington in the county of West Sussex.

The national grid reference for the centre of the site was approximately TQ 12652 16280. A site location plan is given within Figure 1. Figure 2 shows the site development area and Figure 3 shows an aerial photograph of the site.

2.2. Site Description

At the time of site works conducted within October 2024, the existing development comprised a plant nursery greenhouse located on the southern portion of the site, with derelict barns and buildings located across the central area of the site. The site had recently been used to store motorhomes and caravans. The site was noted to have a shallow slope from north to south. A hardstanding driveway was noted to run through the centre of the site from the road down to the entranceway of the greenhouse. The majority of the site comprised loose tarmac/gravel, with majority of the site being overgrown with grass, shrubs and bushes.

Additional site works were then undertaken within January 2025 and demolition works had occurred across the site with the greenhouses and the derelict barns/buildings no longer present on site.

2.3. Proposed Development

At the time of reporting, March 2025, the proposed development was understood to comprise the demolition of the existing buildings and greenhouses on site and the construction of a mixture of detached, semi-detached, terraced and residential flats across the site totalling 74 residential plots. The terraced, semi-detached and detached properties also have associated front and rear gardens and some properties are to have garages as well. The residential flats located on the northern portion of the site will have shared public gardens and a large car park area just to the south.

The proposed development plan is shown in figure 4.

2.4. Third Party Desk Study Report

The report summarises a site walkover undertaken by another company (Ref LP00763 July 2015). The walkover noted two above ground storage tanks located in the centre of the site with a diesel pipe running south form the fuel tanks towards the greenhouses. Asbestos fragments were noted in the surface of the field and bank of the ditch. A bonfire area and pump house was noted to the west of the greenhouses. Asbestos cement sheets were identified in the construction of the buildings along northern boundary of site.

Historical mapping of the site recorded from the earliest map dated 1875-1879 showed the site comprised a field with trees lining the northern boundary and trees scattered along the southern and eastern boundaries. The 1937-1939 maps showed the northern portion of the site had been redeveloped with a plant nursery. A tank was recorded just to the south-west corner of the site. The 1974 maps showed more greenhouses had been constructed on the south-western portion of the site. The tank previously noted is shown as a reservoir and pump house. The 1993 plan showed the site

suggested the nursery is now located to the south of the site with the northern portion being used to store caravans and vehicles. The site environs generally had areas of residential development with no significant environmental contamination sources.

The ground conditions encountered from the previous investigations recorded the following:

Northern field and western grassed area- Topsoil to 0.10-0.90m bgl comprising a gravelly clay with occasional brick, glass and flint, Made Ground to depths of 0.54-1.50m bgl comprising a silty clayey Gravel, with blacktop, glass and medium clinker. The Weald Clay Formation was recorded below to depths of between 1.70-3.00m comprising both a sandy clay and clayey Sand.

The hardstanding area, greenhouses and central portion of the site- Blacktop from GL to 0.05-0.10m with Made Ground below comprising a clayey Gravel of blacktop, glass and medium clinker. The Weald Clay Formation was recorded below to depths of between 1.70-3.00m comprising both a sandy clay and clayey Sand.

The previous testing on site recorded exceedances of PAH's and Lead with parts of the Made Ground located in the centre of the site and to the north of the glass houses. Samples tested from the topsoil recorded no exceedances.

Ground and Water visited site as part of the phases of site investigation works and noted a soil bund extending along the eastern boundary of the site which was predominantly covered with overgrown vegetation and trees growing on top. The reservoir was also not identified on-site however an area of slightly raised ground was noted in its place.

2.5. Conceptual Site Model

The tabulated Conceptual Site Model developed as part of the Third Party Desk Study Report (LS5899 Phase 1 Geo Environmental Investigation October 2021) is outlined overleaf with some additions based on more recent findings. For ease of reference and understanding, the risks have been classified within this risk assessment against four possible levels / categories, summarised in the table below. Any risk deemed to be negligible within the Preliminary Risk Assessment have been excluded from this report.

Risk Categories used in the Tabulated CSM	
Low Risk	Regarding this potential SPR linkage, the site is considered suitable for the proposed end-use and there is not considered to be an unacceptable risk to receptors. However, it is considered that further investigation to confirm this is recommended.
Moderate Risk	Regarding this potential SPR linkage, the site may not be suitable for the proposed end-use in its current condition and there may be an unacceptable risk to receptors. Further investigation is required to confirm this.
High Risk	Regarding this potential SPR linkage, the site is probably or certainly not suitable for proposed end-use and there is likely to be an unacceptable risk to receptors. Contaminants probably or certainly present and urgent action required in the short term.

Tabulated Conceptual Site Model – Pollutant Linkage Summary (On-Site Sources)			
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from construction/ demolition activities: • Asbestos, • PAHs, • TPHs, • VOCs, • Sulphates, and • Metals.	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands • Ingestion of home-grown produce, and soils attached • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	**Human Health** • End Users (Residents/Future site visitors) • Construction workers during development • Site operatives during maintenance works • Neighbours and public	**Moderate-High**
	• Direct uptake of groundwater • Direct uptake of determinands in the soil	**Flora and Fauna** • Vegetation within soft landscaped areas	**Low**
	• Anthropogenic (man-made) pathways • Vertical and lateral migration in permeable strata • Surface water runoff	**Controlled Waters** • Secondary Undifferentiated Aquifer (Head Deposits) • Lancing Brook	**Low**
Aggressive ground conditions with Made Ground and natural ground, including groundwater: • Sulphates, • PAH/TPH.	• Direct contact with aggressive ground conditions	**Building Materials and Services** • Buried Concrete • Underground services (water pipes)	**Moderate**
Potential leaks/spills from on-site tanks: • PAHS • TPHs • VOCs	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands • Ingestion of home-grown produce, and soils attached • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	**Human Health** • End Users (Residents/Future site visitors) • Construction workers during development • Site operatives during maintenance works Neighbours and public	**Moderate**
	• Anthropogenic (man-made) pathways • Vertical and lateral migration in permeable strata • Surface water runoff	**Controlled Waters** • Secondary Undifferentiated Aquifer (Head Deposits) • Lancing Brook	**Low**
Sites historical use as greenhouses/nurseries: • Asbestos	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands	**Human Health** • End Users (Residents/Future site visitors) • Construction workers during development	**Moderate**

• Metals, • Pesticides, • PAHs, • TPHs.	• Ingestion of home-grown produce, and soils attached • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	• Site operatives during maintenance works Neighbours and public	
	• Direct uptake of groundwater • Direct uptake of determinands in the soil	**Flora and Fauna** • Vegetation within soft landscaped areas	**Low**
	• Anthropogenic (man-made) pathways • Vertical and lateral migration in permeable strata • Surface water runoff	**Controlled Waters** • Secondary Undifferentiated Aquifer (Head Deposits) Lancing Brook	**Low**
Ground gases generated by Made Ground: • Methane, • Carbon Dioxide, • Hydrogen Sulphide, and • Carbon Monoxide.	• Migration through anthropogenic & natural pathways • Inhalation of Asphyxiating gases • Explosion (methane only)	**Human Health** • End Users (Residents/Future site visitors) • Construction workers during development (especially in confined spaces) • Site operatives during maintenance works in confined spaces • Neighbours and public	**Low**
	• Migration through anthropogenic & natural pathways • Explosion (methane only)	**Building Materials and Services** • Buildings • Confined spaces • Underground services	**Low**

Tabulated Conceptual Site Model – Pollutant Linkage Summary (Off-Site Sources)			
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from construction/ demolition activities: • Asbestos, • PAHs, • TPHs, • VOCs, • Sulphates, and • Metals.	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	**Human Health** • End Users (Residents/Future site visitors) • Construction workers during development • Site operatives during maintenance works	**Moderate**
	• Direct uptake of groundwater	**Flora and Fauna** • Vegetation within soft landscaped areas	**Low**
Aggressive ground conditions associated with impacted groundwater; • Sulphates, • PAH/TPH.	• Direct contact with aggressive ground conditions	**Building Materials and Services** • Buried Concrete • Underground services (water pipes)	**Moderate**

3. SUMMARY OF PREVIOUS INVESTIGATION

3.1. Summary of Previous Ground and Water Site Investigations

Previous phases of site works have been undertaken at the site and this report should be read in conjunction with GWPR5374/SIR/June 2023, GWPR5759/GIR/January 2024 and GWPR6066/GIR/August 2024. The reports and their findings are summarised below.

Phase II Site Investigation Report – June 2023 (GWPR5374/SIR/June 2023)

Site works were undertaken by Ground and Water on 9th May 2023 and comprised the excavation of 8no. trial pits followed by the drilling of 5no. Windowless Sampler Boreholes to depths of between 2.00-5.00m bgl. Super Heavy Dynamic Probes (DP2 – DP5) were undertaken through the base of boreholes to final depths of between 2.80 – 5.00m bgl.

Contamination Assessment

The comparison between the laboratory analysis and the assessment criteria indicated an unacceptable risk to future receptors caused by exceedances of the following determinands: Arsenic (TP2/0.50m bgl); Lead (TP4/0.20m bgl); Asbestos (TP4/0.20m bgl); and PAHs (WS4/0.30m bgl and TP6/0.20m bgl). The remaining determinands were identified at below the adopted screening value and are not considered to represent an unacceptable risk to future receptors. Where an unacceptable risk to future receptors remains, mitigation is required.

Due to the nature of the contamination encountered at the site, it was considered an unacceptable risk to future receptors.

Groundwater

Given the Level 1 risk assessment does not consider dilution, dispersion or attenuation, and the conceptual site model shows the nearest main receptor / compliance point to be the Lancing Brook, 45m south of the site, the fact that the soils on site comprised cohesive clay soils which are considered to impermeable, therefore reducing the risk of contaminants migrating off site, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

Updated Phase II Site Investigation Report – January 2024 (GWPR5759/GIR/January 2024)

Site works were undertaken by Ground and Water on 20th December 2023 and comprised the excavation of 7no. trial pts (TP101-TP107) to depths of between 1.00-2.00m bgl. The aim of the additional works was to delineate the previously identified contamination and in turn reduce the area of remediation required.

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential without homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

Lead was noted to be elevated in one sample, the one value of 216mg/kg in TP106/0.20m, was elevated when compared to C4SL of 200mg/kg. Mercury was noted to be elevated when compared to the elemental mercury S4UL of 1.2 mg/kg. The S4UL provides an alternative assessment criterion for

inorganic mercury (mercury compounds most likely with sulphur or oxygen) of 56 mg/kg. The mercury present on-site is likely to be in inorganic form due to no evidence at present for an elemental mercury source. Therefore, the higher assessment criteria of 56 mg/kg for inorganic mercury should be applied to the risk assessment. The value identified within the laboratory analysis therefore falls within the assessment criteria. Chemical laboratory testing of the Made Ground/Weald Clay Formation did not reveal any other elevated levels of determinands above the guideline levels for a 'Residential With Homegrown Produce' land-use scenario. In addition, the intrusive investigation did not reveal any visual or olfactory evidence to suggest any hydrocarbon-type contamination in the trial holes excavated on the site. The chemical laboratory results have verified that no elevated concentrations of aliphatic/aromatic hydrocarbons (C5-C35) or BTEX compounds are present in the soils underlying the site.

Contamination Assessment Report – August 2024 (GWPR6066/GIR/August 2024)

Site works were undertaken by Ground and Water on 5th July 2024 and comprised the excavation of 6no. Windowless Sampler boreholes (WS201-WS206) to depths of between 2.50-3.00m bgl. A set of samples (2no. Made Ground and 1no. Weald Clay Formation samples from underneath the road) were submitted for chemical laboratory analysis.

The laboratory analysis identified elevated PAH concentrations within one sample (WS201/0.20m bgl). No other elevated levels of determinands above the guideline levels for a 'Residential With Homegrown Produce' land-use scenario were recorded.

As the identified area of contamination will be located beneath the proposed roadway it was considered that no remedial measures were required. In addition, due to the presence of the Weald Clay directly below the Made Ground which is classified as Unproductive Strata there is no risk to groundwater.

Phase II Site Investigation Report – January 2025 (GWPR6247/SIR/February 2025).

Site works were undertaken on the 8th October 2024 and 28th October 2024 and comprised the excavation of 7No. machine excavated Trial Pits (TP301-TP303 and TP306-TP309) up to 1.50m bgl and the excavation of 12no. hand dug pits (HP301-HP304 and HP305-HP312) to 1.0m bgl.

Additional site works were also undertaken on the 2nd and 8th January 2025 and comprised the machine excavation of 8no. trial pits up to 2.60m bgl and the excavation of hand dug pits (HP401-HP420) to 1.00m bgl. Site works also comprised the drilling of 4no. Windowless Sampler Boreholes (WS401A, WS401B, WS402 and WS405) to depths of between 2.05-3.00m bgl.

The aim of the additional site works within January 2025 was to further investigate particular features of concern across the site for example the historical reservoir within the southwestern corner, bund along the eastern boundary, greenhouses within the southern and northern sections and tanks within the center of the site.

The succession of conditions and description of soils encountered in the trial holes conducted across the October 2024 and January 2025 site works in descending order is tabulated below.

Summary of Strata Encountered (October 2024)			
Strata	**Top Depth (m bgl)**	**Base Depth (m bgl)**	**Thickness (m)**
MADE GROUND: A dark brown, gravelly sandy CLAY. Sand was fine to medium. Gravel was sub-angular to sub-rounded, fine to coarse flint, brick and Type 1 Gravel and road plannings.	GL	0.10-0.40	0.10-0.40
TOPSOIL (HP301 - HP304): A dark brown sandy CLAY with roots. Sand was fine.	GL	0.15	0.15
WEALD CLAY FORMATION: A light brown, orangish brown and grey slightly gravelly sandy CLAY to clayey gravelly SAND. Sand was fine. Gravel was sub-angular, fine to coarse flint and sandstone.	GL – 0.40	>1.00- >1.50	>0.85- >1.50

Summary of Strata Encountered (January 2025)			
Strata	**Top Depth (m bgl)**	**Base Depth (m bgl)**	**Thickness (m)**
MADE GROUND: A dark brown, gravelly sandy CLAY. Sand was fine to medium. Gravel was sub-angular to sub-rounded, fine to coarse flint, brick and Type 1 Gravel and road plannings.	GL	0.15-0.40	0.15-0.40
MADE GROUND (TP405 and TP406): A dark brown sandy gravel comprising medium to cobble bricks, concrete, glass and car parts.	1.30-1.50	2.30	0.80-1.00
REWORKED GROUND: A light brown, orangish brown and grey slightly gravelly sandy CLAY	GL-0.40	1.30-2.00	0.90-2.00
WEALD CLAY FORMATION: A light brown, orangish brown and grey slightly gravelly sandy CLAY to clayey gravelly SAND. Sand was fine. Gravel was sub-angular, fine to coarse flint and sandstone.	GL – 2.50	>0.50- >2.60	>0.30- >2.60

Trial hole locations TP405-TP407 were located within the vicinity of the historical reservoir within the south-western corner. This area was also noted to have a slightly raised ground level. TP405 and TP406 identified the southern perimeter wall of the reservoir structure and the trial holes revealed a significant amount of rubble and debris including vehicle parts used to infill the reservoir structure followed by a concrete base at ~2.30m bgl. TP407 identified the southern and western perimeter walls and the trial hole was excavated along the external side of the northern wall identifying the base of the reservoir (2.30-2.50m bgl) and proved natural ground (orangish brown and grey sandy CLAY) beneath the slab.

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential without homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

The comparison between the laboratory analysis from October 2024 and the assessment criteria indicates that there is an unacceptable risk to future receptors caused by exceedances of the following determinands: Lead; Benzo(a)pyrene; Benzo(b)fluoranthene; and Dibenzo(a,h)anthracene. The remaining determinands were identified at below the adopted screening value and are not considered

to represent an unacceptable risk to future receptors. Where an unacceptable risk to future receptors remains, mitigation is required.

Dibenzo(a,h)anthracene was noted to be elevated within samples of Made Ground from HP311/0.10, HP302/0.10, HP303/0.10, HP310/0.10 and in HP311/0.10m when compared to C4SL of 0.24mg/kg. Benzo(a)pyrene and Benzo(b)fluoranthene were elevated within HP302, HP303 and HP310 at 0.10m bgl. Lead was also found to be elevated within HP309 at 0.10m bgl.

Asbestos was identified within one sample (HP311/0.10m) as chrysotile sheeting/board debris. An Asbestos Management Strategy shall be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

Within the October 2024 site works trial pits were undertaken within the greenhouse structures within the southern section of the site and samples were analysed for pesticides. The concentrations of pesticides were generally recorded beneath the laboratories limit of detection with the exception of 1no. sample (TP303/0.20m bgl) where P,p'-DDT or p,p'-Dichlorodiphenyltrichloroethane was recorded at 0.017mg/kg. Whilst a specific threshold value is not available for P,p'-DDT the recorded value is found to be below the assessment criteria for Dichlorvos which is considered to be the lowest for pesticides (0.032mg/kg) and most conservative approach.

The comparison between the laboratory analysis from January 2025 and the assessment criteria indicates that there is an unacceptable risk caused by exceedances of the following determinands: Lead (HP401/0.20m bg, HP403/0.10m bgl, HP413/0.10m bgl, HP406/0.40m bgl, HP407/0.10m bgl, TP402/0.90m bgl, TP405/1.90m bgl and TP406/2.00m bgl), Benzo(a)pyrene (TP406/2.00m bgl), Benzo(b)fluoranthene (TP406/2.00m bgl and HP412/0.10m bgl) , Dibenzo(a,h)anthracene (TP406/2.00m bgl and HP412/0.10m bgl) and P,p'-DDT (HP417 and HP420/0.10m bgl).

Trial holes HP417-HP420 were undertaken within the vicinity of TP303 within the footprint of the historical greenhouses to confirm whether the previously identified P,p'-DDT formed part of a wider area of pesticide contamination. Similarly to the October 2024 results the pesticides were generally recorded below the laboratories limit of detection with the exception of P,p'-DDT and P,p'-DDE and were compared to the assessment criteria for Dichlorvos which is considered to be the lowest for pesticides (0.032mg/kg) and most conservative approach. Exceedances related to P,p'-DDT were recorded within HP417/0.10m bgl (0.054mg/kg) and HP420/0.10m bgl (0.046mg/kg).

3.2. Water Supply Pipe Risk Assessment

As part of the proposed development it is expected that new water supply pipes will be installed at the site. Water supply pipes have the potential to be exposed to contaminants in the ground that can lead to unacceptable concentrations within the drinking water. If a risk is identified, specialist pipes that are protective of the drinking water are required.

A pipe selection risk assessment should be submitted to the water supply company as part of the development based on the supplier's assessment criteria. An indication of whether there is likely to be a risk can be seen tabulated below, where the PE pipe thresholds are based on *UKWIR Contaminated Land Assessment Guidance, 2014*.

Pipe Selection Risk Assessment			
Determinand	**PE Pipe Threshold (mg/kg)**	**Laboratory Analysis Range (mg/kg)**	**Was the Threshold Exceeded?**
Total BTEX and MTBE	0.1	LOD	No
Phenols	2	LOD	No
TPH EC5 – EC10 (aliphatics and aromatics)	2	LOD	No
TPH EC10 – EC16 (aliphatics and aromatics)	10	LOD – 29.0	Yes
TPH EC16 – EC40 (aliphatics and aromatics)	500	1069	Yes
Naphthalene	5	0.51	No

The Water Supply pipe risk assessment indicated that the use of PE pipes is inappropriate at the site due to the concentrations of TPH within the soils. It is therefore recommended that the use of Metal or Barrier pipes are implemented as part of the design in order to prevent an unacceptable risk to future receptors.

3.3. Groundwater Risk Assessment

In the UK, the water environment is protected under a number of regulatory regimes, mainly governed by the Environment Agency. The Environment Agency is consulted when there may be a risk to Controlled Waters, or where a pollution incident has occurred historically. The Water Framework Directive is implemented in various guises covering groundwater, surface water and drinking water supply.

The soil samples analysed as part of the risk assessments have been used to undertake a Level 1 (soils) Controlled Waters risk assessment. At Level 1 (soils), the conceptual site model and the determinand concentrations of the soils are used to indicate whether the concentrations are sufficient to impact the receptor. At this stage, dilution, dispersion and attenuation along the pathway are not considered.

From analysis of hydrogeological and topographical maps the groundwater table was anticipated to be encountered at shallow to moderate depth within the Head Deposits capping the impermeable Weald Clay Formation. Perched water was also likely to be found within the Made Ground, especially after periods of intense or prolonged rainfall. It was considered that the groundwater was flowing southwards, towards the Lancing Brook and in alignment with local topography.

The nearest surface water feature was observed to be the Lancing Brook located approximately 45m south of the site. A pond was noted approximately 70m south of the site.

During the site investigation, Made Ground was encountered to depths of between 0.05-1.20m bgl, overlying sandy clay and Sand of the Head Deposits on the southern portion of the site with the rest of the site underlain by the Weald Clay Formation. Groundwater strikes were recorded across the site at depths of between 0.60-2.00m bgl.

Comparison between the soil laboratory analysis and the derived Level 1 (soils) target concentrations indicate that some determinands may have the theoretical potential to pose a risk to Controlled Waters. It should be noted that a number of determinands at laboratory limit of detection exceed the target concentration for a Level 1 (soils) risk assessment. Where a determinand is identified at the laboratory limit of detection, no further assessment is considered necessary.

Given the Level 1 risk assessment does not consider dilution, dispersion or attenuation, and the conceptual site model shows the nearest main receptor / compliance point to be the Lancing Brook, 45m south of the site, the fact that the soils on site comprised cohesive clay soils which are considered to impermeable, therefore reducing the risk of contaminants migrating off site, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

3.4. Ground Gas Risk Assessment

A review of Phase I desk study produced by a Third Party, did not identify any source of ground gas on-site or within influencing distance of the site that warranted investigation through ground gas monitoring. The only source of ground gases was anticipated to be limited Made Ground and therefore classified as 'Low risk', where the pragmatic approach to ground gas risk assessment presented within the CL:AIRE research bulletin RB17 and included within Annex D of BS8485:2015+A1:2019 can be considered.

The alternative approach to ground gas risk assessment considers the uncertainty from the measurement of ground gas concentrations and flow rates in monitoring wells for low-risk sites and removes the need for monitoring. Low risk sites typically comprise:

- Natural soils with high carbonate content (e.g. chalk);
- Natural soils that can produce gases (e.g. alluvium, peat etc.);

- Made Ground between 1.00m to 5.00m, with low organic content; and
- Areas of flooded mine workings, unless a building is to be within 20m of shaft or adit.

The method considers the gas generation potential of the soils from data that is not subject to external influences, for example atmospheric pressure can change the recorded flow and concentrations of ground gas during spot monitoring, or a rising groundwater level can displace ground gases in pore spaces. Determination of the characteristic situation is based on the total organic carbon (TOC) of the soils, coupled with any organic-rich material identified within the borehole logs, such as wood gravels. TOC is easily analysed by the laboratory and can also be calculated by the equation outlined below.

Total Organic Carbon (TOC) = 0.58 x Soil Organic Matter (SOM) = 1.33 x Degradable Organic Carbon (DOC)

As part of the original investigation works undertaken in May 2023, ten samples of the Made Ground were submitted to the laboratory for analysis, which identified TOC to vary between <0.2 and 3.05% in the Made Ground. The trial hole logs identified the gravels within the Made Ground to comprise; flint, brick, wood, glass and ash/bituminous material. Made Ground was identified to a maximum depth between 0.05 and 1.20m bgl.

As part of the secondary investigation works undertaken in December 2023, four samples of the Weald Clay Formation and one sample of the Made Ground were submitted to the laboratory for analysis, which identified TOC to vary between <0.2 and 0.913% in the Weald Clay Formation and 4.12% in the Made Ground. The trial hole logs identified the gravels within the Made Ground to comprise; flint, brick and bituminous material. Made Ground was identified to a maximum depth between 0.05 and 0.25m bgl.

During the October 2024 site investigation works 8no. samples of Made Ground and 2no. samples of the Weald Clay Formation were submitted to the laboratory for analysis, which identified TOC to vary between 1.4 and 3.0% in the Weald Clay Formation and <0.1-3.1% in the Made Ground. The trial hole logs identified the gravels within the Made Ground to comprise; flint, brick, Type 1 gravel and road planings. Made Ground was identified to a maximum depth between 0.10 and 0.15m bgl.

The various phases of intrusive investigation has revealed a maximum thickness of Made Ground of 1.20m overlying Head Deposits comprising cohesive and granular soils as well as the Weald Clay Formation comprising cohesive soils. Site has undergone a previous phase of construction and limited degradable material has been identified. The exception to this being the identified reservoir structure and its contents within the southwestern corner which recorded Made Ground up to 2.50m bgl. The introduction of oxygen to the Made Ground through redevelopment may lead to an initial increase of ground gas generation as degradable material within the soils present on-site may act as source of ground gas. The soils at the site are considered to be of variable permeability (low to high) in nature and pathways for ground gas migration will be present.

Using the soil derived method, it is considered that a TOC value of <1% within soil is unlikely to pose an unacceptable risk from ground gases and the site can be characterised as Characteristic Situation CS1. Any value between 3 and 6 % warrants classification as a Characteristic Situation CS3. Any value over 6% requires investigation through ground gas monitoring. Any site with Made Ground <2.00m

bgl will have a limited gas generation potential from the organic carbon present and consideration should be given to this thickness within the risk assessment.

An alternative approach for ground gas risk assessment (CL:AIRE RB17) can be considered utilising measured concentrations from soil parameters that are independent of influencing factors such as atmospheric pressure and groundwater level. Total Organic Carbon (TOC) was tested on 44No. samples with the analytical results ranging between <0.1 and 4.40%.

Based on the soil derived method outlined, the history of the site and the general TOC concentrations encountered, together with the generally limited thickness of made Ground, the soils from site would warrant classification as Characteristic Situation CS1. Six samples of the Made Ground were noted to be slightly over 3% TOC with the rest all below 3% although 3 of these samples related to the infilled reservoir structure which is to be removed as part of the remediation works. Based on this and the absence of organic material within the Made Ground and the overall low TOC values on samples tested it was concluded the site was Characteristic Situation CS1. It should be noted that this only represents the assessment from an on-site source.

3.5. Vapour Risk Assessment

In order to assess the potential for a vapour risk at the site, soil samples were sent to the laboratory for analysis as part of the October 2024 and January 2025 site works. The testing suites included contaminants that may be present in the vapour phrase (Mercury, Napthalene, TPHs and volatile Organic Compounds (VOCs)) taken within Made Ground samples in close proximity to the above surface tanks, as well as samples from the infill material encountered within the reservoir.

All samples scheduled (10No.) identified VOCs at concentrations lower than the laboratory limit of detection. All samples also identified SVOC's at concentrations lower than the laboratory limit of detection with the exception of TP406 at 2.00m bgl where the following were recorded above the laboratory limit; Dibenzofuran at 0.40mg/kg, Carbazole at 0.50mg/kg and Anthraquinone at 2.60mg/kg. A specific assessment criterion is not published for these and so the values have been compared to the lowest SVOC, Vinyl Chloride at 0.00014mg/kg and therefore identified to exceed the assessment criteria. However, this sample relates to the infill material within the reservoir structure which is to be removed as part of the remedial works. This is also likely to be an overconservative number to compare against.

4. REMEDIATION METHOD STATEMENT

4.1. Soils

4.1.1. Infilled Reservoir (south-western corner)

Trial hole locations TP405-TP407 were located within the vicinity of the historical reservoir within the south-western corner. This area was also noted to have a slightly raised ground level. TP405 and TP406 identified the southern perimeter wall of the reservoir structure and the trial holes revealed a significant amount of rubble and debris including vehicle parts used to infill the reservoir structure. TP407 identified the southern and western perimeter walls and the trial hole was excavated along the external side of the northern wall identifying the base of the reservoir (2.30-2.50m bgl) and proved natural ground (orangish brown and grey sandy CLAY) beneath the slab. It was also concluded that the infill material and associated contamination identified from laboratory analysis was contained within the reservoir structure.

A plan showing the approximate extent of the reservoir can be found within Figure 8.

Based on the available information within this report it was proposed that the following remedial methodology shall be undertaken with relation to the reservoir structure:

- Removal of the structure and its contents and removal of surrounding Made Ground, both horizontally and vertically, and potential reworked material to the east covering Plots 50-55;
- Validation of resultant void;
- Placement of soils to backfill void;
- Validation of the clean capping system by a suitably trained Ground and Water Limited engineer.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

Removal of Structure and Contents

The reservoir structure and its contents will be excavated and removed. The excavation must also be extended both horizontally and vertically in all directions until all significant depths of Made Ground and reworked ground have been excavated and clean soils or reworked soils that are proven to be clean via laboratory analysis are encountered.

Contaminated materials (as per the reuse criteria) shall be either removed from site or processed to make them suitable for reuse onsite subject to the reuse criteria. Any excavated uncontaminated soils may be reused onsite under DoWCoP below the proposed capping layer. The void shall be backfilled with suitable site-won or imported non-organic soils.

Following removal the void shall be inspected and samples must be taken from the base and walls of the excavation and tested for lead, TPH and PAH's to enable validation that the associated contamination has been removed. Should these samples indicate unacceptable concentrations, further removal is required. The excavation must remain open until the laboratory analysis is completed and confirms that the base and sides are not contaminated.

Materials must be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site shall be stored away from imported soils to avoid cross-contamination. Materials to be removed off-site must be classified by carrying out Waste Acceptance Produce (WAP) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

Root Protection Zones

Root Protection Zones are recorded along the southern boundary of the site in close proximity to the area of remediation detailed above. The remedial methodology for these areas has been agreed with the Tree Officer. The remedial excavations will be undertaken up to the line of root protection areas then works shall pause to allow for sampling and analysis of the edge of the excavation. If contamination is still present, then excavation will continue by hand with manual tools in accordance with the methodology stated within the agreed Arboriculture Method Statement ref RC0339 / Chanctonbury Nurseries / Rev 02 / Planning / 07-03-25 to remove contaminated material within the Root Protection Zone and backfilled with clean capping. The process must be supervised by an appointed arboriculture consultant.

A plan showing the Root Protection Zones in relation to the proposed development can be seen within Figure 9.

Clean Capping of Soil

Following confirmation from the laboratory analysis that the base and side of the excavation are not contaminated the resulting void shall be backfilled suitable site-won engineering type fill material. Given the depth of the void the backfill material shall comprise compacted, selected and treated soils that are compliant with the Earthwork Specification (Specification for Highway Works - General Fill), which is not organic in nature to allow for structural stability and to not pose a potential ground gas risk to the residential dwellings. The treatment and testing of the soils will include analysis of Total-Organic content.

The top 150mm of the clean capping shall comprise suitable topsoil for use as a growing medium. It is a requirement that this shall be no less than 100mm thick with subsoil utilised to reach the required 600mm capping.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health, see 'Imported Material' Section 4.8.

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed.

The remediation works shall be validated through a site visit, sampled and photographed by a suitably trained Ground and Water Limited Engineer following the removal, and after placement of the clean soils.

Validation samples of the material proposed for backfill of the reservoir void shall be taken at a ratio of 1 sample per 500m^3 of soil. The top 150mm of the clean caping shall comprise suitable topsoil and due to the design of the proposed development, validation shall be undertaken at a rate of 1 validation trial hole and 1 sample of clean cover per plot.

All stages must be photographed for inclusion within the validation report.

4.1.2. Bund (eastern site boundary)

Trial holes into the bund along the eastern boundary of the site identified it to comprised Made Ground up to ~0.30m bgl over reworked ground. Laboratory analysis of samples retrieved from the bund has identified exceedances of lead in relation to the assessment criteria and asbestos has also been detected.

The extent of the bund does extend into areas proposed for soft-landscaped gardens and some communal soft-landscaped areas. It is therefore proposed as part of the construction that the bund will be removed from gardens and the footprint of properties to facilitate construction. A plan showing the extent of the bund to be removed can be found in Figure 10. Some of the bund is to remain due to the presence of self-seeded trees however this will not form part of the proposed garden areas and will not be accessible to site users/residents. As part of the proposed development the gardens will be fenced off from the bund therefore preventing access. A retaining structure at the base of the fence will separate the garden and bund at low level, thus preventing the bund from becoming part of the gardens at a later date. Access from any communal areas to the bund will again be prevented with the introduction of fences between communal areas and the bund. The remaining bund area will also be controlled by the Management Company appointed to maintain the communal areas. The identified lead and asbestos are located within sections of the bund which will require removal to enable the formation of the gardens and properties. Following the partial removal of the bund to facilitate construction further sampling and analysis across the remaining portions of the bund is required to confirm removal of the identified contamination.

Reuse of any soils relating to the bund is subject to treatment, removal of visible asbestos fragments and the submission and approval of a DoWCoP MMP by a QP and CLAIRE. The reuse of soils from the bund will be limited to beneath the site cover system which will be limited to beneath buildings, hardstanding or appropriate clean capping in gardens/soft-landscaping.

Root Protection Zones

Root Protection Zones are recorded along the eastern boundary of the site in close proximity to the area of remediation detailed above. The remedial methodology for these areas has been agreed with the Tree Officer. The remedial excavations will be undertaken up to the line of root protection areas then works shall pause to allow for sampling and analysis of the edge of the excavation. If contamination is still present, then excavation will continue by hand with manual tools in accordance with the methodology stated within the agreed Arboriculture Method Statement ref RC0339 / Chanctonbury Nurseries / Rev 02 / Planning / 07-03-25 to remove contaminated material within the Root Protection Zone and backfilled with clean capping. The process must be supervised by an appointed arboriculture consultant.

A plan showing the Root Protection Zones in relation to the proposed development can be seen within Figure 9.

4.1.3. Above Surface Tanks and Associated Infrastructure

The former above surface tanks were removed as part of the demolition works. The associated diesel pipeline is to be appropriately decommissioned and removed from site as part of the development works. This process must include the off-site removal of any potentially contaminated liquids, sludges or oil product, as well as any visual or olfactorily contaminated soils that surround the infrastructure. Following removal of the pipeline the underlying soils shall be sampled and analysed to confirm presence/absence of contamination.

Whilst the tanks have already been removed the associated concrete hardstanding is still present and are to be removed as part of the remedial works. Sampling and analysis shall be undertaken beneath the footprint of the slab following its removal.

4.1.4. Additional Pesticide Analysis

The phases of site investigation included laboratory analysis for pesticides. The results identified concentrations of pesticides as generally below the laboratories limit of detection with the exception of P,p'-DDT within HP417/0.10m bgl and HP420/0.10m bgl.

Following removal of Made Ground in this area, to confirm the absence of pesticide impact on the underlying natural soils, additional sampling and analysis shall be undertaken at formation level.

It is recommended that the natural soil formation level, exposed following remediation, below the locations where an exceedance of pesticides was highlighted, is sample and tested. In addition, further samples should be taken 3-5m north, south, east and west from this location.

4.1.5. All Soft-Landscaped Private Garden Areas

It is understood that within the soft-landscaped gardens the remediation contractor proposes to utilise a 600mm clean capping of soil. Based on the available information it is not considered that this is required across the whole site however this proposal provides a conservative approach across all garden areas.

It was therefore proposed that the following remedial methodology must be undertaken within **all private garden areas, including soft landscaping**:

- A 600mm clean capping of soils;
- Validation of the clean capping system by a suitably trained Ground and Water Limited engineer.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

600mm Clean Capping of Soil

The capping system must be at least 600mm in thickness within all garden areas and soft landscaping. The top 150mm of the clean capping shall comprise suitable topsoil for use as a growing medium with subsoil utilised to reach the required 600mm capping.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health. See 'Imported Material' Section 4.8.

Change in Level

In locations where site levels are to be lowered, Made Ground shall be removed from the location to allow the capping of 600mm to be placed. Materials shall be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site shall be stored away from imported soils to avoid cross-contamination. The void shall then be backfilled with 600mm of clean certified soil.

Materials to be removed off-site must be classified by carrying out Waste Acceptance Criteria (WAC) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

If levels are raised, the imported materials must be clean and validated, where the top 600mm within areas of soft landscaping will still need to be covered with a clean capping of soil.

It is understood that it is intended for soils to be reused on site following treatment/processing under a DoWCoP MMP following submission and approval by a QP and CL:AIRE .

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed. Validation holes must prove the depth of the clean cover and enable the sampling of soils. Due to the design of the proposed development, validation must be undertaken at a rate of 1 validation trial hole and 1 sample of clean cover per plot.

4.1.6. Communal Soft-landscaped Areas

It is understood that within the communal soft-landscaped areas the remediation contractor proposes to utilise a 450mm clean capping of soil. Based on the available information it is not considered that this is required across the whole site however this proposal provides a conservative approach across communal areas.

It was therefore proposed that the following remedial methodology shall be undertaken within **all communal soft landscaped areas**:

- A 450mm clean capping of soils;
- Validation of the clean capping system by a suitably trained Ground and Water Limited engineer.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

450mm Clean Capping of Soil

The capping system shall be at least 450mm in thickness within all garden areas and soft landscaping. The top 150mm of the clean capping shall comprise suitable topsoil for use as a growing medium.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health. See 'Imported Material' Section 4.8.

Change in Level

In locations where site levels are to be lowered, Made Ground must be removed from the location to allow the capping of 450mm to be placed. Materials shall be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site shall be stored away from imported soils to avoid cross-contamination. The void shall then be backfilled with 450mm of clean certified soil.

Materials to be removed off-site must be classified by carrying out Waste Acceptance Criteria (WAC) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

If levels are raised, the imported materials must be clean and validated, where the top 450mm within areas of soft landscaping will still need to be covered with a clean capping of soil.

It is understood that it is intended for soils to be reused on site following treatment/processing under a DoWCoP MMP following submission and approval by a QP and CL:AIRE .

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed. Validation holes must prove the depth of the clean cover, inspect quality (free from visible contamination, invasive species or unsuitable material such as brick, timber, glass) and enable the sampling of soils. Due to the design of the proposed development, validation shall be undertaken at a rate of 1 validation trial hole and 1 sample per area of soft-landscaping.

4.1.6.1. Water Supply Pipes

The Water Supply pipe risk assessment indicated that the use of PE pipes is inappropriate at the site due to the concentrations of TPH within the soils. It is therefore required that Metal or Barrier pipes are implemented as part of the design in order to prevent an unacceptable risk to future receptors.

4.1.7. Groundwater

Given the Level 1 risk assessment does not consider dilution, dispersion or attenuation, and the conceptual site model shows the nearest main receptor / compliance point to be the Lancing Brook, 45m south of the site, the fact that the soils on site comprised cohesive clay soils which are considered to impermeable, therefore reducing the risk of contaminants migrating off site, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

4.2. Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation (e.g. underground storage tanks and within bund). Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers must be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

4.3. Material Re-Use

It is understood a remediation contractor is in place and it is intended for soils to be reused on site following treatment/processing under a DoWCoP MMP following submission and approval by a QP and CL:AIRE.

The CL:AIRE Definition of Waste: Development Industry Code of Practice (DoWCoP) allows you to:

- Reuse materials on the Site of Origin.
- Direct use of Clean Naturally Occurring Soil and Mineral Materials on another Development Site (Direct Transfer).
- Cluster Projects – Decontamination Hub site set up to aid the remediation and/or development of a number of site in a relative close proximity.
- Fixed Soil Treatment Facilities.

Materials are only considered to be waste if they are discarded, intended to be discarded or required to be discarded by the holder.

Good practice has three basic steps:

- Ensuring that an adequate Materials Management Plan (MMP) is in place, covering the use of materials on a specific site;
- Ensuring that the MMP is based on an appropriate risk assessment, that underpins the Remediation Strategy or Design Statement, concluding that the objectives of preventing harm to human health and pollution of the environment will be met if materials are used in the proposed manner;
- Ensuring that materials are actually treated and used as set out in the MMP and that this is subsequently demonstrated in a Verification Report.

Soil intended for re-use must be fit for purpose and must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended. It must be tested prior to placing (ideally) or after placing, to ensure that the future receptors (human health and vegetation) cannot come into contact with compounds that could be detrimental to their health. Validation must be undertaken at a rate of 1 validation trial hole per area of soft-landscaping or plot and a sample taken equating to 1 sample per 250m^3 of reused material.

4.4. Imported Materials

It is required that clean soils will be brought onto site as part of the validation works. Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The soil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, prior to placing (ideally) and after placing, to ensure that the future receptors (human health and vegetation) cannot come into contact with compounds that could be detrimental to their health. The compounds that are to be tested for are those given in the Generic Assessment Criteria, which can be viewed in Appendix D of this report.

Chemical analyses must be undertaken at a rate of 1 validation trial hole per plot or area of soft-landscaping and a sample taken equating to 1 sample per $50m^3$ imported for topsoil and 1 per $50m^3$ for subsoil. Validation trial holes must also prove the depth of the clean cover and inspect quality of the material (free from visible contamination, invasive species or unsuitable material such as brick, timber, glass).

4.5. Waste Disposal

The excavation of foundations and other soils is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal, all waste must be classified as either: Inert; Non-hazardous; or Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM3) document outlines the methodology for classifying wastes. Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

January 2024

Following the investigation, 1No. Made Ground, 14No. Weald Clay Formation samples were submitted to the analytical laboratory to undergo a suite of testing for contamination testing. Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all the additional soil samples tested encountered on-site were NON-HAZARDOUS, however these are either natural ground samples across the site and a sample of the bund.

October 2024

Following the October investigation, 7No. Made Ground, 4No. Weald Clay Formation samples were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all the additional soil samples of Made Ground and Weald Clay Formation tested encountered on-site were NON-HAZARDOUS.

Soils containing asbestos are considered HAZARDOUS if the level of asbestos in the Made Ground is above the threshold of 0.1% or visual fragments can be observed.

January 2025

Following the January 2025 investigations, 20No. samples were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all soil samples of Made Ground and reworked ground encountered on-site were NON-HAZARDOUS with the exception of one sample. The sample of infill material from TP406 within the reservoir structure was classified as HAZARDOUS due to the concentrations of lead and zinc.

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM3, therefore producing an initial classification in accordance with the guidance, this method classifies soils as either non-hazardous or hazardous and landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

Where contaminated soils are to be removed, they shall be placed on an impermeable membrane (visqueen or similar) to ensure that no cross-contamination of soils occurs.

4.6. Validation Strategy

Any remedial works undertaken on the site will need to be inspected and independently validated by a Ground and Water Limited Engineer. All remedial excavations will need to be inspected, documented and photographed.

Following completion of all the remediation and validation works outlined above, a report must be submitted to the local authority for approval. The report shall include:

- Photographic evidence of removal of the infilled reservoir and bund
- Full details of the source of the imported soil (company, location, permit)
- Supplier test certificate for any imported clean cover material
- Trial pit logs to confirm ground conditions
- Laboratory analysis results from the independent testing
- Independent confirmation of clean cover thickness

- Copies of Waste Transfer Notes for the removed material.

Full liaison must be made with the statutory authority, prior to the implementation of this method statement and/or the removal of any material from site. All works must be undertaken to meet their full approval.

4.7. Health and Safety

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

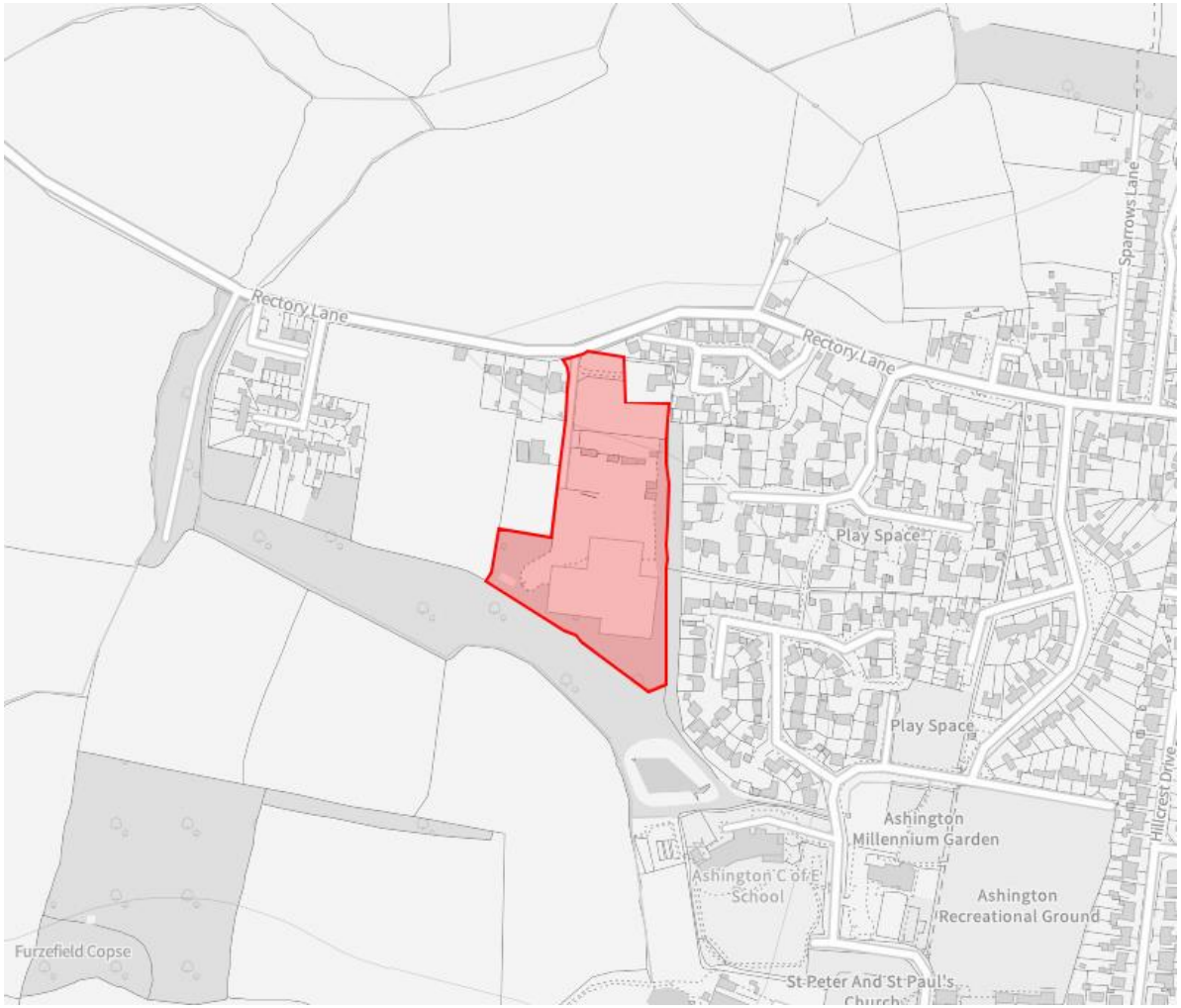
To prevent exposure to airborne dust by both the general public and construction personnel the site shall be kept damp during dry weather and at other times when dust is generated as a result of construction activities.

The site shall be securely fenced at all times to prevent unauthorised access. Washing facilities shall be provided and eating restricted to mess huts.

FIGURES

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001



Site Location

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 1 – Site Location Plan	**GWPR6247**

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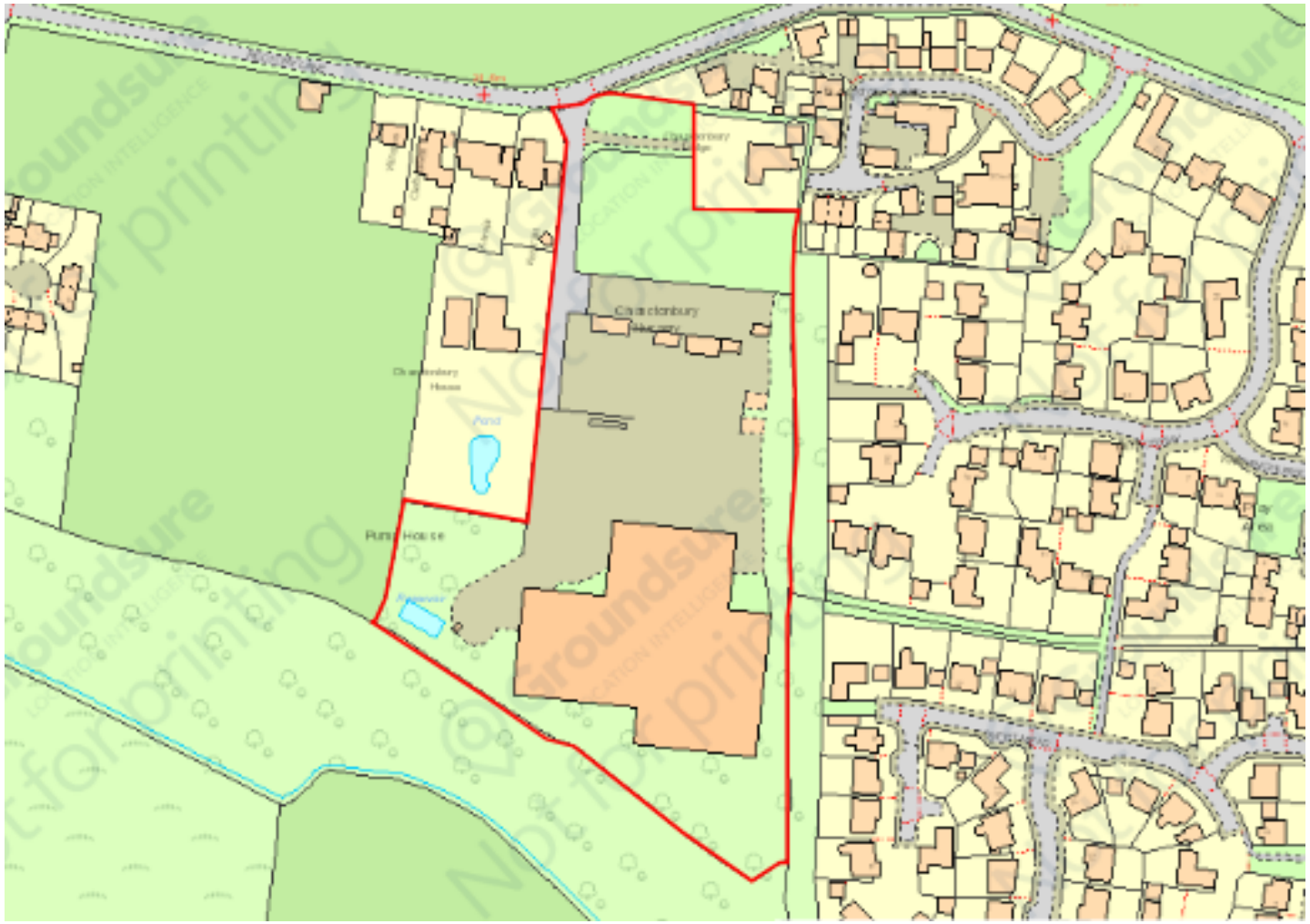

Site Boundary

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 2 – Site Development Area	**GWPR6247**

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Site Boundary

NTS

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 3 – Aerial Photograph	**GWPR6247**

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NTS

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 4 – Proposed site development plan	**GWPR6247**



- Phase 1 Trial Holes (TP1 – TP8)
- Phase 1 Boreholes (WS1 – WS5)
- Phase 2 Trial Holes (TP101 – TP107)
- Phase 3 Boreholes (WS201 – WS206)

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 5 – Trial Hole Location Plan (June 2023, December 2023 and August 2024)	**GWPR6247**

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- Phase 1 Trial Holes (TP1 – TP8)
- Phase 1 Boreholes (WS1 – WS5)
- Phase 2 Trial Holes (TP101 – TP107)
- Phase 3 Boreholes (WS201 – WS206)
- Phase 4 Trial Holes (TP301 – TP309)
- Phase 4 Handpits (WS301 – TP310)

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 6 – Trial Hole Location Plan (October 2024)	**GWPR6247**

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- Phase 1 Trial Holes (TP1 – TP8)
- Phase 1 Boreholes (WS1 – WS5)
- Phase 2 Trial Holes (TP101 – TP107)
- Phase 3 Boreholes (WS201 – WS206)
- Phase 4 Trial Holes (TP301 – TP309)
- Phase 4 Handpits (HP301 – HP310)
- Phase 5 Trial Holes (TP401 – TP408)
- Phase 5 Handpits (HP401 – HP420)
- Phase 5 Boreholes (WS401A – WS402 and WS405)

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS

Elivia Homes (Southern) Limited	**March 2025**
Figure 7 – Trial Hole Location Plan (January 2025)	**GWPR6247**

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Approximate Extent of Reservoir structure

Approximate Potential Extent of Made Ground/Reworked Ground

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 9 – Extent of Reservoir	**GWPR6247**

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Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS

Elivia Homes (Southern) Limited	**March 2025**
Figure 9 – Tree Protection Plan	**GWPR6247**

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Extent of bund to remain

Extent of bund to be removed

Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS	
Elivia Homes (Southern) Limited	**March 2025**
Figure 10 – Extent of Bund Removal	**GWPR6247**

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APPENDIX A: Conditions and Limitations

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The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly, any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist.

The conclusions and recommendations relate to Chanctonbury Nursery, Rectory Lane, Ashington RH20 3AS.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

APPENDIX B: Technical Glossary

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TECHNICAL GLOSSARY

The list of possible definitions within the report may be seen below. Please note that some definitions may not be relevant to this report.

HYDROGEOLOGY:

A **Principal Aquifer** is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Secondary (B) Aquifers consist of deposits with predominantly lower permeability layers with may stoke and yield limited amounts of groundwater due to localised features such as fissures, think permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Aquifers (Undifferentiated) are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both a minor aquifer and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

FLOOD ZONES:

Environment Agency Flood Zone 2, defined as; land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Environment Agency Flood Zone 3 shows the extent of a river flood with a 1 in 100 (1%0 or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

Environment Agency Flood Zone 3 area that benefits from flood defences, defined as; land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year.

GROUNDWATER SOURCE PROTECTION ZONES (SPZS):

Inner Zone (SPZ1): This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.

Outer Zone (SPZ2): This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.

Total Catchment (SPZ3): This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Zone of Special Interest (SPZ4): This zone is where local conditions require additional protection.

IN-SITU STRENGTH GEOTECHNICAL TESTING:

Windowless Sample and/or Cable Percussion and/or Rotary Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50mm and an inside diameter of 35mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. The sample tube is driven 150mm into the ground and then the number of blows needed for the tube to penetrate each 75mm up to a depth of 450mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (SHDP) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).

APPENDIX C: Asbestos Management Strategy

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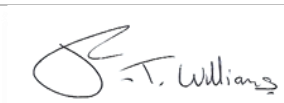
geotechnical and environmental consultants

ground&water

Asbestos Management Strategy

Chactonbury Nursery, Rectory Lane, Ashington RH20 3AS

On behalf of Elivia Homes (Southern) Limited

Report Reference: GWPR6247/AMS/January 2025			Status: Final
Issue	Prepared By	Checked By	Verified By
v.1.01			
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1. Management Plan

The Principal Contractor to be appointed by Elivia Homes, will be responsible for ensuring compliance with this strategy.

The measures outlined in the following sections are designed to ensure that potential contamination does not endanger groundworkers or end-users of the proposed development and those end-users do not come into contact with potentially contaminated materials.

- Further to this asbestos management strategy, on-site induction/toolbox talks should be given to all site workers. These toolbox talks should highlight the site-specific asbestos risks and what procedures should be undertaken to minimise the risk of exposure to workers (e.g. damping down and appropriate PPE use when excavating/disturbing any soils where residual asbestos is present). Any personnel on-site should be made aware of this Asbestos Management Strategy as part of the toolbox talks.
- The site manager and any Ground and Water Limited Engineers/Technicians should have asbestos awareness qualifications.
- Asbestos containing soils must not be reused on-site. Therefore, any soils of the Made Ground containing asbestos that is excavated must be removed to a suitably licensed facility.
- All groundworks where there is excavation/disturbance of the asbestos contaminated Made Ground on-site should be undertaken with sufficient damping down to minimize the production of dust/airborne asbestos fibres. Damping down should be undertaken using a water tanker/bowser/other suitable water supply which can cover the area of excavation/disturbance with a fine spray of water.
- There may be areas of contamination/buried asbestos containing materials (ACMs) that have not been identified during the intrusive investigation. Such occurrences may be discovered during the construction phases for the redevelopment of the site. Groundworkers should be instructed to report to the Site Manager if they encounter any evidence for such contamination.

Should evidence of potential ACM's or fibres be identified during the works then the following procedures should be adopted:

- Upon discovery of suspected ACMs, groundworks within the vicinity should be halted and Ground and Water Limited should be informed such that appropriate remedial measures and health and safety protection may be applied.
- It is considered likely that any further asbestos remediation required on-site will be Non-licensed Non-notifiable Asbestos Activity. Ground and Water Limited Engineers are all non-licensed operatives. However, should pipe lagging or loose fill installation/fibrous materials be encountered, HSE will need to be notified and remediation will need to be undertaken by an appropriately licensed asbestos removal contractor.
- Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.
- It is recommended that in the event of contamination being identified, remedial works are supervised by a Ground and Water Limited Engineer. This will allow for supervision and segregation of the waste produced whilst remedial works are ongoing. This may reduce overall disposal costs.
- Stockpiled materials, destined for removal from site, must be placed on an impermeable liner with raised edge and must be covered at all times.
- Stockpiles will need to be named/assigned to differentiate and their location and size marked.

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- It is recommended a separate skip be brought to site that is designated as the asbestos skip for all contaminated PPE and samples to be disposed in. Given the nature of the works these works are likely to be classified as a Non-licensed Non-notifiable Asbestos Activity. Ground and Water Limited Engineers are all non-licensed operatives.

2. General/Site Safety

General PPE required during the works will be:

- Safety glasses;
- Gloves;
- Hard Hat, safety boots and hi-vis jackets;

Should potential ACMs be encountered then the following PPE would also be required until such point as it can be proven that the asbestos has been successfully remediated:

- Face-Fitted PP3 Particulate Masks;
- 2x 16 – 18L Knapsack Sprayers to minimise dust production during sampling.
- Tyvex suits (Type 6 Minimum) and Shoe covers.

Mobile telephones will be held by designated personnel and these would be used to contact the emergency services in the event of an emergency. Wearing shorts is not allowed.

Should further remediation be necessary, supervision of the work area will be undertaken by a Ground and Water Limited Engineer during works. We have assumed that the Main Contractor will cordon off the working area associated with the remediation.

We have assumed that a suitable water supply will be present on-site to enable damping down of soils and excavations.

All site operatives/personnel will need to comply with site regulations.

3. Sampling

Fragments of suspected cement bound asbestos identified during the works will be double bagged in accordance with the Non-licensed training undertaken. Cement bound debris will be placed within the red plastic bags first and sealed with a swan-neck and zip tie. The red bag will then be placed within an additional white bag with swan neck and zip tie closure.

The double bags will then be placed within the asbestos skips present on-site.

4. Decontamination

At the end of the day, and any subsequent days work, all PPE, including masks, suits and shoe covers, will be double bagged in line with the requirements of the bound asbestos materials and disposed of in the same way.

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5. Dust and Vapours

All groundworks where there is excavation/disturbance of the Made Ground on-site should be undertaken with sufficient damping down to minimize the production of dust/airborne asbestos fibres, this includes damping down of material in buckets and tyres during vehicle movement.

Damping down should be undertaken using a water tanker/bowser/other suitable water supply which can cover the area of excavation/disturbance with a fine spray of water.

APPENDIX D:
Soil
Assessment
Criteria

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Ground and Water Limited

Soil Guideline Values and Generic Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'. At preliminary risk assessment stage, risks are evaluated qualitatively. As the site investigation progresses to a generic or detailed quantitative risk assessment, data is collected and assessment criteria are utilised to evaluate whether the contaminants represent an unacceptable risk to the identified receptors.

1. Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

1) EA Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
2) EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
3) EA CLEA Bulletin (2009).
4) CLEA software version 1.07 (2015)
5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- Do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures;
- Do not cover risks to the environment, such as groundwater, ecosystems or buildings;
- Do not provide a definitive test for telling when human health risks are significant; and
- Are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

1.1. Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models outlined in the following sections.

1.1.1. Residential (with home grown produce) (RwHP)

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small-terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur. (Residential without homegrown produce (RwoHP)).

1.1.2. Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

1.1.3. Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

2. LQM/CIEH Suitable 4 Use Levels (S4UL)

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J., *The LQM/CIEH S4UL's for Human Health Risk Assessment*. **Land Quality Press**. 2015

2.1. S4UL Background

The Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH) S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure,

as calculated by the CLEA software, equals the Health Criteria Value. The S4ULs have been derived for substances based on various generic land use and soil organic matter contents.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

2.2. S4UL Land-use

S4UL's have been derived for the basic CLEA land-uses, as described in section 1.2, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi).
- Public Park (POSpark).

2.2.1. Public Open Spaces near Residential Housing (POSresi)

Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

2.2.2. Public Park (POSpark)

An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visists and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

The following LQM/CIEH S4Uls (Copyright Land Quality Management Limited) have been reproduced with permission, to the publication number S4UL3072.

3. Category 4 Screening Levels (C4SLs)

In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.07 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category

system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

> *"4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:*
> *(a) Land where no relevant contaminant linkage has been established.*
> *(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.*
> *(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.*
> *(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).*
>
> *4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low."*

The C4SLs are intended as "relevant technical tools" (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

> *"The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land."*

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

> *"SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health."*

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

> *"4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a "Category 4: Human Health" case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages."*

C4SLs, therefore, should not be viewed as "SPOSH levels" and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological "minimal risk" interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on "other considerations" (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

4. CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

> CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment.* **Contaminated Land: Applications in the Real Environment**. 2009.

Within this report, Contaminated Land: Applications in Real Environments (CL:AIRE) provided Generic Assessment Criteria (GAC) in accordance with the CLEA software and the principles outlined previously for a further 35 contaminants sometimes encountered on land affected by contamination.

5. SoBRA Acute GAC

The Society of Brownfield Risk Assessment (SoBRA) identified that most human health risk assessments focus on the chronic risks arising from long-term exposure to specific substances. As chronic risks often occur at lower doses than acute risks, they are often the key drivers, however, in some instances the acute dose may also be an important consideration within risk assessments.

The methodology for deriving the acute GAC were related to two distinct receptor groups:

- Members of the public, where the 'critical' receptor for this group will typically be a female child, which is consistent with CLEA residential and Public Open Space/allotments land-uses;
- Workers involved with excavations. The critical receptor for this group is assumed to be a female working adult, without the use of PPE.

The acute GACs relate to short term exposure of high concentrations of a substance that lead to acute effects. They are not considered to be average exposures across a specific / defined area. As a result, the GACs should be normally be compared with the maximum likely concentration that the individual may be exposed to, and not the average concentration within a specific area.

The SoBRA acute GAC will primarily be used for contaminants that do not currently have any GAC, most notably Cyanide.

6. Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

- Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.
- Developing more accurate parameters using site data.

7. Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- BS3882:2015 – *Specification for Topsoil*

The trigger values are relevant only to those contaminants, where present in excess, have the potential to inhibit plant growth, or kill plants (Cu, Ni and Zn). The criteria have been based on a wide range of planting that are common within a multi-purpose topsoil.

8. Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

CL:AIRE published guidance in 2020, *Guidance in comparing soil contamination data with a critical concentration,* superseding the CL:AIRE/CIEH 2008 report of the same name. The guidance provides ways to assist land contamination stakeholders to apply statistical methods to their data to enable decisions under the legislative framework; either planning system or Part 2A of the Environmental Protection Act 1990.

The use of the statistical tests should only be applied if the following statements are valid for the datasets:

- Averaging areas, as well as the smallest area of concern have been identified on the basis of the CSM, including the desk study and/or the site walkover;
- The sample locations were chosen using a simple random, stratified random or stratified systematic (square, herringbone or triangular grid) sampling pattern, rather than being targeted to locations suspected of being contaminated;
- The sample locations are relatively evenly spread across the area and are not clustered, to avoid giving undue weight to some parts of the site over others in the calculated statistics;
- The analyses do not suggest a hotspot or outlier of contamination that should be treated as a separate zone. This has been established by a histogram and/or a names statistical test;
- The sample locations are all taken from one population (i.e. the same material);
- Where an averaging zone encompasses several averaging areas, analyses do not show a spatial trend or other spatial pattern across that zone; and
- The number of samples has been shown to be sufficient for a statistical analysis.

Any included statistical spreadsheet is based on an in-house method of statistical analysis, in line with those outlined within the CL:AIRE guidance (2020).

Treatment of Hot-Spots

- A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

9. Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of the Generic Quantitative Risk Assessment are tabulated in the following pages, where the source of each has been outlined in the previous sections.

9.1. Inorganics

SoBRA – Acute Generic Assessment Criteria						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Cyanide	24	24	24	1400	24	24

9.2. Metals

C4SL Low Level of Toxicological Concern						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Lead	< 200	< 310	< 80	< 2300	< 630	< 1300

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	220
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	130	180	53	980	230	800
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

Phytotoxicity (Harmful to Plants) Threshold Trigger Values			
Determinand	**Soil pH < 6.0 (mg/kg)**	**Soil pH 6.0 – 7.0 (mg/kg)**	**Soil pH > 7.0 (mg/kg)**
Copper	100	135	200
Nickel	60	75	110
Zinc	200	200	300
Notes: BS3882:2015 – *Specification for Topsoil*. Based on a wide range of common plants that will be exposed to multi-purpose topsoil. Toxicity of contaminant may also be impacted by pH of soils. Site observation of plant vitality may give additional guidance.			

CL:AIRE Soil Generic Assessment Criteria				
Determinand	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000
ND – Not derived				

9.3. Total Petroleum Hydrocarbons (TPHs)

9.3.1. BTEX Compounds

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Determinand	**Soil Organic Matter**	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Benzene	1.0% SOM	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	1.0% SOM	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	1.0% SOM	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	1.0% SOM	60	88	28	6600	41000	17000
	2.5% SOM	140	210	67	15000	42000	24000
	6.0% SOM	330	480	160	33000	43000	33000
m-Xylene	1.0% SOM	59	82	31	6200	41000	17000
	2.5% SOM	140	190	74	14000	42000	24000
	6.0% SOM	320	450	170	31000	43000	33000
p-Xylene	1.0% SOM	56	79	29	5900	41000	17000
	2.5% SOM	130	180	69	14000	42000	23000
	6.0% SOM	310	430	160	30000	43000	31000
SOM = Soil Organic Matter Content (%)							

9.3.2. Total Petroleum Hydrocarbons – Aliphatic

LQM/CIEH Suitable 4 Use Levels For TPH							
Aliphatic		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
EC 5-6	1.0% SOM	42	42	730	3,200 (304) [sol]	570,000 (304) [sol]	95,000 (304) [sol]
	2.5% SOM	78	78	1,700	5,900 (558) [sol]	590,000	130,000 (558) [sol]
	6.0% SOM	160	160	3,900	12,000 (1150) [sol]	600,000 (1150)[sol]	180,000 (1150) [sol]
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) [sol]	600,000	150,000 (144) [sol]
	2.5% SOM	230	230	5,600	17,000 (322) [sol]	610,000	220,000 (322) [sol]
	6.0% SOM	530	530	13,000	40,000 (736) [sol]	620,000	320,000 (736) [sol]
EC >8-10	1.0% SOM	27	27	320	2,000 (78) [sol]	13,000	14,000 (78) [sol]
	2.5% SOM	65	65	770	4,800 (118) [vap]	13,000	18,000 (118) [vap]
	6.0% SOM	150	150	1,700	11,000 (451) [vap]	13,000	21,000 (451) [vap]
EC >10-12	1.0% SOM	130 (48) [vap]	130 (48) [vap]	2,200	9,700 (48) [sol]	13,000	21,000 (48) [sol]
	2.5% SOM	330 (118) [vap]	330 (118) [vap]	4,400	23,000 (118) [vap]	13,000	23,000 (118) [vap]
	6.0% SOM	760 (283) [vap]	760 (283) [vap]	7,300	47,000 (283) [vap]	13,000	24,000 (283) [vap]
EC >12-16	1.0% SOM	1,100 (24) [sol]	1,100 (24) [sol]	11,000	59,000 (24) [sol]	13,000	25,000 (24) [sol]
	2.5% SOM	2,400 (59) [sol]	2,400 (59) [sol]	13,000	82,000 (59) [sol]	13,000	25,000 (59) [sol]
	6.0% SOM	4,300 (142) [sol]	4,400 (142) [sol]	13,000	90,000 (142) [sol]	13,000	26,000 (142) [sol]
EC >16-35	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.3.3. Total Petroleum Hydrocarbons – Aromatic

LQM/CIEH Suitable 4 Use Levels For TPH							
Aromatic		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) [sol]	56,000	76,000 (1220 [sol]
	2.5% SOM	140	690	27	46,000 (2260) [sol]	56,000	84,000 (2260) [sol]
	6.0% SOM	300	1,400	57	86,000 (4710) [sol]	56,000	92,000 (4710) [sol]
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) [vap]	56,000	87,000 (869) [sol]
	2.5% SOM	290	1,800	51	110,000 (1920) [sol]	56,000	95,000 (1920) [sol]
	6.0% SOM	660	3,900	120	180,000 (4360) [vap]	56,000	100,000 (4360) [vap]
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) [vap]	5,000	7,200 (613) [vap]
	2.5% SOM	83	110	21	8,100 (1500) [vap]	5,000	8,500 (1500) [vap]
	6.0% SOM	190	270	51	17,000 (3850) [vap]	5,000	9,300 (3580) [vap]
EC >10-12	1.0% SOM	74	250	13	16,000 (364) [sol]	5,000	9,200 (364) [sol]
	2.5% SOM	180	590	31	28,000 (899) [sol]	5,000	9,700 (889) [sol]
	6.0% SOM	380	1,200	74	34,000 (2150) [sol]	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) [sol]	5,100	10,000
	2.5% SOM	330	2,300 (419) [sol]	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.4. Polycyclic Aromatic Hydrocarbons (PAHs)

LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAHs)							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Acenapthene	1.0% SOM	210	3,000 (57.0) [sol]	34	84,000(57.0) [sol]	15,000	29,000
	2.5% SOM	510	4,700(141) [sol]	85	97,000(141) [sol]	15,000	30,000
	6.0% SOM	1100	6,000(336) [sol]	200	100,000	15,000	30,000
Acenapthylene	1.0% SOM	170	2,900(86.1) [sol]	28	83,000(86.1) [sol]	15,000	29,000
	2.5% SOM	420	4,600(212) [sol]	69	97,000(212) [sol]	15,000	30,000
	6.0% SOM	920	6,000(506) [sol]	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) [vap]	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)flouranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)flouranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.50	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40
Flouranthene	1.0% SOM	280	1,500	52	23,000	3,100	6,300
	2.5% SOM	560	1,600	130	23,000	3,100	6,300
	6.0% SOM	890	1,600	290	23,000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) [sol]	27	63,000(30.9) [sol]	9,900	20,000
	2.5% SOM	400	3,800(76.5) [sol]	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) [sol]	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	15	36	65	1,600	11,000	800
	2.5% SOM	36	36	130	3,700	15,000	1,200
	6.0% SOM	85	85	200	8,400	17,000	1,900
Phenanthrene	1.0% SOM	95	1,300(183) [sol]	15	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound)	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.5. Volatile and Semi-volatile Organic Compounds

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Chloroalkanes & alkenes							
1,2 Dichloroethane	1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
	2.5% SOM	0.011	0.013	0.0083	0.97	29	24
	6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane	1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
	2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
	6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane	1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
	2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
	6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene	1.0% SOM	0.18	0.18	0.65	19	1,400	810 [sol](424)
	2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 [sol](951)
	6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane	1.0% SOM	8.80	9.00	48	660	140,000	57,000 [vap](1425)
	2.5% SOM	18	18	110	1,300	140,000	76,000 [vap](2915)
	6.0% SOM	39	40	240	3,000	140,000	100,000 [vap] (6392)
Tetrachloromethene	1.0% SOM	0.026	0.026	0.45	2.90	890	190
	2.5% SOM	0.056	0.056	1.00	6.30	920	270
	6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene	1.0% SOM	0.016	0.017	0.041	1.20	120	70
	2.5% SOM	0.034	0.036	0.091	2.60	120	91
	6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane	1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
	2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
	6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride	1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
	2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
	6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40
Explosives							
2,4,6 Trinitrotoluene	1.0% SOM	1.60	65	0.24	1,000	130	260
	2.5% SOM	3.70	66	0.58	1,000	130	270
	6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7)[sol]
	2.5% SOM	250	13,000	38	210,000	26,000	51,000
	6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35)[vap]
	2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39)[vap]
	6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48)[vap]
Atrazine	1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
	2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
	6.0% SOM	17.40	620	2.70	9,400	1,200	2,400

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Pesticides							
Aldrin	1.0% SOM	5.70	7.30	3.20	170	18	30
	2.5% SOM	6.60	7.40	6.10	170	18	31
	6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin	1.0% SOM	0.97	7.00	0.17	170	18	30
	2.5% SOM	2.00	7.30	0.41	170	18	30
	6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos	1.0% SOM	0.032	6.40	0.0049	140	16	26
	2.5% SOM	0.066	6.50	0.0100	140	16	26
	6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan	1.0% SOM	7.40	160(0.003)[vap]	1.20	5,600(0.003)[vap]	1,200	2,400
	2.5% SOM	18	280(0.007)[vap]	2.90	7,400(0.007)[vap]	1,200	2,400
	6.0% SOM	41	410(0.016)[vap]	6.80	8,400(0.016)[vap]	1,200	2,400
Beta - Endosulfan	1.0% SOM	7.00	190(0.00007)[vap]	1.10	6,300(0.00007)[vap]	1,200	2,400
	2.5% SOM	17	320(0.0002)[vap]	2.70	7,800(0.0002)[vap]	1,200	2,400
	6.0% SOM	39	440(0.0004)[vap]	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes	1.0% SOM	0.23	6.90	0.035	170	24	47
	2.5% SOM	0.55	9.20	0.087	180	24	48
	6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes	1.0% SOM	0.085	3.70	0.013	65	8.10	15
	2.5% SOM	0.200	3.80	0.032	65	8.10	15
	6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes	1.0% SOM	0.06	2.90	0.0092	67	8.2	14
	2.5% SOM	0.14	3.30	0.0230	69	8.2	15
	6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes							
Chlorobenzene	1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675)[sol]
	2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520)[sol]
	6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene	1.0% SOM	23	24	94	2,000 (571) [sol]	90,000	24,000(571)[sol]
	2.5% SOM	55	57	230	4,800 (1370) [sol]	95,000	36,000(1370)[sol]
	6.0% SOM	130	130	540	11,000 (3240) [sol]	98,000	51,000(3240)[sol]
1,3-Dichlorobenzene	1.0% SOM	0.40	0.44	0.25	30	300	390
	2.5% SOM	1.00	1.10	0.60	73	300	440
	6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene	1.0% SOM	61	61	15	4,400 (224)[vap]	17,000[g]	36,000 (224)[vap]
	2.5% SOM	150	150	37	10,000 (540)[vap]	17,000[g]	36,000 (540)[vap]
	6.0% SOM	350	350	88[g]	25,000 (1280)[vap]	17,000[g]	36,000 (1280)[vap]
1,2,3,-Trichlorobenzene	1.0% SOM	1.50	1.50	4.70	102	1,800	770(134)[vap]
	2.5% SOM	3.60	3.70	12	250	1,800	1,100(330)[vap]
	6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)[vap]
1,2,4,-Trichlorobenzene	1.0% SOM	2.60	2.60	55	220	15,000	1,700(318)[vap]
	2.5% SOM	6.40	6.40	140	530	17,000	2,600(786)[vap]
	6.0% SOM	15	15	320	1,300	19,000	4,000(1880)[vap]
1,3,5,-Trichlorobenzene	1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7)[vap]
	2.5% SOM	0.81	0.81	12	55	1,700	590(90.8)[vap]
	6.0% SOM	1.90	1.90	140	130	1,800	860(217)[vap]

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Chlorobenzenes (cont.)							
1,2,3,4,- Tetrachlorobenzene	1.0% SOM	15	24	4.40	1,700(122)^{vap}	830	1,500(122)^{vap}
	2.5% SOM	36	56	11	3,080(304)^{vap}	830	1,600
	6.0% SOM	78	120	26	4,400(728)^{vap}	830	1,600
1,2,3,5,- Tetrachlobenzene	1.0% SOM	0.66	0.75	0.38	49(39.4)^{vap}	78	110(39)^{vap}
	2.5% SOM	1.60	1.90	0.90	120(98.1)^{vap}	79	120
	6.0% SOM	3.70	4.30	2.20	240(235)^{vap}	79	130
1,2,4, 5,- Tetrachlobenzene	1.0% SOM	0.33	0.73	0.06	42(19.7)^{sol}	13	25
	2.5% SOM	0.77	1.70	0.16	72(49.1)^{sol}	13	26
	6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlrobenzene	1.0% SOM	5.80	19	1.20	640(43.0)^{sol}	100	190
	2.5% SOM	12	30	3.10	770(107)^{sol}	100	190
	6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene	1.0% SOM	1.80(0.20)^{vap}	4.10 (0.20)^{vap}	0.47	110(0.20)^{vap}	16	30
	2.5% SOM	3.30(0.50)^{vap}	5.70 (0.50)^{vap}	1.10	120	16	30
	6.0% SOM	4.90	6.70 (1.2)^{vap}	2.50	120	16	30
Phenols & Chlorophenols							
BTEX	1.0% SOM	280	750	66	760^{dir}(31,000)	760^{dir}(11,000)	760^{dir}(8,600)
	2.5% SOM	550	1,300	140	1,500^{dir}(35,000)	1,500^{dir}(11,000)	1,500^{dir}(9,700)
	6.0% SOM	1100	2,300	280	3,200^{dir}(37,000)	3,200^{dir}(11,000)	3,200^{dir}(11,000)
Chlorophenols (4 Congeners)	1.0% SOM	0.87	94	0.13	3,500	620	1,100
	2.5% SOM	2.00	150	0.30	4,000	620	1,100
	6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols	1.0% SOM	0.22	27(16.4)^{vap}	0.03	400	60	110
	2.5% SOM	0.52	29	0.08	400	60	120
	6.0% SOM	1.20	31	0.19	400	60	120
Others							
Carbon Disulphide	1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
	2.5% SOM	0.29	0.29	10	22	11,000	1,900
	6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3-Butadiene	1.0% SOM	0.29	0.32	0.25	31	25	48
	2.5% SOM	0.70	0.78	0.61	68	25	50
	6.0% SOM	1.60	1.80	1.40	120	25	51
^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets. ^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.							

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds					
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
1,1,2 Trichloroethane	1.0% SOM	0.60	0.88	0.28	94
	2.5% SOM	1.20	1.8	0.61	190
	6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane	1.0% SOM	2.40	2.50	9.20	280
	2.5% SOM	3.90	4.10	17	450
	6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene	1.0% SOM	0.23	0.23	2.80	26
	2.5% SOM	0.40	0.41	5.60	46
	6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene	1.0% SOM	0.35	0.41	0.38	42
	2.5% SOM	0.85	0.99	0.93	99
	6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane	1.0% SOM	0.024	0.024	0.62	3.3
	2.5% SOM	0.042	0.042	1.20	5.9
	6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol	1.0% SOM	19	210	3.10	16000*
	2.5% SOM	43	410	7.20	24000*
	6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene	1.0% SOM	1.50	170*	0.22	3700*
	2.5% SOM	3.20	170	0.49	3700*
	6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene	1.0% SOM	0.78	78	0.12	1900*
	2.5% SOM	1.70	84	0.27	1900*
	6.0% SOM	3.90	87	0.61	1900*
2-Chloronapthalene	1.0% SOM	3.70	3.80	40	390*
	2.5% SOM	9.20	9.30	98	960*
	6.0% SOM	22	22	230	2200*
Biphenyl	1.0% SOM	66*	220*	14	18000*
	2.5% SOM	160	500*	35	33000*
	6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate	1.0% SOM	280*	2700*	47*	85000*
	2.5% SOM	610*	2800*	120*	86000*
	6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene	1.0% SOM	0.87	0.91	3.2	97
	2.5% SOM	2.0	2.1	7.6	220
	6.0% SOM	4.7	4.9	18	520
Bromodichloromethane	1.0% SOM	0.016	0.019	0.016	2.1
	2.5% SOM	0.030	0.034	0.032	3.7
	6.0% SOM	0.061	0.070	0.068	7.6
Bromoform	1.0% SOM	2.8	5.2	0.95	760
	2.5% SOM	5.9	11	2.1	1500
	6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate	1.0% SOM	1400*	42000*	220*	940000*
	2.5% SOM	3300*	44000*	550*	940000*
	6.0% SOM	7200*	44000*	1300*	950000*

*soil concentration above saturation limit

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds					
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Chloroethane	1.0% SOM	8.3	8.4	110	960
	2.5% SOM	11	11	200	1300
	6.0% SOM	18	18	380	2100
Chloromethane	1.0% SOM	0.0083	0.0085	0.066	1.0
	2.5% SOM	0.0098	0.0099	0.13	1.2
	6.0% SOM	0.013	0.013	0.23	1.6
***Cis* 1,2 Dichloroethene**	1.0% SOM	0.11	0.12	0.26	14
	2.5% SOM	0.19	0.20	0.50	24
	6.0% SOM	0.37	0.39	1.0	47
Dichloromethane	1.0% SOM	0.58	2.10	0.10	270
	2.5% SOM	0.98	2.80	0.19	360
	6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate	1.0% SOM	120*	1800*	19*	150000*
	2.5% SOM	260*	3500*	41*	220000*
	6.0% SOM	570*	6300*	94*	290000*
Di-*n*-butyl phthalate	1.0% SOM	13*	450*	2.00	15000*
	2.5% SOM	31*	450*	5.00	15000*
	6.0% SOM	67*	450*	12	15000*
Di-*n*-octyl phthalate	1.0% SOM	2300*	3400*	940*	89000*
	2.5% SOM	2800*	3400*	2100*	89000*
	6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane	1.0% SOM	0.20	0.22	0.27	22*
	2.5% SOM	0.48	0.54	0.67	53*
	6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene	1.0% SOM	11	12	32	1400*
	2.5% SOM	27	28	79	3300*
	6.0% SOM	64	67	190	7700*
Methyl *tert*-butyl ether (MTBE)	1.0% SOM	49	73	23	7900
	2.5% SOM	84	120	44	13000
	6.0% SOM	160	220	90	24000
Propylbenzene	1.0% SOM	34	40	34	4100*
	2.5% SOM	82	97	83	9700*
	6.0% SOM	190	230	200	21000*
Styrene	1.0% SOM	8.10	35	1.60	3300*
	2.5% SOM	19	78	3.70	6500*
	6.0% SOM	43	170	8.70	11000*
Total Cresols (2-, 3-, and 4-methylphenol)	1.0% SOM	80	3700	12	160000
	2.5% SOM	180	5400	27	180000*
	6.0% SOM	400	6900	63	180000*
***Trans* 1,2 Dichloroethene**	1.0% SOM	0.19	0.19	0.93	22
	2.5% SOM	0.34	0.35	1.90	40
	6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide	1.0% SOM	0.25	1.40	0.042	130*
	2.5% SOM	0.59	3.10	0.100	180*
	6.0% SOM	1.30	5.70	0.240	200*

*soil concentration above saturation limit

C4SL Low Level of Toxicological Concern							
Determinands		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
1,2-Dichloroethane (Ethylene Dichloride)	1.0% SOM	0.11	0.16	0.054	12	300	300
	2.5% SOM	0.18	0.24	0.10	17	310	330
	6.0% SOM	0.31	0.41	0.19	29	310	380
Cis-1,2-Dichloroethene	1.0% SOM	0.46	0.50	0.89	38	3,800	2,000
	2.5% SOM	0.78	0.84	1.7	64	3,800	2,400
	6.0% SOM	1.5	1.6	3.6	120	3,900	3,100
Tetrachloroethene (PCE)	1.0% SOM	0.31	0.32	2	24	3,200	1,400
	2.5% SOM	0.70	0.71	4.8	55	3,300	1,900
	6.0% SOM	1.60	1.60	11	130	3,400	2,500
Trans-1,2-Dichloroethene	1.0% SOM	0.90	0.93	3.70	69	13,000	5,600
	2.5% SOM	1.60	1.70	7.50	120	13,000	7,000
	6.0% SOM	3.30	3.40	16	260	13,000	9,100
Trichloroethene (TCE)	1.0% SOM	0.0093	0.0097	0.032	0.73	76	41
	2.5% SOM	0.020	0.020	0.072	1.5	78	54
	6.0% SOM	0.043	0.045	0.16	3.4	79	69
Vinyl Chloride (Chloroethene)	1.0% SOM	0.0064	0.015	0.0017	1.1	7.8	18
	2.5% SOM	0.010	0.019	0.0031	1.4	7.8	19
	6.0% SOM	0.017	0.029	0.0058	2.2	7.8	19

9.6. Asbestos

No asbestos or asbestos containing materials (ACM's) are considered acceptable on-site from a human health perspective. Therefore the GAC for asbestos & ACM's within any imported material should be none detected (ND).