



Remediation Strategy Supplementary Investigation Report

at

Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ

for

Crayfern Homes

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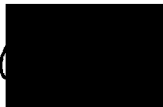
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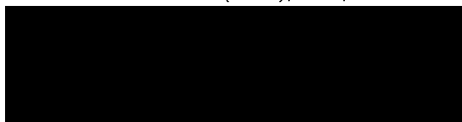
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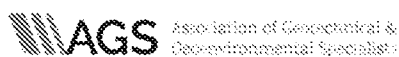
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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person 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.



Commission

Soils Limited was commissioned by Crayfern Homes to undertake an intrusive ground investigation and prepare a Remediation Strategy Supplementary Investigation Report on a site known as land at Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ. The scope of the investigation was outlined in the Soils Limited quotation reference Q23474, dated 23rd September 2020.

This document comprises the Remediation Strategy Supplementary Investigation Report and incorporates the results, discussion and conclusions to the Remediation Strategy Supplementary Investigation Intrusive Works.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 10175:2011+A2:2017 - Investigation of potentially contaminated sites
- NHBC Standards 2019

The chemical analyses were undertaken by Derwentside Environmental Testing Services in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

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

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Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Crayfern Homes to undertake an intrusive ground investigation and to prepare a Remediation Strategy Supplementary Investigation Report to supply the client and their designers with information regarding ground conditions in the Cinders Lane Phase II area. The area considered in this report, being occupied and in use at the time of the initial investigations, had not previously been investigated by Soils Limited, but lies directly south and adjacent to the area formerly known as Cinders Nursery, which had been subject to intensive investigation by Soils Limited (Ref: 17926 dated November 2019 and 17034/MIR/Rev1.01 dated August 2018). On this basis a supplementary investigation was commissioned for this site by the Client to advise if remediation would be required on this site, given the findings of the investigations in the adjacent areas.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination.

I.2 Location

The site was located at Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ and had an approximate O.S Land Ranger Grid Reference of SU 980 025.

The site location plan is given in Figure 1.

I.3 Site Description

At the time of this investigation in October 2020, the site had been cleared and was open undeveloped ground. No evidence of the former buildings was noted on site.

An aerial photograph of the site and its close environs taken prior to clearance has been included in Figure 2.

I.4 Proposed Development

The proposed residential development comprised 10 No. properties including detached and semi-detached houses and a single small apartment block. Soft landscaping includes private gardens, informal open space and allotments. Hard landscaping includes access roads, parking and storage areas.

In compiling this report reliance was placed on a drawing provided by the Client named Land at Southern End of Cinders Lane dated Jan 20 ref: 97.17.P100 B. Any change or deviation from the scheme outlined in the drawing could invalidate the remediation

recommendations presented within this report. Soils Limited must be notified about any such changes. The development plans provided by the client are presented in Appendix C.

1.5 Anticipated Geology

The 1:50,000 BGS map was revisited for this investigation and showed the site to be located upon the bedrock Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (Undifferentiated) hereafter referred to as the White Chalk Subgroup with overlying superficial River Terrace Deposits.

1.5.1 River Terrace Deposits

River Terrace Deposits are superficial deposits of Quaternary age that lie along the margins of rivers and are predominantly found in the southern part of West Sussex, along the coastal plain and are typically less than 10m thick. The composition of the River Terrace Gravel varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sands and gravels of roughly bedded flint or chert gravels commonly in a matrix of silts and clays. In West Sussex the rivers flow mainly south over the Weald Clay, which contains some sandstones and limestone that could be incorporated into the river gravel.

1.5.2 White Chalk Subgroup

The White Chalk Subgroup typically comprises chalk with flints, locally with discrete marl seams, nodular chalk, sponge-rich and flint seams throughout. Typology of flints and incidence of marl seams is important for correlation.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually in-filled with drift deposits, are found in the chalk. The features sometimes manifest themselves at the surface as shallow circular depressions. Solution features may be reactivated by the concentrated ingress of water from leaking drains or soakaways. Reactivation may lead to surface collapse.

1.6 Limitations and Disclaimers

This Remediation Strategy Supplementary Report relates to the site located at Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ and was prepared for the sole benefit of Crayfern Homes (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General

Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

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 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.

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.

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. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not

address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

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

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to supply the client and their designers with information regarding environmental ground conditions and suitability of use of extant site materials across the Phase II site area in light of the proposed development. The intended investigation, as outlined within the Soils Limited quotation (Q23474, dated 23rd September 2020), was to comprise the following items:

- 10 No up to 1m deep windowless sampler boreholes
- Contamination laboratory testing

2.1.1 Actual Project Works

The actual project works were undertaken on 22nd October 2020 and comprised:

- 10 No 1m deep windowless sampler boreholes
- Contamination laboratory testing

All locations were backfilled with arisings on completion.

No geotechnical analysis or testing was commissioned for this investigation.

All trial hole locations from this investigation have been presented in Figure 3.

Following completion of site works, samples were forwarded to the laboratory for contamination testing.

2.2 Ground Conditions

On 22nd October 2020 ten windowless sampler boreholes (WS1 – WS10) were drilled, using a tracked windowless sampler rig, to depths of 1.00m below the then local ground level at locations selected by Soils Limited using a development plan provided by the Client.

Locations were chosen to give both a reasonable coverage of the site as a whole but also to concentrate on proposed garden and open areas for preference as these would be considered the highest risk sections of the site on development.

The maximum depths of trial holes have been included in

Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)
WSI – WS10	1.00
Note:	

The approximate trial hole locations are shown on Figure 3 superimposed on the proposed development plan provided by the Client.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as:

Made Ground/Topsoil (MG/TS)
River Terrace Deposits (RTD)
White Chalk Subgroup (WHCK)

The ground conditions encountered in the trial holes are summarised in Table 2.2 .

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Anthropocene	GL	0.15-0.50	0.30	Firm greyish brown, slightly sandy, slightly gravelly CLAY with brick, flint and clinker.
TS	Anthropocene	GL	0.20	0.20	Firm, greyish brown, slightly sandy, SILT. Frequent rootlets.
RTD	Quaternary	0.15-0.50	1.00 ¹	1.00 ²	Firm, slightly greyish brown and brown mottled, yellowish brown, slightly sandy, silty CLAY with very rare sub-angular fine flint gravel.
WHCK	Cenomanian to Maastrichtian				Not encountered during this investigation
Note: ¹ Final depth of trial hole. ² Base of strata not encountered					

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Made Ground / Topsoil

Soils described as Made Ground were encountered in nine of the ten trial holes from ground level to depths ranging between 0.15 (WS5) and 0.50m bgl (WS10).

The Made Ground typically comprised firm greyish brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to sub-angular, fine to coarse brick, flint and clinker. Frequent rootlets.

Topsoil was only encountered at one location (WS3) to 0.20m bgl. It comprised firm, greyish brown, slightly sandy, SILT. Frequent rootlets.

The depths of Made Ground and Topsoil have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground / Topsoil

<i>Trial Hole</i>	<i>Type</i>	<i>Depth (m bgl)</i>
WS1	MG	0.2
WS2	MG	0.15
WS3	TS	0.20
WS4	MG	0.3
WS5	MG	0.15
WS6	MG	0.3
WS7	MG	0.45
WS8	MG	0.35
WS9	MG	0.2
WS10	MG	0.5

Notes: MG = Made Ground, TS = Topsoil

2.3.2 River Terrace Deposits

River Terrace deposits were encountered at all ten locations to final depth at 1.00m bgl. The River Terrace Deposits were generally described as firm, slightly greyish brown and brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium. Frequent rootlets. Occasional black speckling. Very rare sub-angular fine flint gravel.

The depth of River Terrace Deposits has been included in Table 2.4.

Table 2.4 Final Depth of River Terrace Deposits

Trial Hole	Depth (m bgl)
WS1	1.00 ¹
WS2	1.00 ¹
WS3	1.00 ¹
WS4	1.00 ¹
WS5	1.00 ¹
WS6	1.00 ¹
WS7	1.00 ¹
WS8	1.00 ¹
WS9	1.00 ¹
WS10	1.00 ¹
Note: ¹ Final depth of trial hole.	

2.3.3 White Chalk Subgroup

Soils of the White Chalk Subgroup were not encountered during this investigation, but is recorded locally from previous investigations at the adjacent site to the north (Cinders Lane Nursery) as being present from depths between 2.40-4.85m bgl.

2.4 Roots

Roots / rootlets were encountered in all ten locations to depths of up to 1.00m across the site. Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

2.5 Groundwater

Groundwater was not encountered during this investigation due to the shallowness of the excavations. The investigation was conducted in October (2020), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

Groundwater equilibrium conditions at the adjacent site were established through a period of monitoring undertaken between September 2018 and March 2019 as noted and reported in Soils Limited Letter Report, ref: 17034/GW, dated April 2019.

Section 3 Determination of Chemical Analysis

3.1 Site Characterisation and Revised Conceptual Site Model

Reports undertaken previously regarding the adjacent site to the north had not indicated any significant off-site sources relevant to either the Phase I or the Phase II sites and the investigations undertaken by Soils Limited had also not indicated any evidence of significant on or off-site sources or required modification of the conceptual site model to account for either the Phase I or Phase II sites as potential sources.

The Remediation Strategy Supplementary Investigation, post demolition and clearance, identified Made Ground to depths between 0.15m and 0.50m bgl. The Made Ground is slightly different reflecting the different site history and nature of the buildings and hard cover over the majority of the site when compared with the Nursery area to the north. Made Ground at Phase II was generally comprised of firm greyish brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to sub-angular, fine to coarse brick, flint and clinker with frequent rootlets.

No visible evidence of potential hydrocarbon staining, fibrous or distinctly coloured materials were identified in the logs or samples, though possible asbestos containing materials (ACM) as surface wastes (sheet type, probably chrysotile or amosite) were observed near WS10 by the asbestos aware technician at the time of the investigation and details forwarded to the Client. Superficial River Terrace Deposits were encountered underlying the Made Ground at all locations and no groundwater was encountered.

3.2 Soil Sampling

A non-targeted sampling strategy is appropriate when there is:

- No adequate information available regarding the likely locations of contamination
- No sensitive areas where there is a need for a high degree of confidence

A targeted sampling strategy is appropriate when there is:

- Adequate information available regarding the likely locations of contamination
- Sensitive areas where there is a need for a high degree of confidence

Options appraisal and review of existing data from the adjacent site had not identified any additional sources and to ensure appropriate coverage a non-targeted sampling pattern was adopted in this case. However, locations were concentrated on areas of garden and open spaces where the greatest potential exposure risk had been identified and on samples of Made Ground as this was seen as the greatest potential source of contamination.

3.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from previous investigations at the Phase I site, as no additional potential sources were identified for Phase II during the appraisal and review. As such and to allow comparison with Phase I data, all samples during this investigation were analysed for the same analytical suite as used during the previous investigations thereby comprising an asbestos screen, a range of industrial metals, semi-metals and metalloids, pH, organic content, banded hydrocarbons phenols and PAH's.

Section 4 Qualitative Risk Assessment

4.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix B.22.

4.2 Representative Contamination Criteria - Soil

The proposed residential development comprised 10 No. properties including detached and semi-detached houses and a single small apartment block. Soft landscaping includes private gardens, informal open space and allotments. Hard landscaping includes access roads, parking and storage areas.

In compiling this report reliance was placed on a drawing provided by the Client named Land at Southern End of Cinders Lane dated Jan 20 ref: 97.17.P100 B. Any change or deviation from the scheme outlined in the drawing could invalidate the remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

The chemical laboratory results were compared against the representative contaminants concentration for human health receptor to Soil Guideline Values (SGV), Category 4 Screening Levels (C4SL's) or Suitable 4 Use Level (S4UL) assuming a residential with plant uptake land use scenario.

Table 4.1 outlines the samples that have exceeded their relevant assessment criteria for this investigation. The full laboratory report is presented in Appendix B.11.

Table 4.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'Residential' with plant uptake land-use scenario
PAHs	Di-benzo(a,h)anthracene 0.3mg/kg against 0.28mg/kg – WS6 0.15m (S4UL)
Asbestos locations where material found (no threshold just presence)	
None Detected	

The guideline values are assessed initially against the **Residential with plant uptake** land-use scenario, which was considered the most appropriate and conservative land-use scenario, given the type of the proposed redevelopment.

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for, Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed SOM values of between 1.5% and 4.6%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

In summary, for this investigation one of the samples tested (WS6 0.15m bgl) showed a technical concentration in excess of the relevant S4UL for a residential land-use scenario (0.30mg/kg against 0.28mg/kg). However, it should be noted that the variance for analysis of organic materials under MCerts accredited analysis is +/-25% and the result is within 10% of the generic value and on this basis as the only exceedance cannot be significant.

None of the other substances tested recorded concentrations above the most conservative residential with plant uptake end-use screening values and, as with the Phase I Investigations, no asbestos was detected in any sample analysed. Unlike the Phase I investigation, no significant outlier values were noted and no lead or metal exceedances, probably reflecting the fact that the Phase II site was not part of the nursery area and has therefore never had greenhouses on it which may be a source of metals including lead.

Results of PAH ratio analysis suggests samples with elevated total levels (WS6 0.15m and WS10 0.25m) are the result of coal organic based materials. Given the history of the site and the extensive hard standing historically present and the recent site clearance, this is probably a relict fragment of older coal-tar based tarmac, ash/clinker or tar (often used in roofing) in the sample and are not indicative of any systematic contamination of the site or hotspots. Tarmac as the source would also explain the noted in the samples evidencing slightly elevated levels of TPH which are heavily biased towards the heavier C16+ ranges in these samples. This and the lack of any significant increases in metals tends to contraindicate paint or other potential sources such as might arise from the former greenhouses on Phase I. Similar outliers, ascribed to the same tarmac source, were also noted in the Phase I investigations.

Statistical analysis of the results of this investigation has been undertaken in line with current guidance (updated and re-issued earlier this year) and related to current generic UK guidance values. The results of the statistical analysis of the 10no samples indicated no evidence of any systematic contamination for any of the analysed parameters as either average or US95 results in relation to a proposed residential with plant uptake end use and identified no significant outliers.

4.2.1 Asbestos

No Asbestos Containing Material (ACM) or asbestos in soil was detected within any of the samples analysed and in this regard this finding mirrors the findings of the Phase 1 investigations.

However, given the site history and the site observations, it is still possible that asbestos is present in other areas of the site. If encountered, care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

4.3 Risk to Groundwater

Risk to groundwater was not directly assessed as part of this investigation and no groundwater was encountered at any location. The site is underlain by a Secondary A Aquifer (River Terrace Deposits) and Principal Aquifer (White Chalk Subgroup) at depth, both of which have been confirmed in Phase I investigations. The site was not located within a Source Protection Zone (SPZ) and no abstractions were recorded within 1km. However, the superficial deposits and Made Ground encountered during the Investigation were predominately cohesive in nature with very low permeability as evidenced by the log descriptions essentially acting as an aquitard even assuming a potential source is present in any remaining Made Ground.

4.4 Tier I Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil, groundwater and soil gas, but no CSM has been created as no significant sources or pathways have been identified to date. The full laboratory chemical report is presented in Appendix B.1.

4.4.1 Soils

Only one of the samples tested (WS6 0.15m) showed concentration for a single PAH's in excess of the relevant generic guidance values for a residential with plant uptake land-use scenario, as outlined and detailed in Section 4.2 of this report. This is similar to other noted exceedances during the Phase I investigations and ascribed to relict tarmac. In addition, the result of this single exceedance is not beyond the analytical error associated with the analysis and therefore cannot be significant and likewise in the context of the statistical analysis of the data set.

The Tier 1 Quantitative risk assessment has therefore established that there is low to negligible risk to the human health receptors of construction workers or future end-users and no remediation strategy is considered necessary.

4.4.2 Groundwater

The Groundwater Risk Assessment has established that there is a low to negligible risk to the identified groundwater receptor at depth, assuming a pathway is actually present.

4.4.3 Soil Gas

No significant potential sources of soil gas have been identified in proximity to the site and risk is therefore considered low to negligible by default. However, a potential risk could be identified from Made Ground with up to 4.6% organic content in parts were it not for the shallowness of the strata (0.50m or less), a lack of any obviously putrescible or deleterious materials noted in the investigations to date and the proximity of the Made Ground to atmosphere to which it can freely vent.

4.5 Remedial Objective

Soil chemical analysis from this investigation recorded only one exceedance of generic

guidance values and this is not considered significant in context and is probably due to contamination of the sample with relict coal-tar based tarmac as on Phase I.

The remedial objective for any site is to ensure site clean-up removes any unacceptable risk to the identified receptors. In essence the remedial objective should sever any source-pathway-receptor pollutant linkages that have been established. Once this has been achieved, by whatever means, there can theoretically be no risk. On the basis of no sources being identified on site, no pathways can be significant and risk to receptors is low to negligible by default and no remediation is necessary.

4.6 Development of Soil Remediation Strategy

Production of a remediation strategy report was considered part of the brief for this Investigation, but as noted, the results to date indicate that no remediation is necessary.

However, Soils Limited would make the following comments based on the information to date and the proposed development.

4.6.1 Further Chemical Testing and Human Health Risk Assessment

Further verification and validation testing and analysis may be required by the regulator following development to ensure that the development process (including importation of materials from off-site q.v.) has not lead to the incorporation of deleterious materials into the at risk garden areas and that the materials therein are suitable and fit for purpose.

4.6.2 Excavation of Impacted Soil

If unexpected deleterious materials are encountered i.e. through application of the Discovery strategy (q.v.), it could be proposed to excavate and stockpile such impacted material on the site in preparation for classification and subsequent disposal off-site to a suitable licensed facility. Such stockpiled materials awaiting disposal must be placed on an impermeable liner with raised edges. During periods of rainfall, the stockpile must be covered over to minimise leaching and run-off into the underlying soils. Covering of the stockpile may be required to prevent fumes impacting receptors off-site.

Any such remedial works must be inspected and independently validated by a suitable person and on completion of the development, a Validation and Closure Report must be supplied to both the Local Authority and the NHBC detailing the remediation works undertaken on the site. Any voids resulting from the removal of impacted soil must be backfilled with a suitable, fit for purpose certified clean material.

4.6.3 Excavation of All Made Ground

Made Ground was encountered across the site to depths between 0.1-0.5m bgl following site clearance. This material could be stripped entire from the site as part of the development thereby removing all potential sources including outliers. Given

that all of the Made Ground encountered to date is essentially fit for purpose as is, this is probably not a very sustainable or cost-effective option, especially if imported material will be required for replacement.

However, if material is to be replaced on site, imported to site (topsoil for back gardens for example) or a surplus will otherwise be created during the development (from service, foundations or other works) it may be worth considering a preference for removal from site and replacement of Made Ground with in-situ derived “natural” underlying materials.

4.6.4 Asbestos

No asbestos has been identified on this site to date, however a potential always remains on any site for unknown materials and due care in line with current guidance should be exercised during any excavation.

4.7 Duty of Care

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 should be kept damp during dry weather and at other times when dust is generated as a result of construction activities. The site should be securely fenced at all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

4.8 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered and competent advice should always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a competent person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with

current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

Other options are available that may lead to significant savings against disposal to landfill and expert advice should always be sought from a competent person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnline™ can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed, though none are indicated in the results to date.

Most of the Made Ground encountered on this site would probably classify as inert (excepting where organic content is >3% which may influence the type of landfill it could be deposited at) and is suitable and fit for purpose and re-use on site. However, as noted previously, preference could be given for re-use or replacement of Made Ground with other site won materials. This is unlikely to have a significant effect on disposal costs and options but may require additional analysis and consideration by the waste contractor.

4.9 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

All of the materials identified and analysed on site to date should be suitable and fit for purpose within the context of the development but should still be recorded in accordance with the requirements of the site MMP and WMP under CDM.

4.10 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended. It is strongly advised that specification of imported material be contractual and based on the appropriate British Standards and guidance for Topsoil and Subsoil so that if subsequently proven unsuitable a non-conformance case can be made for replacement at the supplier's expense. Compliance with current guidance values for soils may also be required to prove suitability and fitness for purpose and should be undertaken and checked by competent persons prior to, during and following provision to site.

4.11 Discovery Strategy

There may be further areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third-party Engineer/Environmental consultant notified immediately. An approval from the Local Planning Authority must be sought prior to implementing any proposed mitigation action.

If during development, any visible contaminated or odorous material, (for example, asbestos containing material, stained soil, petrol / diesel / solvent odour, underground tanks or associated pipework) not previously identified, is found to be present at the site, no further development (unless otherwise expressly agreed in writing with the Local Planning Authority) shall be carried out until it has been fully investigated using suitably qualified independent consultant(s). The Local Planning Authority must be informed immediately of the nature and degree of the contamination present and a method statement detailing how the unsuspected contamination shall be dealt with must be prepared and submitted to the Local Planning Authority for approval in writing before being implemented.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

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List of Appendices

Appendix A Field Work

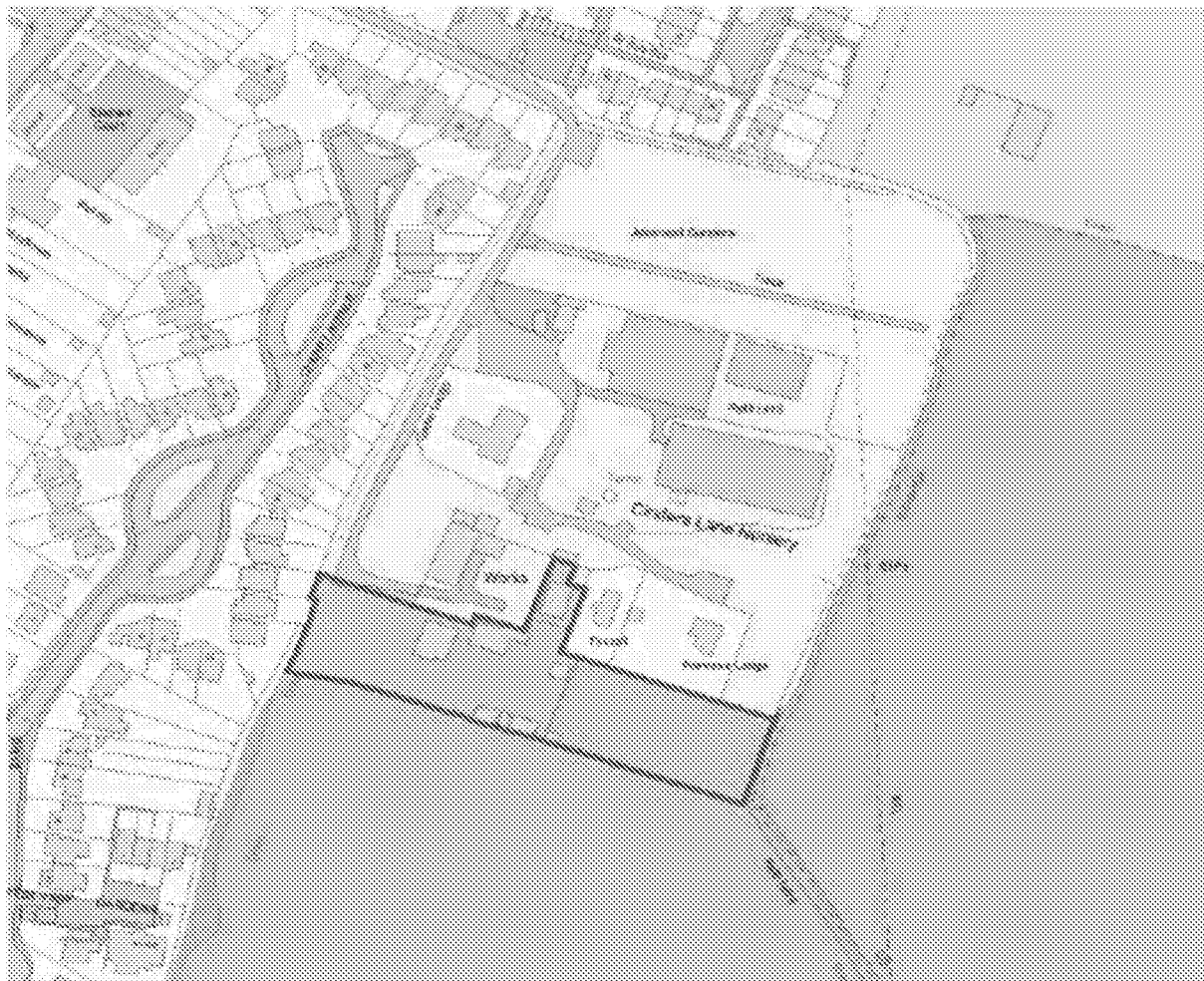
Appendix A.1 Engineers Logs

Appendix B Chemical Laboratory Testing

Appendix B.1 Chemical Laboratory Results

Appendix B.2 General Assessment Criteria

Appendix C Information Provided by the Client



Job Number 18706	Project Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ
Client Crayfern Homes	Date November 2020



**Figure 2 – Aerial Photograph
- Pre-demolition and
clearance**

Project

Cinders Phase II, Cinders Lane,
Yapton, West Sussex BN18 0JJ

Client

Crayfern Homes

Date

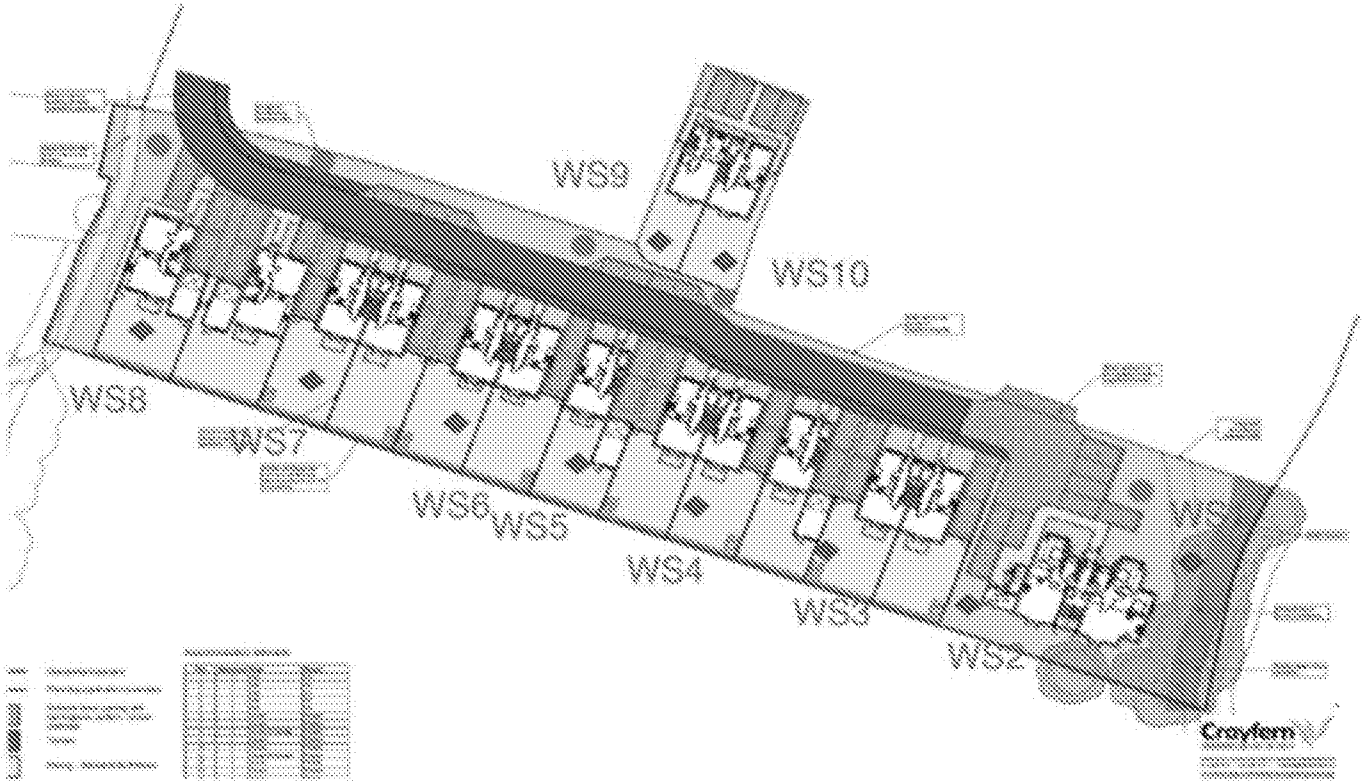
November 2020

Job Number

18706



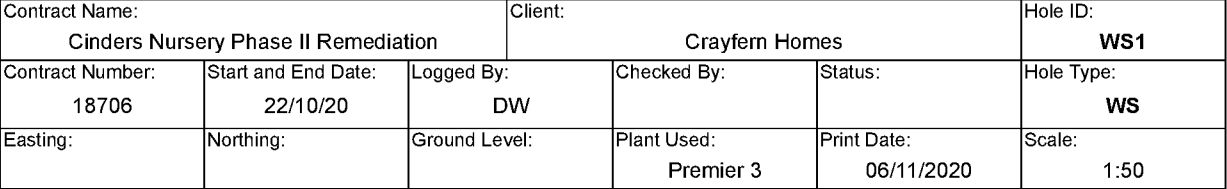
Figure 3 – Trial Hole Plan



Project
Cinders Phase II, Cinders Lane, Yapton, West Sussex BN18 0JJ
Client
Crayfern Homes
Date
November 2020
Job Number
18706

Appendix A Field Work

Appendix A.1 Engineers Logs

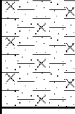


Weather:	Termination:		Sheet 1 of 1
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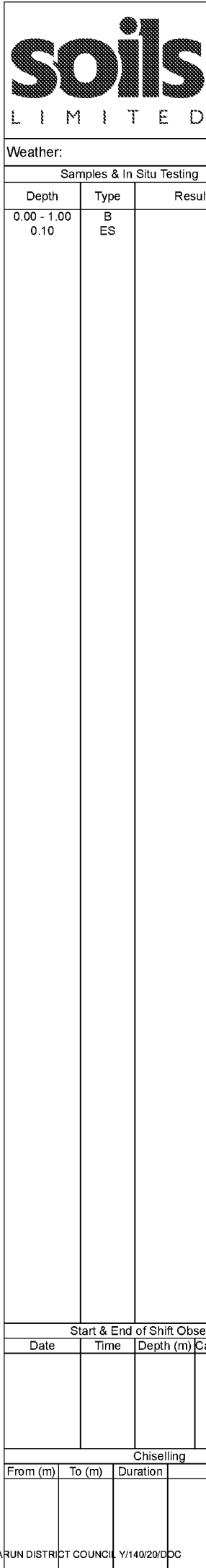
Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
0.00 - 1.00 0.10	B ES			0.20 (0.80) 1.00		Firm greyish brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to sub-angular, fine to coarse brick, flint and clinker. Frequent rootlets. MADE GROUND.			
						Firm, brown becoming yellowish brown with depth, slightly sandy, silty CLAY. Sand is fine to medium. Occasional rootlets. Occasional black speckling. Very rare sub-angular fine to medium flint gravel.			
						Silt lens from 0.85 - 0.88m bgl.			
						End of Borehole at 1.00m			
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		
							10		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: Rootlets observed to 1.0m bgl.
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	
Chiselling					Installation				
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	
RUN DISTRICT COUNCIL Y/140/20/DOC									

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS2					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:				Termination:								Sheet 1 of 1		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00 0.05	B ES			0.15 (0.85) 1.00	 	Firm, dark brown mottled, greyish brown, slightly sandy, SILT. Sand is fine to medium. Occasional rootlets. Rare angular coarse flint gravel. Possibly MADE GROUND. Firm, slightly greyish brown and brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium. Occasional rootlets. Occasional black speckling. Very rare sub-angular fine flint gravel.								
						End of Borehole at 1.00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.0m bgl.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

ARUN DISTRICT COUNCIL Y/140/20/DDC

			Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS3				
			Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS		
			Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50		
Weather:				Termination:								Sheet 1 of 1			
Samples & In Situ Testing					Strata Details								Groundwater		
Depth		Type	Results		Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description					Water Strike	Backfill/Installation	
0.00 - 1.00 0.10		B ES				0.20		Firm, greyish brown, slightly sandy, SILT. Frequent rootlets. TOPSOIL.							
						(0.80)		Firm, slightly greyish brown and brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium. Frequent rootlets. Occasional black speckling. Very rare sub-angular fine flint gravel.							
						1.00		End of Borehole at 1.00m					1		
													2		
													3		
													4		
													5		
													6		
													7		
													8		
													9		
													10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.0m bgl.						
Chiselling					Installation		Water Strikes								
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
												0	0.00	No groundwater encountered.	
ARUN DISTRICT COUNCIL Y/140/20/DDC															
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.															

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS4					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00 0.15	B ES			(0.30) 0.30 (0.90) 1.00	   	Firm, dark brown mottled, greyish brown, slightly sandy, peaty SILT. Peat is amorphous. Frequent rootlets. Occasional sub-angular medium to coarse flint gravel. Possibly MADE GROUND. <i>Occasional fine light fragments at 0.8m bgl. Silty lens with sub-rounded, fine calcic weak mudstone gravel at 0.95m bgl.</i> Firm, slightly greyish brown and brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium. Frequent rootlets. Occasional black speckling. Very rare sub-angular fine flint gravel. <i>Occasional fine light fragments at 0.8m bgl. Silty lens with sub-rounded, fine calcic weak mudstone gravel at 0.95m bgl.</i> End of Borehole at 1.00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.0m bgl.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS5					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:				Termination:								Sheet 1 of 1		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00 0.20	B ES			0.15		Black, grey, and red mottled, sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse						1		
				0.30		clinker, concrete, brick and flint. MADE GROUND.								
				(0.70)		Firm, slightly reddish brown and brown mottled, brownish grey, slightly sandy, silty CLAY. Occasional rootlets.								
				1.00		Firm, black speckled, slightly brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium. Occasional rootlets.								
						End of Borehole at 1.00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.0m bgl.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														
ARUN DISTRICT COUNCIL Y/140/20/DDC														

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS7					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00	B					Black, sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse clinker, with rare flint. MADE GROUND.								
0.40	ES			0.25		Black, grey, and red mottled, slightly silty, very sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse concrete, with rare brick, flint, and clinker. Occasional clay pockets. MADE GROUND.								
				0.45		Firm, slightly reddish brown and brown mottled, dark grey to brownish grey with depth, slightly sandy, silty CLAY. Occasional decomposing rootlets. Rare angular to sub-angular fine to medium flint and brick gravel. Odour of decomposition. Possibly re-worked material.								
				(0.35)		Firm, black speckled, slightly brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium.								
				0.80		Occasional sub-rounded, fine calcic weak mudstone gravel at 0.9m bgl.								
1.00						End of Borehole at 1.00m								
												1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	No rootlets observed.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														
ARUN DISTRICT COUNCIL Y/140/20/DDC														

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS8					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:			Termination:									Sheet 1 of 1		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00 0.20	B ES			(0.35)		Multicoloured mottled, slightly silty, very, sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse flint, brick, concrete, and clinker. Concrete cobble at base of stratum. MADE GROUND. <i>Band of cinder from 0.6 - 0.65m bgl.</i>								
				0.35										
				(0.65)		Firm, slightly dark brown mottled, dark grey to greenish grey with depth, slightly sandy, silty CLAY. Occasional rootlets and decomposing rootlets. Rare angular to sub-angular fine flint gravel. Odour of decomposition.								
				1.00										
						End of Borehole at 1.00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: Rootlets observed to 1.0m bgl.					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

ARUN DISTRICT COUNCIL Y/140/20/DDC

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS9					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:				Termination:								Sheet 1 of 1		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00 0.15	B ES			0.20		Multicoloured mottled, brown, clayey, very, sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse flint, brick, concrete, and clinker. Occasional clay pockets. MADE GROUND. Firm, black and reddish brown stained, greyish brown slightly sandy, silty CLAY. Rare sub-angular to sub-rounded, fine to medium brick and flint gravel. Possibly re-worked material. MADE GROUND. Firm, black speckled, slightly brown reddish mottled, light greyish brown, slightly sandy, silty CLAY. Sand is fine to medium. Very rare sub-angular medium flint, chalk and sandstone gravel. Rare sub-rounded, fine calcic weak mudstone gravel at 0.95m bgl.								
				0.35										
				(0.65)										
				1.00										
End of Borehole at 1.00m												1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: No rootlets observed.					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

ARUN DISTRICT COUNCIL Y/140/20/DDC

	Contract Name: Cinders Nursery Phase II Remediation				Client: Crayfern Homes				Hole ID: WS10					
	Contract Number: 18706		Start and End Date: 22/10/20		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 06/11/2020		Scale: 1:50			
Weather:			Termination:									Sheet 1 of 1		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.00 - 1.00	B			(0.50)		Multicoloured mottled, brown, clayey, very, sandy GRAVEL/gravelly, CLAY. Gravel is angular to sub-angular, fine to coarse flint, brick, concrete, chalk, sandstone, and clinker. Occasional gravel and clay pockets. MADE GROUND. Band of slightly silty, sandy angular to rounded, fine to medium flint gravel from 0.4 - 0.5m bgl.								
0.25	ES			0.50										Firm, black speckled, slightly brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine to medium.
				(0.50)		End of Borehole at 1.00m								
				1.00										
												1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: No rootlets observed.					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

ARUN DISTRICT COUNCIL Y/140/20/DDC

Appendix B Chemical Laboratory Testing

Appendix B.1 Chemical Laboratory Results



Chris Swainston
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN

DETS Report No: 20-12737

Site Reference: Cinders Nursery

Project / Job Ref: 18706

Order No: 18706

Sample Receipt Date: 30/10/2020

Sample Scheduled Date: 30/10/2020

Report Issue Number: 1

Reporting Date: 06/11/2020

Authorised by:



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS1	WS2	WS3	WS4	WS5
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.10	0.05	0.10	0.15	0.20
Reporting Date: 06/11/2020	DETS Sample No	507827	507828	507829	507830	507831

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO 17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.7	7.3	6.8	7.4	7.7
Organic Matter	%	< 0.1	MCERTS	3.7	4.6	4.4	4.2	1.5
Arsenic (As)	mg/kg	< 2	MCERTS	9	8	7	7	9
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4	0.6	0.2	0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	20	19	18	18	22
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	22	26	14	17	12
Lead (Pb)	mg/kg	< 3	MCERTS	102	71	30	38	26
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	13	11	9	9	11
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	27	27	26	25	31
Zinc (Zn)	mg/kg	< 3	MCERTS	184	764	135	153	63
Total Phenols (monohydric)	mg/kg	< 2	NONE	6.2	4.4	3	4	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.15	0.40	0.20	0.15	0.25
Reporting Date: 06/11/2020	DETS Sample No	507832	507833	507834	507835	507836

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO 17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.5	8.5	8.4	8.0	7.8
Organic Matter	%	< 0.1	MCERTS	3.4	1.9	2.6	2.2	2
Arsenic (As)	mg/kg	< 2	MCERTS	5	6	7	9	11
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.2	0.2	0.3	0.3	0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	14	15	17	14	14
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	12	13	22	13	27
Lead (Pb)	mg/kg	< 3	MCERTS	37	42	85	34	144
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	7	8	11	8	8
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	23	20	29	24	22
Zinc (Zn)	mg/kg	< 3	MCERTS	48	58	95	59	148
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS1	WS2	WS3	WS4	WS5
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.10	0.05	0.10	0.15	0.20
Reporting Date: 06/11/2020	DETS Sample No	507827	507828	507829	507830	507831

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.25	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.86	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.78	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.29	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.35	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.49	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.17	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.30	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.21	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	3.9	< 1.6	< 1.6	< 1.6	< 1.6



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.15	0.40	0.20	0.15	0.25
Reporting Date: 06/11/2020	DETS Sample No	507832	507833	507834	507835	507836

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.42	< 0.1	0.23	< 0.1	0.62
Anthracene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	< 0.1	< 0.1	0.24
Fluoranthene	mg/kg	< 0.1	MCERTS	1.57	0.38	0.78	< 0.1	2.23
Pyrene	mg/kg	< 0.1	MCERTS	1.45	0.40	0.72	< 0.1	2.02
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.69	0.23	0.35	< 0.1	1.09
Chrysene	mg/kg	< 0.1	MCERTS	0.93	0.14	0.37	< 0.1	0.86
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	1.55	0.32	0.63	< 0.1	1.42
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.53	0.13	0.18	< 0.1	0.57
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.17	0.23	0.44	< 0.1	1.12
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.99	0.18	0.32	< 0.1	0.59
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.30	< 0.1	< 0.1	< 0.1	0.20
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	1	0.19	0.35	< 0.1	0.58
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	10.7	2.2	4.4	< 1.6	11.5



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS1	WS2	WS3	WS4	WS5
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.10	0.05	0.10	0.15	0.20
Reporting Date: 06/11/2020	DETS Sample No	507827	507828	507829	507830	507831

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	0.06	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	5	< 1	< 1	< 1	< 1
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	29	< 6	< 6	< 6	< 6
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	34	< 6	< 6	< 6	< 6



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Rose Lane
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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 20-12737	Date Sampled	22/10/20	22/10/20	22/10/20	22/10/20	22/10/20
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Cinders Nursery	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 18706	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 18706	Depth (m)	0.15	0.40	0.20	0.15	0.25
Reporting Date: 06/11/2020	DETS Sample No	507832	507833	507834	507835	507836

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	30
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	13	3	4	< 1	227
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	261	54	60	< 6	450
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	275	57	64	< 6	707



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 20-12737	
Soils Ltd	
Site Reference: Cinders Nursery	
Project / Job Ref: 18706	
Order No: 18706	
Reporting Date: 06/11/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
507827	WS1	None Supplied	0.10	19.7	Brown loamy sand with stones
507828	WS2	None Supplied	0.05	20.7	Brown loamy sand
507829	WS3	None Supplied	0.10	24.4	Brown loamy sand with vegetation
507830	WS4	None Supplied	0.15	21.7	Brown loamy sand
507831	WS5	None Supplied	0.20	16.4	Brown sandy clay
507832	WS6	None Supplied	0.15	8.7	Brown sandy gravel with stones and concrete
507833	WS7	None Supplied	0.40	9.9	Brown sandy gravel with stones and concrete
507834	WS8	None Supplied	0.20	9.1	Brown loamy sand with stones and concrete
507835	WS9	None Supplied	0.15	9.1	Brown loamy sand with stones and chalk
507836	WS10	None Supplied	0.25	10.7	Brown loamy sand with stones and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-12737

Soils Ltd

Site Reference: Cinders Nursery

Project / Job Ref: 18706

Order No: 18706

Reporting Date: 06/11/2020

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix B.2 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

Introduction

The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2;

‘Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) pollution of controlled waters is being, or is likely to be, caused.’

The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 1.3 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 1.4 and SR3, ref. 1.5.

In establishing whether a site fulfils the statutory definition of ‘contaminated land’ it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A ‘pollutant linkage’ may be defined as the link between a contaminant ‘source’ and a ‘receptor’ by means of a ‘pathway’.

Assessment Methodology

The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

Stages 1 and 2 develop a '*conceptual model*' based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 1.6. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 1.7. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. Specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to specific industrial processes.

If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref 1.8. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

All site works should be in general accordance with the British Standards BS 10175:2011, ref. 1.9. and BS 5930:2015, ref. 1.10.

The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.

The end-use may be defined as one of the following ref. 1.15;

- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetables may be grown for home consumption
- Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
- Allotments – specific areas where vegetables are grown for home consumption.
- Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.
- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children's play area, sports grounds and dog walking.
- Commercial – industrial premises where there is limited exposure to soil.

Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

Residential with homegrown produce

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 home-grown 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 the Residential land-use is **Residential without Homegrown produce**. The generic scenario assumes low density housing with communal landscaped gardens where the consumption of home grown vegetables will not occur.

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.
-

Commercial

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).
-

Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

-
- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
 - Predominantly used by children for playing and may be used for activities such as a football kick about
 - Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
 - older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
 - ingestion rate 75 mg.day⁻¹
-

Public Open Space Park

This generic scenario refers to any public park that is more than 0.5ha in area:

-
- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
 - Female child age classes 1-6
 - Soil ingestion rate of 50 mg.day⁻¹
 - Occupancy period outdoors = 2 hours.day⁻¹
 - Exposure frequency of 170 days.year⁻¹ for age classes 2-18 and 85 days.year⁻¹ for age class 1
 - Outdoor exposure pathways only (no tracking back).
-

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. 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 Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

In 2014, the publication of Category 4 Screening Levels (C4SL) ref 1.15, 1.16, as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3) ref 1.5 used in the generation of SGVs. C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010 ref 1.16. Where a C4SL has been published, Soils Limited has adopted them as GAC for these six substances.

For all other substances the soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM ref. 1.12, which were developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants.

Where no S4UL or C4SL is available, the assessment criteria (AC) may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.13. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 1.6, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 1.17, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 1.18 and for contaminants not considered in this

document the fate and transport data used in previous versions of the CLEA model has been used.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 1.14. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

References

- 1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.
- 1.2 Environment Act 1995, Section 57, DoE 1995.
- 1.3 CLR 11, '*Model Procedures for the Management of Contaminated Land*', DEFRA and Environment Agency, 2004.
- 1.4 Environment Agency Science Report SC050021/SR2 'Human health toxicological assessment of contaminants in soil'.
- 1.5 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008
- 1.6 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.
- 1.7 CLR 3 '*Documentary Research on Industrial Sites*', Report by RPS Consultants Ltd., DOE, 1994
- 1.8 CLR 4, '*Sampling strategies for contaminated land*', Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994
- 1.9 BS 10175: 2011 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2011
- 1.10 BS 5930: 2015 '*Code of practice for ground investigations*', British Standards Institute, 2015
- 1.11 Science Report SC050021 '*Contaminants in Soil: Updated Collation of Toxicological Data and Intake Values for Humans*', Environment Agency, 2009
- 1.12 The LQM/S4ULs for Human Health Risk Assessment, Nathanail P, McCaffery C, Gillett A, Ogden R, and Nathanail J, Land Quality Press, Nottingham, published 2015.
- 1.13 CLEA '*Software Version 1.071*' (downloaded from the Environment Agency website, <http://www.environment-agency.gov.uk>)
- 1.14 CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*', Chartered Institute of Environmental Health (CIEH) and Contaminated Land: Applications in Real Environments (CL:AIRE), May 2008.
- 1.15 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.
- 1.16 Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). '*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*', Revision 2, DEFRA research project SP1010.
- 1.17 Generic Assessment Criteria for Human Health Risk Assessment, Nathanail CP, McCaffery C, Ashmore M, Cheng Y, Gillett A, Hooker P and Ogden RC
- 1.18 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date		
			With			Without			Allotments			Commercial			Residential			Park							
			home-grown produce	home-grown produce	home-grown produce																				
Type	Contaminants	Species	Year	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6				
Metals	Antimony		2010						550						7500							EC/AGS/CLAIRE	EC/AGS/CLAIRE	2010	
	Arsenic		2014			37			40				49		640			79		160		C4SL	DEFRA	2014	
			2015			37			40				40		640			79		170		S4UL	LQM/CIEH	2015	
	Beryllium		2015			1.7			1.7				35		12			2.2		63		S4UL	LQM/CIEH	2015	
	Boron		2015			290			11000				45		240000			21000		46000		S4UL	LQM/CIEH	2015	
	Cadmium		2015			11			85				1.9		190			120		532		S4UL	LQM/CIEH	2015	
			2014			26			149				4.9		410			220		680		C4SL	DEFRA	2014	
	Chromium	III	2015			910			910				18000		8600			1500		33000		S4UL	LQM/CIEH	2015	
			VI	2014			21			21				170		49			23		250		C4SL	DEFRA	2014
			VI	2015			6			6				1.8		33			7.7		220		S4UL	LQM/CIEH	2015
	Copper		2015			2400			7100				520		68000			12000		44000		S4UL	LQM/CIEH	2015	
	Lead					200			310				80		2330			630		1300		C4SL	DEFRA	2014	
	Mercury	Elemental	2012			1.0			1.0				26		26							SGV	DEFRA	2012	
			2015			1.2			1.2				21		58			16		30		S4UL	LQM/CIEH	2015	
		Inorganic	2012			170			170				80		36000							SGV	DEFRA	2012	
			2015			40			56				19		1100			120		240		S4UL	LQM/CIEH	2015	
		Methyl	2012			11			11				8		410							SGV	DEFRA	2012	
			2015			11			15				6		320			40		68		S4UL	LQM/CIEH	2015	
	Nickel		2012			130			130				230		1800							SGV	DEFRA	2012	
			2015			130			180				53		980			230		800		S4UL	LQM/CIEH	2015	
	Selenium		2012			350			350				120		13000							SGV	DEFRA	2012	
			2015			250			430				88		12000			1100		1800		S4UL	LQM/CIEH	2015	
	Vanadium		2015			410			1200				91		9000			2000		5000		S4UL	LQM/CIEH	2015	
	Zinc		2015			3700			40000				620		730000			81000		170000		S4UL	LQM/CIEH	2015	
BTEX & PTX	Benzene		2012			0.33			0.33				0.07		95							SGV	DEFRA	2012	
			2014			0.87			3.3				0.18		98			140		230		C4SL	DEFRA	2014	
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015	
	Toluene		2012			610			610				120		4400							SGV	DEFRA	2012	
			2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015	
	Ethylbenzene		2012			350			350				90		2800							SGV	DEFRA	2012	
			2015	47	110	260	83	190	440	16	39	91	4700	13000	27000	24000	24000	25000	17000	22000	27000	S4UL	LQM/CIEH	2015	
	Xylenes	o-xylene	2012			250			250				160		2600							SGV	DEFRA	2012	
			2015	60	140	330	88	210	480	28	67	160	6600	15000	33000	41000	42000	43000	17000	24000	33000	S4UL	LQM/CIEH	2015	
		m-xylene	2012			240			240				180		3500							SGV	DEFRA	2012	
			2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000	S4UL	LQM/CIEH	2015	
		p-xylene	2012			230			230				160		3200							SGV	DEFRA	2012	
			2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000	S4UL	LQM/CIEH	2015	
Petroleum Hydrocarbons Fractions	Aliphatic >C3 - C6		2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000	S4UL	LQM/CIEH	2015	
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	600000	610000	620000	150000	220000	320000	S4UL	LQM/CIEH	2015	
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000	S4UL	LQM/CIEH	2015	
	Aliphatic >C10 - C12		2015	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000	S4UL	LQM/CIEH	2015	
	Aliphatic >C12 - C16		2015	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000	S4UL	LQM/CIEH	2015	
	Aliphatic >C16 - C35		2015	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015	
	Aliphatic >C35 - C44		2015	65000	92000	140000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015	
	Aromatic >C3 - C7		2015	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000	S4UL	LQM/CIEH	2015	
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015	
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300	S4UL	LQM/CIEH	2015	
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000	S4UL	LQM/CIEH	2015	
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015	
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015	
	Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015	

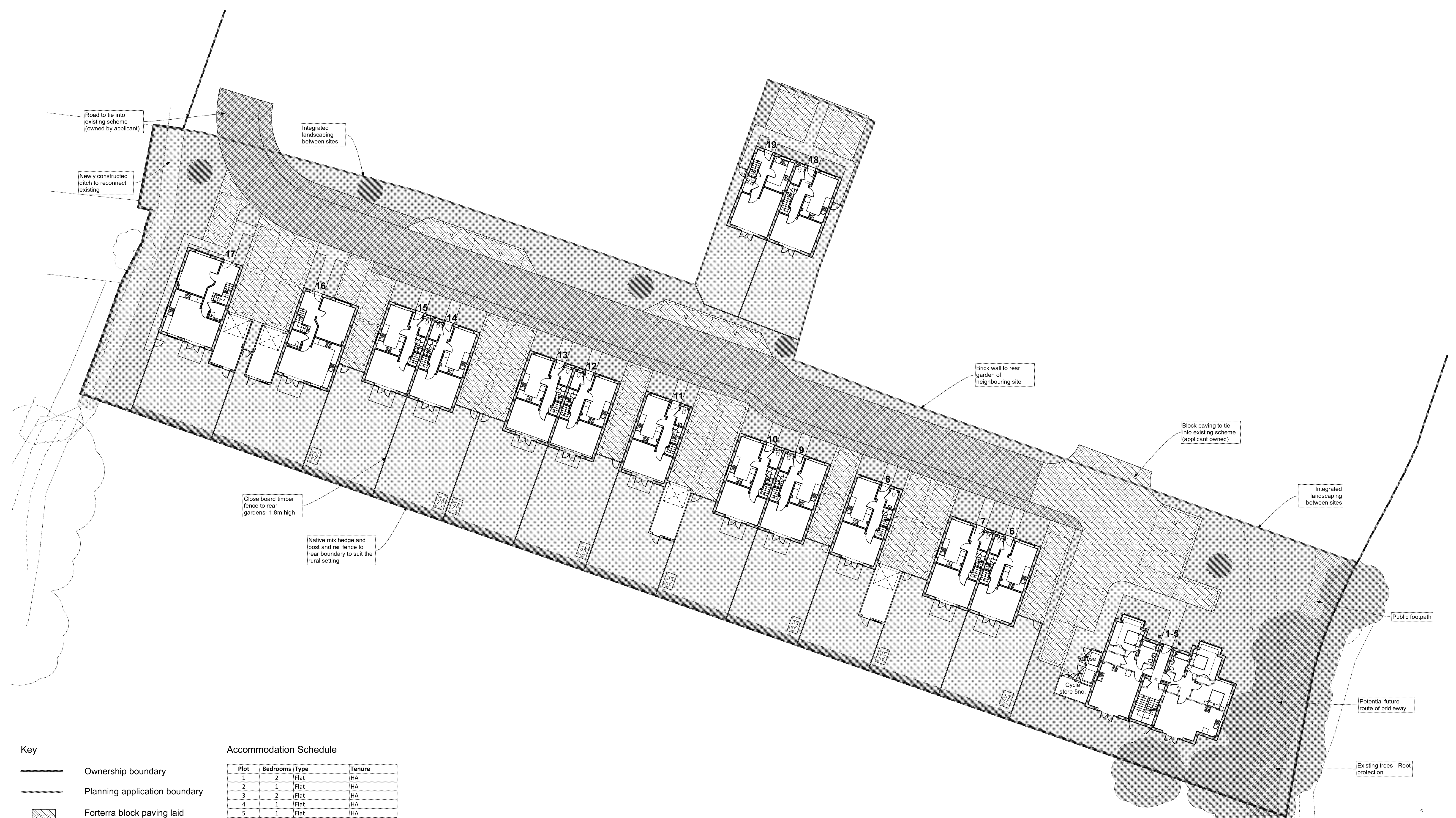
Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			Allotments						Commercial			Residential						Park						
			With home-grown produce			Without home-grown produce																		
Type	Contaminants	Species	Year	SQM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6		
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70			1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAHs) (mg/kg)	Acenaphthene		2015	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene		2015	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene		2015	2400	5400	11000	31000	35000	37000	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene		2014			5			5.3			5.7			76			16		21	C4SL	DEFRA	2014	
			2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene		2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene		2015	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene		2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene		2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene		2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015
	Fluoranthene		2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene		2015	170	400	860	2800	3800	4500	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene		2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene		2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190	460	1100	4900	4900	4900	1200	1900	3000	S4UL	LQM/CIEH	2015
	Phenanthrene		2015	95	220	440	1300	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene		2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)		2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane		2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane		2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000	76000	100000	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane		2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane		2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene		2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810	1100	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)		2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene		2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane		2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
Explosives	Vinyl Chloride (chloroethene)		2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
	2,4,6 Trinitrotoluene		2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)		2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)		2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000	23000	24000	S4UL	LQM/CIEH	2015
Pesticides	Aldrin		2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin		2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine		2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos		2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan		2015	7.4	18	41	160	280	410	1.2	2.9	6.8	5600	7400	8400	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan		2015	7	17	39	190	320	440	1.1	2.7	6.4	6300	7800	8700	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes		2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes		2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
Chlorobenzenes	Gamma -Hexachlorocyclohexanes		2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
	Chlorobenzene		2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300	2000	2900	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene		2015	23	55	130	24	57	130	94	230	540	2000	4800										

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			With			Without			Allotments			Commercial			Residential			Park						
			home-grown produce			home-grown produce																		
Type	Contaminants	Species	Year	SQM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6		
Phenols & Chlorophenols	1,2,3,5-, Tetrachlorobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49	120	240	78	79	79	110	120	130	S4UL	LQM/CIEH	2015
	1,2,4, 5-, Tetrachlorobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42	72	96	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
	Pentachlorobenzene		2015	5.8	12	22	19	30	38	1.2	3.1	7	640	770	830	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene		2015	1.8	3.3	4.9	4.1	5.7	6.7	0.47	1.1	2.5	110	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
	Phenols		2012	420			420			280			3200									SGV	DEFRA	2012
			2015	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
	Others	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH
Hexachloro-1,3-Butadiene			2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
Sum of PCDDs, PCDFs and dioxin-like PCB's.			2012	8			8			8			240									SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg ⁻¹)
1	Site Specific Assessment Criteria (SSAC) (Soils Limited)
2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CLARE), 2014)
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)
4	2015: Suitable 4 Use Level (S4UL) (Nathanail <i>et al</i> , 2015)
For Generic Risk Assessment, the values in Bold have priority	
Table reviewed February 2020	

Appendix C Information Provided by the Client



Key

- Ownership boundary
- Planning application boundary
- Forterra block paving laid herringbone pattern. Colour- charcoal
- Tarmac
- Paving - Standard Buff Riven
- Proposed trees
- Visitor parking space
- 6' x 4' shed - Cycle storage

Accommodation Schedule

Plot	Bedrooms	Type	Tenure
1	2	Flat	HA
2	1	Flat	HA
3	2	Flat	HA
4	1	Flat	HA
5	1	Flat	HA
6	3	House	Private
7	3	House	Private
8	3	House & Garage	Private
9	3	House	Private
10	3	House	Private
11	3	House & Garage	Private
12	3	House	Private
13	3	House	Private
14	3	House	Private
15	3	House	Private
16	4	House & Garage	Private
17	4	House & Garage	Private
18	3	House	Private
19	2	House	Private



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SITE LAYOUT | PROPOSED DEVELOPMENT AT:
Land at Southern end of Cinders Lane
Yapton
BN18 0JJ
FOR
CRAYFERN HOMES LIMITED
Scale : 1:200 @ A1 Date : JAN 20
Drawing No : 97.17.P100 B

Soils Limited
Geotechnical & Environmental Consultants

**Newton House
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