



Geo-Environmental

REMEDIATION METHOD STATEMENT

for the site at the former

ANGELS NURSERY,

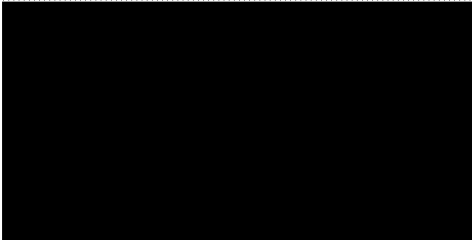
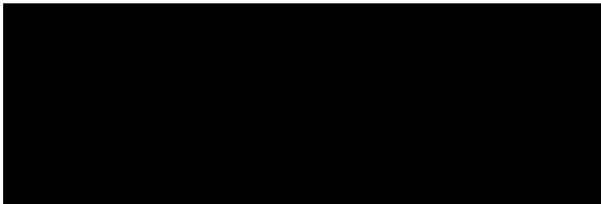
YAPTON ROAD, BARNHAM

WEST SUSSEX, PO22 0AY

on behalf of

LOVELL PARTNERSHIPS LIMITED

**Ground Investigation Report**

Report:	REMEDICATION METHOD STATEMENT
Site:	ANGELS NURSERY, YAPTON ROAD, BARNHAM
Client:	LOVELL PARTNERSHIPS LIMITED
Date:	10/12/2015
Reference:	GE15163-RMS-DEC15
Version:	1.0
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1.0 INTRODUCTION

1.1 General

Following a Phase I and Phase II investigation undertaken on site by Geo-Environmental Services Limited ('Geo-Environmental'), detailed within the Ground Investigation Report, GE10423-GIR-JO01-150910, Geo-Environmental was appointed by Lovell Partnerships Limited to formulate a remediation strategy for the redevelopment works on the site at the former Angels Nursery, Yapton Road, Barnham, West Sussex, PO22 0AY (Figure 1).

1.2 Objectives

Investigation of the site by Geo-Environmental identified the presence of potential hazards and through a risk assessment process a series of pollutant linkages were identified which require action to mitigate or otherwise reduce the risk. This Remediation Method Statement (RMS) sets out the proposed remedial works to be undertaken on the subject site to support its development for a residential end use.

1.3 Planning Permission

Planning Permission for the site was granted by Arun District Council ref: APP/C3810/A/10/2132014 on the 6th January 2011. The following planning condition relating to contamination, or which could impact on remediation proposals, have been imposed on the planning permission granted for the site:

20) No development shall take place until Remediation Strategy (taking account of the recommendation within the Contamination Desk Study submitted with the application) has been submitted to and approved in writing by the local planning authority. Prior to commencement of development, a Verification Report shall also include any plan (a 'long term monitoring and maintenance plan') for monitoring of pollution linkages, maintenance and arrangements for contingency action and for the reporting of this to the local authority.

The following document sets out the proposed remediation strategy for the site required in order to clear the above condition.



2.0 BACKGROUND

This Remediation Method Statement (RMS) has been developed following a review of the Ground Investigation Report, ref. GE10423-GIR-SEP15, prepared by Geo-Environmental for this site.

A brief overview of salient findings of the report is presented below. For further information, the Report should be referred to directly.

2.1 Former Site Use

The site comprised an approximately rectangular shaped parcel of land extending to approximately 3.5Ha located at NGR 496260 104030. With reference to the site topographical survey, the ground levels across the site were relatively uniform with typical levels within the site ranging from 8.05m to 9.25m Above Ordnance Datum (AOD) in the northern and southern portions of the site respectively.

At the time of the original walkover survey, June 2015, the site was vacant and comprised a former plant nursery. The majority of the site was generally overgrown with grass and brambles. A series of ditches ran parallel to each other from north to south in the southern portion of the site. Several rows and individual mature trees were scattered throughout the site. A vacant two-storey brick building was located to the east of the nursery access road in the north-eastern portion of the site. The access was off Yapton Road via an overgrown access track which extended towards the centre of the site.

The central and north-western portions of the site comprised an area of open space with heavily disturbed ground which contained fragments of brick, concrete, cast iron, reinforcing bars and the like. The existing tarmac road which ran from north to south through the centre of the site was partly obscured by the mixture of topsoil and demolition rubble. Along the road, several rectangular concrete footprints, presumably of the removed nursery buildings, were observed. In the southern portion of the site, the access track branched off towards the western portion of the site with a concrete crossing located over the drainage ditch.

The surrounding area comprised mostly open fields with clusters of residential properties. The village of Barnham was located to the northwest. The site was bounded to the north by Yapton Road with residential properties and open beyond, caravan site to the east, community hall to the west and a series of nurseries to the south.

A review of the available historical maps indicated that the site had previously formed portions of open field networks prior to circa 1938 when it was divided into four individual plots of land with small properties. The site was developed as a plant nursery in circa 1974 and remained in use as a nursery since this date.



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The investigation broadly comprised seven machine excavated trial pits and six window sampler boreholes located across the whole site. The laboratory analysis undertaken on samples of the near surface soils and subsequent statistical analysis indicated a 'hot-spot' of contamination in the north-western portion of the site in the vicinity of one of the window sampler boreholes (WS6). When compared to the calculated site specific assessment criteria (SSAC), elevated concentrations of several poly-aromatic hydrocarbons (PAHs) were encountered. Furthermore, the physical quality of the soils located in the hotspot area and the central portion of the site was poor and considered not suitable for re-use in private gardens due to being contaminated with demolition rubble.

2.2 Proposed site use

The proposed site use comprises the construction of a residential development incorporating low-rise houses with private gardens, communal soft landscaping, parking, utilities and associated infrastructure. A total of 95 units are proposed to be built on the site.

2.3 Conceptual Site Model

The conceptual site model (CSM) developed following the investigation works reported (as referenced in Section 2.0) identified particular hazards, or potential hazards which were considered to require intervention (remediation) to mitigate the risk of harm.

The investigation and CSM identified a requirement to protect end users from sporadic contamination within near surface Made Ground within the central portion of the site. Furthermore, the poor physical quality of soils in this area deemed the Topsoil and Made Ground unsuitable for re-use as part of the development. Whilst the remedial strategy is only required for the central portion of the site, given that the ground levels are proposed to be raised across the site the proposed cover system is expected to be implemented for all gardens (including communal gardens) across the site. The CSM did not identify requirement for remedial action in relation to ground gas or controlled waters.

2.4 Approach for Remediation, Monitoring and Validation

The overall development strategy included the increase in ground levels across the site by between 400mm and 550mm and as such, the remedial strategy was developed from a position of the affected soils being left in-situ wherever possible. As such, remediation works are proposed to break the identified pollutant linkages, thereby mitigating the associated risk of harm to human health.



3.0 SOILS

The ground investigations identified the presence of concentrations of Polyaromatic Hydrocarbon (PAH) in near surface Made Ground at a single location in the central portion of the site which exceeded the site specific assessment criteria derived for the proposed development on this site. In addition, in several areas across the site (primarily in the central portion and areas where former nursery buildings were located) the Topsoil appeared to have been disturbed and re-worked such that extraneous fragments such as brick, concrete, reinforcing bars, nails and cast iron fragments were encountered. These soils were logged as Made Ground, although were considered to be derived primarily through natural processes prior to disturbance rather than through the importation or placement of soils and/or fill materials in an *ad hoc* manner on the site.

Given that the existing ground levels across the site are proposed to be increased by a minimum of 400mm, this would serve as part of a cover system designed to block exposure pathways and thus break the pollutant linkages with end users. Thus, although the area requiring remedial action would be focused on gardens and soft landscaping in the central portion of the site where exposure to contaminated and physically unsuitable soils could potentially occur, it is recommended that the proposed cover system is incorporated across the entire site.

3.1 Site Workers

It is the responsibility of the Principal Contractor and their appointed sub-contractors to implement and manage safe systems of work, prepare their own risk assessments in accordance with Health and Safety legislation in order to protect persons in their employ, as well as mitigate the risk of harm to others due to works in their control. Special consideration should be given to the provisions of the Construction (Design & Management) Regulations 2015, Health and Safety at Work Act and the Control of Substances Hazardous to Human Health regulations in order to protect the safety of persons in their employment. Additional guidance can be sought from the CIRIA publication entitled "A Guide for Safe Working on Contaminated Sites".

In addition to the safe systems of works to be implemented alongside appropriate risk assessments and method statements, all site personnel shall benefit from on-site hygiene facilities including wash area, toilets and drying room.

A separate canteen area should be provided. Smoking anywhere within this construction site is not permitted in line with UK legislation. All eating and drinking should be restricted to the canteen area and only once site personnel have removed outer PPE and washed exposed skin.

In the event of dry spells, or where the exposed surface becomes dry, the surface of the site will require to be regularly damped down to prevent the release of soil dust which could impact on site operatives or migrate off-site and thereby mitigate both off-site exposure and nuisance for neighbours.

3.2 End Users

On the basis of the soil contamination assessment set out in the Ground Investigation Report, it is considered that risk mitigation measures will be required to protect human health. It was acknowledged within the report that whilst this could possibly be achieved by removal of the unsuitable and contaminated soils, the proposed increase in ground levels across the site by a minimum of 600mm will act as a sufficient barrier for potential contamination. As such, remedial measures are to be implemented across the entire site rather than in the affected areas alone. The thickness of the proposed cover system has been verified using the BRE Cover System approach and assumes a total mixing zone thickness of 600mm.

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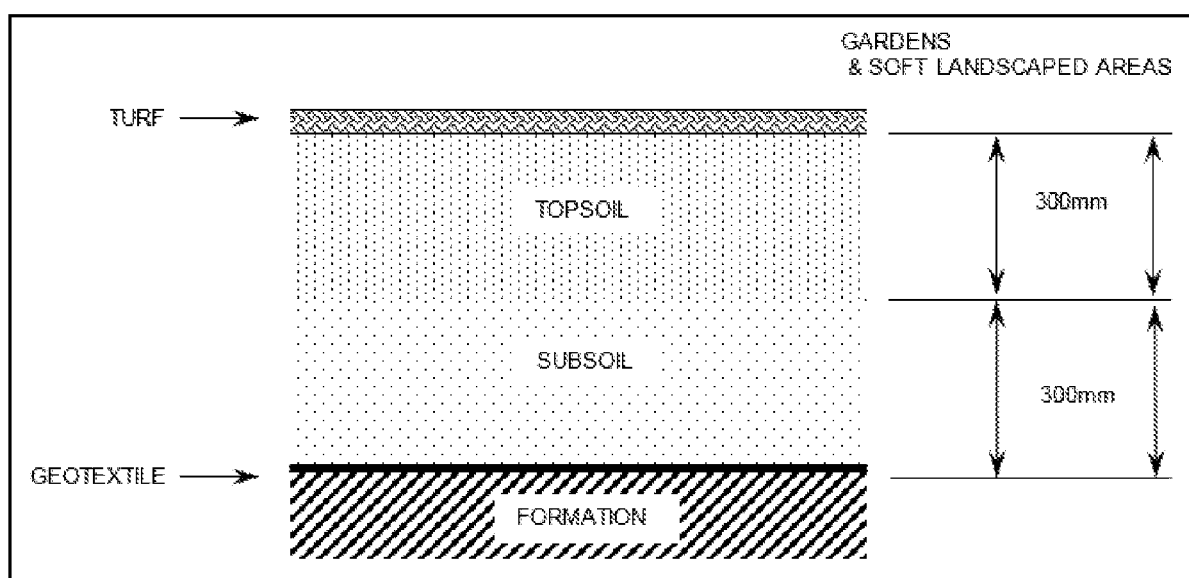
The remedial works are to incorporate an overall system thickness of 600mm in private gardens and communal landscaping, comprising at least 300mm verifiably 'clean' Topsoil over 300mm of verifiably 'clean' sub-soil laid on a geotextile membrane.

Where the proposed increase in ground levels in the central portion of the site is less than the thickness of the cover system, the underlying unsuitable soils will need to be reduced appropriately in order to ensure that a minimum of 600mm of 'clean' soils is in place.

Figure 2 shows the proposed gardens and soft landscaping where the unsuitable soils were encountered.

The depth of soil cover for the above solution may need to be increased where planting is proposed, e.g. for tree pits.

A schematic section through the proposed cover system placed on the affected soils is shown below.



Where the end use comprises permanent hard cover, e.g. roads, parking and houses, this hard cover would serve to block exposure pathways and thus break the potential pollutant linkages. As such no further action would be required in hard landscaped areas.

Furthermore, in areas of public open space where existing ground levels are to be retained, the unsuitable soils should be removed to the formation level or a depth at which extraneous materials are no longer present within the soil matrix.

Given the absence of suitable Topsoil and subsoil on the site, it will be necessary to import Topsoil and subsoil on to the development. Prior to importation, the chemical, physical and nutritional suitability of all Topsoil and subsoil should be verified. Importation of topsoil or subsoil from unverified or unsuitable sources would require their removal from site and replacement with suitable materials. All topsoil and subsoil to be placed in gardens and soft landscaping must be able to support plant life. Materials such as aggregate are not suitable for use either as Topsoil or subsoil. As a matter of good practice, it is recommended that the location, approximate extent and thickness of any imported subsoil and/or topsoil are recorded and presented in the Validation/Verification Report to be prepared by the Environmental Consultant. A copy of the recommended specification for imported subsoil and topsoil is provided in Appendix A.



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3.3 Inspection

Upon completion of the remediation, the Environmental Consultant shall be instructed to visit the site and inspect the cover system in order to verify its installation.

3.4 Imported Fill Materials

Due to the unsuitability of the near surface materials across the majority of the site as growing media and proposed increase in ground levels across the site, it is likely that the importation of verifiably 'clean' Topsoil and subsoil will be necessary in order to facilitate and sustain plant growth in the gardens and soft landscaped areas.

All imported fill materials shall meet the chemical standards set-out in Appendix A, be supplied from a reliable and traceable source, and be of an appropriate physical quality.

The Contractor should supply chemical certification prior to importing materials onto site in order to confirm its suitability for use on site. The date of certification should be within one month of the materials importation on to site. Samples will be taken for analysis where the physical quality of the materials is considered to be sub-standard based on a visual inspection.

Where certificates of suitability cannot be supplied for the imported materials, then samples will be taken for laboratory analysis.

Unless otherwise specified by the Landscape Designer, all Topsoil materials should generally conform to Multipurpose grade as specified under BS3882:2015, or will otherwise be rejected.

Samples for laboratory testing shall be placed in appropriate containers including plastic pots and glass jars with Teflon lids. Samples shall be contained within temperature controlled storage prior to and after analysis. All chemical analyses shall be undertaken by a laboratory accredited by UKAS for the tests specified.

3.5 Soft Landscaping – Phytotoxicity

The ground investigation identified the presence of concentrations of zinc which are considered phytotoxic. However, application of the cover systems as set out to protect human health, and deepened for tree pits if required, would also serve to protect plant life.

3.6 Build Environment

Whilst no specific remediation was required to protect the built environment, a requirement for barrier pipe was identified to protect drinking water supply pipes. This is subject to confirmation by the local water utility undertaker.



4.0 WASTE

4.1 Waste Classification and Segregation

Waste may be defined as any substance or object in Annex 1 of the Waste Framework Directive which the holder discards, intends to discard, or is required to discard. The holder of waste is anyone in possession of waste or generates it and therefore both the contractor and ultimately the developer are responsible for safe disposal of waste.

Waste Acceptance Criteria (WAC) testing has already been carried out on two samples of the Made Ground and a single sample of Topsoil. The results of the analysis undertaken on one of the Made Ground samples demonstrated the material to be classified as 'Stable non-reactive Hazardous' for the purpose of disposal primarily on the basis of elevated levels of Total TPH. The remaining samples were classified as Inert Waste. The results were presented within the Geo- Environmental Ground Investigation Report, September 2015.

Based on the results of the sampling undertaken it is considered that the natural soil arisings removed are likely to be classified as Inert Waste, suitable for disposal at an inert landfill site. Whilst Made Ground may be classified as Inert and/or Hazardous Waste, subject to the levels of residual contaminants identified. Where elevated levels of hydrocarbons are identified these soils are more likely to be classified as Hazardous Waste. The results of the chemical analysis should be provided to the proposed landfill site for confirmation.

It is recommended that once materials for disposal have been identified (i.e. from the areas of public open space), then further WAC testing should be undertaken to further clarify the materials for the purpose of disposal. Depending on the contaminants present, it is possible that ex-situ treatment could be used to remediate the soil to lower the waste classification.

In the event of dry spells, or where the exposed surface becomes dry, it is recommended that the surface of the site is regularly damped down to prevent the release of soil dust which could migrate off-site and thereby mitigate both off-site exposure and nuisance for neighbours.

It is recommended that a materials management and handling plan is developed for the construction works on this site. This should include contingency plans in case asbestos or free phase hydrocarbons are encountered, e.g. within the fabric of existing buildings, during the development.

In accordance with CL:AIRE Code of Practice (2011) materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded by the holder'.

The Code of Practice therefore allows soils to be reused on site where the following criteria are met:

- Pollution of the environment and harm to human health is prevented in reusing the excavated materials;
- The material are suitable for use (without any further processing);
- There is certainty of use; and
- The quantity that is absolutely necessary (and no more) is used.

In order to comply with the Code of Practice, a material management plan that confirms the above criteria are met has to be prepared. The material management plan must be reviewed by a 'Qualified Person' who then issues a declaration to the Environment Agency. Geo-Environmental can provide this service should it be required.



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Where materials do not meet the required criteria, it may be possible to treat them under an environmental permit so that they may be re-used on site.

Materials exhibiting hydrocarbon contamination or strong odours, or that have been identified as posing a risk to human health or the environment will be removed to a suitable waste treatment hub or landfill.

Should material be reused under the Definition of Waste Code of Practice, the reuse of material will need to be fully documented and included within the Validation Report produced on completion of the works.



5.0 EXCAVATION AND STOCKPILING OF MATERIAL

5.1 Excavation Process

In line with the proposed measures to protect human health, there are no specific proposals for the excavation of contaminated soils within the private gardens and soft landscaping. Excavation works will be required within the public open space areas in order to remove the unsuitable soils.

For each area, the excavation works shall progress laterally to uncontaminated faces. Once lateral removal has been completed, the excavation shall be progressed vertically. This approach will minimise the potential for cross contamination.

Excavation would also be limited where it is not reasonably practicable to do so in a safe manner, such as:

- Instability adjacent to roadways, buildings, walls or site boundaries;
- Close proximity of adjacent services, particularly foul sewers and high voltage cables.
- Ingress of water that cannot be dealt with by normal pumping equipment.

5.2 Stockpiling of Soils

All stockpiles of contaminated soil, where required shall be constructed no larger than 250m³ and no higher than 1.8m. Stockpiles shall be placed on stable and level ground, with a perimeter bund overlain by a polythene liner for run-off control. The liner will extend across the full base area of the stockpile. The stockpile shall also be covered by a second polythene (or similar) sheet to prevent the ingress of rainfall into the stockpile and the emission of odours from the stockpile. This upper sheet shall be weighted down or otherwise secured to the stockpile.

Prior to placement of material the bund will be inspected to ensure that it is impermeable and as such will be sufficient to retain surface runoff during the period of storage. Should water be noted to be building up within the bund it will be pumped out of the bund and disposed of under the appropriate duty of care.

On completion of on-site remediation works and removal of the stockpiles, the bund and liner materials will be removed to enable development of this portion of the site to continue. At this stage, the exposed ground will be inspected to confirm/validate that no leakage occurred from the stockpile. Any such new impact would be dealt with under the Discovery Strategy set out in Section 6 of this report.

5.3 Confirmatory Sampling of Stockpiles

Materials placed in stockpiles will not be reused in gardens or retained on site; instead they will be removed to an appropriately licensed disposal facility.

Where test results are not already available, stockpiled soils will be sampled for Waste Acceptance Criteria (WAC) analysis to determine whether the materials represent Inert, Non-Hazardous or Hazardous waste in order for them to be disposed of at an appropriate facility. In general, stockpile sampling shall be such that a minimum of 3 No. Samples shall be taken each of approximately 2kg weight for WAC analysis. Where stockpiles do not exceed 50m³, a single sample may be taken. Sampling shall be undertaken by Geo-Environmental's Site Representative in such a manner, as determined on site, in order that the sample is representative of the stockpile mass. Where possible this material will be sampled prior to excavation in order to allow for direct excavation to disposal from site without the need for a stockpile.



5.4 Validation Sampling from Excavations

Excavation of contaminated soil and validation of the reduced dig is proposed as part of the remediation works in public open space areas. Validation is to comprise a visual inspection of the base of any excavations in the affected area and include photographic evidence.

5.5 Backfilling

All public open spaces areas will require backfilling in compliance with the measures set out in Section 3.2 of this report. All such measures will be subject to site inspection and laboratory analysis to verify compliance and suitability.

Subsoil and Topsoil shall not be imported to site without prior acceptance of provenance and chemical suitability. Import suitability criteria are presented in Appendix A. Where materials are to be imported on to the site for use as subsoil and Topsoil, these shall be derived from one of two sources, i.e. natural or processed. Where natural sourcing is proposed, the provenance of the material shall be determined by confirmation of the source site's history to confirm no previous potentially contaminative use, coupled with analysis of soils at a minimum rate of 3No. samples per source site (up to 250m³) and 1 sample per 250m³ thereafter. Where Topsoil or subsoil are derived from a manufactured source, testing would be undertaken at a rate of 1 sample per 50m³. With regards to physical and nutritional composition and minimum testing regime of 1 sample per 250m³ is recommended for either source.

Subsoil shall be placed with nominal compaction provided from excavator movement in public open space areas.

All subsoil and Topsoil imported on to the development shall comprise a loam type soil suitable for sustaining plant growth, as well as compliant with criteria for the protection of human health.

Aggregates or soils with high stone content would not be considered suitable as subsoil or Topsoil.

**6.0 DISCOVERY STRATEGY**

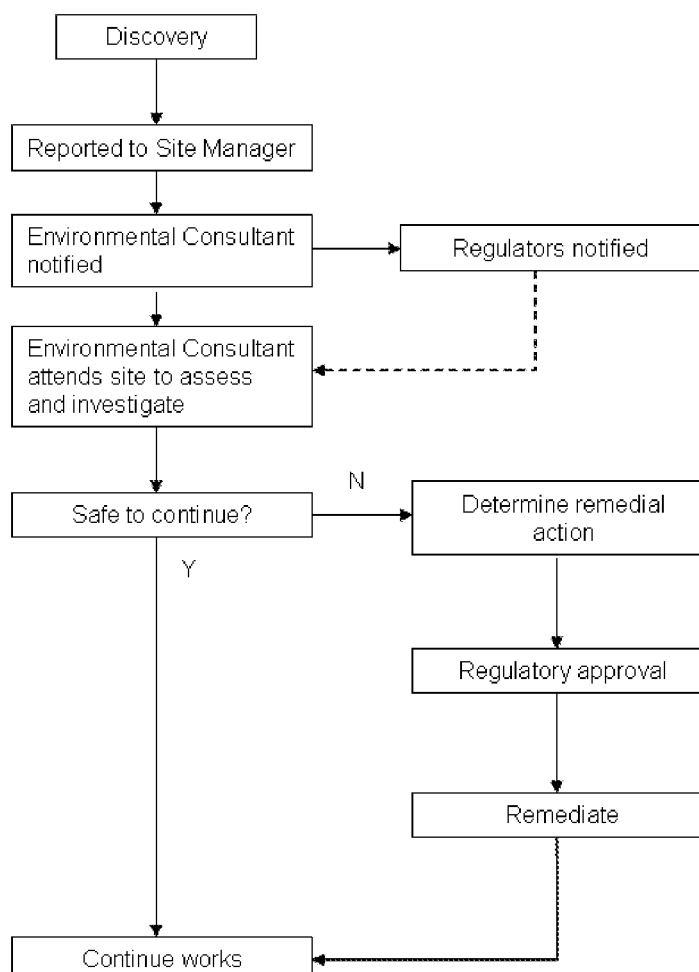
Whilst the investigation undertaken on the site to date is considered to be thorough, it remains possible that previously unexpected soil conditions may be encountered during the process of site demolition and construction.

Examples may include oily pockets within the soil, pockets of cement boarding or fibrous materials within the soil, black ashy materials, soils exhibiting strong odours, brightly coloured materials, and former structures or brickwork.

Should previously undiscovered contamination be encountered during the demolition/construction of the new buildings the following course of action should be adhered to:

- Works in the area of the suspected contamination should cease immediately. The ground workers should report any suspected contamination immediately to the Client's site supervisor. The supervisor should contact the Environmental Consultant, who should visit the site to assess the extent of the 'contamination'.
- The Environmental Consultant shall make records of their inspection, and pass details of these to the Local Authority.
- Where the conditions revealed differ from those previously anticipated, the Environmental Consultant shall take samples as deemed appropriate to be dispatched for appropriate chemical testing.
- Depending on the results of the testing either: 1) no further work will be required; 2) a further detailed risk assessment will be required; and/or 3) localised specific remedial measures will be necessary. Appraisal criteria will vary depending on the nature of the assessment.
- The results of any such testing will be sent to the Regulatory Authority for consultation. If further remediation is required, the Regulatory Authority will be informed of the date and time of the proposed works.
- Any further remediation will be undertaken in accordance with a method statement submitted to the Local Authority for approval. The works shall be supervised by the Environmental Consultant who shall provide a Validation Report for the Local Authorities purposes.

The process is summarised overleaf:

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A copy of this strategy should be lodged on site, and provisions made to ensure that all workers are made aware of their responsibility to observe, report, and act on any potentially suspicious or contaminated materials they may encounter.



7.0 VERIFICATION

On completion of the development a verification report will be prepared for the remedial works undertaken. The report will be submitted to the Client and Local Authority for formal approval.

The Verification Report will refer to the works as set out within this RMS and verification plan and include relevant site based information such as records from site inspections, photographs of specific remedial or waste handling measures, material datasheets, QA certification (where relevant) and an audit trail for imported sub-soil and Topsoil, including source, provenance, analytical results, placement location and thickness.

The remedial works will be inspected and validated by the Environmental Consultant (Geo-Environmental).



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IMPORTED SOIL SPECIFICATION



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1.0 Introduction

This documents sets out the requirements for cover systems and imported materials for any project undergoing redevelopment or other works where capping work is required.

Within the specification reference has been made to topsoil and subsoil. Topsoil relates to the top layer of natural soil that can support healthy vegetation growth. Subsoil relates to the layer of soil immediately below the topsoil to the depth of the underlying broken rock or geological parent material.

The specification considers the chemical, nutritional and physical properties of soils that are to be imported onto site, in order to ensure materials used are suitable for their intended use and do not introduce any new hazard or pollutant linkage on to the site.

Where there is any discrepancy between this specification and BS3882:2015 or BS8601:2013, the latter documents shall take precedence unless otherwise formally confirmed by the relevant regulator.

2.0 Chemical Composition

The chemical criteria listed below are based on published CLEA Soil Guideline Values (SGVs), generic assessment criteria calculated using UK policy compliant software or by reference to current guidance and best practice. From time to time these values may change in line with regulatory or UK policy changes. Such changes will require revision and re-issue of this document.

At the time of preparation, where SGVs have not been published, generic assessment criteria (GAC) have been generated using the Contaminated Land Exposure Assessment (CLEA) model v1.06 published by the Environment Agency, or the Category 4 Screening Levels (C4SLs) published by DEFRA have been used. Although the C4SLs were released for Part 2A use, the associated policy companion document for the C4SLs indicated that they may also be used for planning. Although the C4SLs represent a marginally higher risk level than the SSACs (low risk rather than minimal risk) it is considered that the risk levels remain very low. Therefore, the final C4SLs are considered to be suitable to assess soils under the planning regime. Where SGVs or GAC are published for a range of Soil Organic Matter (SOM) values, these ranges and their respective SOM values have been presented and would be considered when assessing compliance with this Specification.

2.1 Method of Analysis

Samples should be analysed using UKAS or MCERTS accredited laboratories. For TPH analysis sample preparation must not include air drying.

2.1.1 Poly Aromatic Hydrocarbon (PAH)

The PAH analysis must include the EPA priority 16.

2.1.2 Total Petroleum Hydrocarbons (TPH)

The analysis for TPH should be undertaken on the 'as received' sample and not be subject to any pre-treatment and include aliphatic and aromatic carbon banding split.



2.2 Topsoil (0-300mm depth)

Table 1 provides a list of the maximum acceptable concentrations for imported topsoil.

Parameter	Maximum concentration (mg/kg)
Inorganic	
Arsenic (total)	<32
Boron (water soluble)	<291
Cadmium (total)	10 (SOM=6%)
Chromium (total)	<130
Copper (total)	<2330
Cyanide (total)	<250
Lead (total)	<200
Mercury (total inorganic)	<8
Nickel (total)	<130 (SOM=6%)
pH	5.5 – 7.8
Selenium (total)	<350 (SOM=6%)
Sulphate (total)	<2000
Zinc (total)	<3750
Asbestos	Absent
Organic	
Soil Organic Matter (SOM)	
Phenols (total)	<420 (SOM=6%)
Poly Aromatic Hydrocarbon (speciated)	See Table 1a
Total Petroleum Hydrocarbon (speciated)	See Table 1b

Table 1 Chemical Specification for Topsoil

Determinant	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Acenaphthene	210	480	1000
Acenaphthylene	170	400	850
Anthracene	2300	4900	9200
Benz(a)anthracene	3.1	4.7	5.9
Benzo(a)pyrene	0.83	0.94	1.0
Benzo(b)fluoranthene	5.6	6.5	7.0
Benzo(ghi)perylene	44	46	47
Benzo(k)fluoranthene	8.5	9.6	10
Chrysene	6.0	8.0	9.3
Dibenz(ah)anthracene	0.76	0.86	0.9
Fluoranthene	260	460	670
Fluorene	160	380	780
Indeno(1,2,3CD)pyrene	3.2	3.9	4.2
Naphthalene	1.5	3.7	8.7
Phenanthrene	92	200	380
Pyrene	560	1000	1600

Table 1a Topsoil Specification for Speciated PAH



Determinant	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Aliphatic			
EC 5-6	30	55	110
EC >6-8	73	160	370
EC >8-10	19	46	110
EC >10-12	93	230	540
EC >12-16	740	1700	3000
EC >16-35	45000	64000	76000
EC >35-44	45000	64000	76000
Aromatic			
EC 5-7 (benzene)	65	130	280
EC >7-8 (toluene)	120	270	611
EC >8-10	27	65	151
EC >10-12	69	160	346
EC >12-16	140	310	593
EC >16-21	250	480	770
EC >21-35	890	1100	1230
EC >35-44	890	1100	1230
Aliphatic and Aromatic			
EC >44-70	1200	1300	1300

Table 1b Topsoil Specification for Speciated TPH

Determinant	Phytotoxicity GAC (mg/kg)		
	pH <6.0	pH 6.0-7.0	pH >7.0
Zinc	200	200	300
Copper	100	135	200
Nickel	60	75	110

Table 1c Topsoil Specification for phytotoxicity

2.3 Subsoil (300-1000mm depth)

Table 2 provides a list of the maximum acceptable concentrations for imported subsoil.

Parameter	Maximum concentration (mg/kg)
Inorganic	
Arsenic (total)	<32
Boron (water soluble)	<291
Cadmium (total)	10 (SOM=6%)
Chromium (total)	<130
Copper (total)	<2330
Cyanide (total)	<250
Lead (total)	<200
Mercury (total inorganic)	<8
Nickel (total)	<130 (SOM=6%)
pH	5.5 – 7.8



Parameter	Maximum concentration (mg/kg)
Inorganic	
Selenium (total)	<350 (SOM=6%)
Sulphate (total)	<2000
Zinc (total)	<3750
Asbestos	Absent
Organic	
Soil Organic Matter (SOM)	
Phenols (total)	<420 (SOM=6%)
Poly Aromatic Hydrocarbon (speciated)	See Table 1a
Total Petroleum Hydrocarbon (speciated)	See Table 1b

Table 2 Chemical Specification for Subsoil

Determinant	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Acenaphthene	210	480	1000
Acenaphthylene	170	400	850
Anthracene	2300	4900	9200
Benz(a)anthracene	3.1	4.7	5.9
Benzo(a)pyrene	0.83	0.94	1.0
Benzo(b)fluoranthene	5.6	6.5	7.0
Benzo(ghi)perylene	44	46	47
Benzo(k)fluoranthene	8.5	9.6	10
Chrysene	6.0	8.0	9.3
Dibenz(ah)anthracene	0.76	0.86	0.9
Fluoranthene	260	460	670
Fluorene	160	380	780
Indeno(1,2,3CD)pyrene	3.2	3.9	4.2
Naphthalene	1.5	3.7	8.7
Phenanthrene	92	200	380
Pyrene	560	1000	1600

Table 2a Subsoil Specification for Speciated PAH

Determinant	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Aliphatic			
EC 5-6	30	55	110
EC >6-8	73	160	370
EC >8-10	19	46	110
EC >10-12	93	230	540
EC >12-16	740	1700	3000
EC >16-35	45000	64000	76000
EC >35-44	45000	64000	76000
Aromatic			
EC 5-7 (benzene)	65	130	280



Determinant	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
EC >7-8 (toluene)	120	270	611
EC >8-10	27	65	151
EC >10-12	69	160	346
EC >12-16	140	310	593
EC >16-21	250	480	770
EC >21-35	890	1100	1230
EC >35-44	890	1100	1230
Aliphatic and Aromatic			
EC >44-70	1200	1300	1300

Table 2b Subsoil Specification for Speciated TPH

Determinant	Phytotoxicity GAC (mg/kg)		
	pH <6.0	pH 6.0-7.0	pH >7.0
Zinc	200	200	300
Copper	100	135	200
Nickel	60	75	110

Table 2c Subsoil Specification for phytotoxicity

3.0 Nutritional Composition

The nutritional criteria listed below are based on BS3882:2015 for topsoil and BS8601:2013 for subsoil. In the absence of published criteria, current guidance and best practice has been applied to derive appropriate criteria.

3.1 Topsoil & Subsoil

Table 3 details the minimum acceptable concentrations for imported topsoil and subsoil.

Topsoil/Subsoil	Parameter	Concentration
Topsoil	Phosphorous	16 – 140 mg/l
	Potassium	121 – 1500 mg/l
	Magnesium	51 – 600 mg/l
	Nitrogen	0.15 % m/m
	Carbon:nitrogen ratio	<20:1
Subsoil	Phosphorous	16 mg/l
	Potassium	121 mg/l
	Magnesium	51 mg/l
	Nitrogen	0.15 %
	Carbon:nitrogen ratio	<20:1

Table 3 Nutritional Specification for Topsoil and Subsoil

4.0 Physical Composition

The physical criteria listed below are based on BS 3882:1994 Specification for Topsoil. In the absence of published criteria, current guidance and best practice has been applied to derive appropriate criteria.



4.1 Topsoil

Table 4 details requirements for imported topsoil and subsoil.

Topsoil/Subsoil	Parameter	Specification requirements
Topsoil	Textural Classification	Sandy clay loam, sandy loam, loamy sand, sandy silt loam (as defined in BS 3882, Figure 1)
	Loss on Ignition	3 - 20% (for 5-20% clay soil) 5 -20% (for 20-35% clay soil)
	Maximum Stone content:	>2mm = 30% >20mm = 10% >50mm = 0%
Subsoil	Textural Classification	Refer to BS8601 Figure 1
	Loss on Ignition	2%
	Maximum Stone content:	>2mm = 40% >20mm = 20% >75mm = 0%

NB: Topsoil and Subsoil must be free from glass, brick fragments, asbestos and other deleterious materials.

Table 4 Physical Specification for Topsoil & Subsoil

5.0 Source Requirements

5.1 Topsoil and Subsoil

The following will be provided with all soils imported to site:

- Location of site which is clean and has no history of potentially contaminative uses.
- A site plan detailing the location and address of the source site.

5.2 Manufactured soils

Where natural soils are unavailable manufactured soils may be utilised the following should be provided:

- Details of the soil manufacturing process, including criteria for received soils, quality control procedure and validation protocol.
- Soils should be tested at a minimum ratio of one sample per 50m³.

6.0 Testing Rates and Compliance

Sampling shall be undertaken in accordance with BS3882:2015 and BS8601:2013.

6.1 Topsoil

Where natural sourcing is proposed, the provenance of the material shall be determined by confirmation of the source site's history to confirm no previous potentially contaminative use, coupled with analysis of soils at a minimum rate of 3No. samples per source site (up to 250m³) and 1 sample per 250m³ thereafter.

Where Topsoil is derived from a manufactured source, testing would be undertaken at a rate of 1 sample per 50m³.



With regards to physical and nutritional composition and minimum testing regime of 1 sample per 250m³ is recommended for either source.

6.2 Subsoil

Where the source of the material is known and a due diligence review has established no previous contaminative use associated with the proposed subsoil, validation sampling should be undertaken at a minimum rate of 3 sample per source (up to 250m³) and 1 sample per 250m³ thereafter.

Where the source of the material is not known the validation sampling should be undertaken at a minimum of 1 sample per 50m³.

6.3 Manufactured soils

Soils should be tested at a minimum ratio of one sample per 50m³.

6.4 Sample failure

In the event that a sample fails to meet the specified criteria for any parameter the Environmental Consultant should be contacted for advice on the suitability of the materials.

Further testing may be required to provide reassurance that the exceedances are not representative of the soil.

6.5 Timing

Sampling and analysis undertaken by a manufactured topsoil supplier shall be no earlier than two weeks from the date of import, any results which are older than two weeks will be deemed not to be representative of the soils to be imported and rejected. Results showing consistency of batching shall may be requested.

Imported soil suppliers and groundworks contractors are required to take reasonably practicable measures to ensure that compliance with this Specification does not hinder formal completion of individual plots or developments.

6.6 General Compliance

All analytical suites shall correspond with the chemical and nutritional compliance criteria (as set out in Tables 1 to 3). The soil supplier shall ensure that the analytical limits of detection are equal or lower than the compliance values presented within this Specification. Where either testing suites or limits of detection do not comply with this Specification, the entire set of results shall be rejected.