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# BICESTER, PLOT A OFFICES

## REMEDIATION STRATEGY

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Client Name: Peveril Securities Ltd

Client Address: Maisie House, 8 Maisie's Way, South Normanton, Derbyshire, DE55 2DS

Site Address: Development at Lakeview Drive, Bicester

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# 1 INTRODUCTION

This Remediation Strategy has been prepared by Curtins for Peveril Securities Ltd (the Client) to provide guidance with respect to remedial requirements for the proposed development site at Lakeview Drive, Bicester, Oxfordshire, OX26 1DE.

The proposed development on site comprises the construction of up to 55,000m$^2$ of office space, this Remediation Strategy refers to the Plot A Office building only.

The site has been characterised through a desk-based Phase 1 Geo-Environmental Assessment (Ref. 1) and a Phase 2 Geo-Environmental Assessment (Ref. 2) undertaken by BWB in August and September 2017 respectively.


*Figure 1 – Site Location Plan*

It must be noted that this Remediation Strategy refers only to the Plot A Office. A site location plan is presented in *Figure 1* with the approximate site boundary for the Plot A Offices outlined in red.

The wider site is irregular in shape and occupies approximately 21.0 Ha of land. The site currently comprises three large open fields used for grass / hay making a landscaped area to the north; and a large pond. Two drainage ditches cut north to south across the site. The Plot A Offices site occupies approximately 1.10 Ha of land in the north-west of the wider site and comprises vacant land with a stone roadway, believed to have formed a yard area during recent development works (Ref. BWB Phase 1, 2017).

## 1.1 Requirements of the Remediation Strategy

The Remediation Statement is to account for the following;

- A description of the materials likely to be encountered by the developer and their contractor/sub-contractors;
- Proposals for excavations with respect to the materials likely to be encountered;

- Revised risk ratings associated with ground contamination and primary pollutant linkages remaining;
- Recommendations for the specification of the cover of Made Ground soils in proposed soft landscaped areas;
- Recommendations for appropriate PPE and managing asbestos appropriately during construction;
- Recommendations for re-use of materials and use of a Materials Management Plan (MMP);
- A strategy a watching brief during earthworks and for handling potentially contaminative incidents.
- Proposals for the verification of remedial measures, including a regime for verification and chemical analysis of the cover layer material;

## 1.2 Definitions

In this document the following definitions apply:

**Contractor** Refers to the appointed contractor responsible for undertaking the remediation works.

**Site Manager** Refers to a representative of the appointed contractor resident on site.

**Engineer** Refers to a suitably qualified representative from Curtins, who would not normally be resident on site.

## 1.3 References

The Remediation Strategy has been prepared with reference to the following existing reports;

- **Reference 1:** BWB (2017) Phase 1 Geo-Environmental Assessment. Ref. LDB-BWB-00-XX-RP-EN-0001-DS_P1
- **Reference 2:** BWB (2017) Phase 2 Geo-Environmental Assessment. Ref. LDB-BWB-00-XX-EN-RP-0001_PH2_P1

# 2 GROUND CONDITIONS

The following sections present a summary of the ground conditions identified during the BWB intrusive ground investigation.

## 2.1 Made Ground

Made Ground soils were recorded in all exploratory hole locations associated with the Plot A Offices (BH101, BH102, TP101, TP102, TP103 and TP124) from ground level to a maximum depth of 1.00m bgl. Thickness of Made Ground encountered during the ground investigation ranged between 0.20m and 1.00m.

Made Ground descriptions comprised firm brown / dark brown / yellow or grey sandy gravelly clay; brown gravelly sand; brown occasionally yellow sandy, gravelly cobbles; and firm brown mottled grey clayey, gravelly sand (reworked natural ground).

Rare anthropogenic fragments comprised brick, plastic, timber, ceramic, concrete, asphalt, and glass.

## 2.2 Superficial Deposits

### 2.2.1 Topsoil

Topsoil was encountered within TP124 only, from ground level to 0.25m bgl. This topsoil comprised grass over brown slightly clayey gravelly fine and medium sand with frequent rootlets. The gravel comprised fine to coarse, angular quartzite, flint, and limestone.

### 2.2.2 Alluvium

Superficial deposits of Alluvium were encountered within BH102, TP102 and TP103, from depths of 0.20 to 0.80m bgl, with thicknesses ranging from 0.30m to 0.50m. The Alluvium comprised stiff greyish brown mottled yellow and orange slightly gravelly clay with occasional rootlets in BH102; firm brown to dark brown slightly sandy gravelly clay and brown mottled grey clayey gravel of limestone, flint and quartzite in TP102; and soft slightly gravelly clay with occasional rootlets in TP103.

## 2.3 Bedrock Deposits

### 2.3.1 Kellaways Clay Member

The Kellaways Clay Member was encountered within TP101 and TP102, interbedded with weathered Cornbrash Formation deposits. This stratum was encountered from 1.60m, 1.95m and 2.33m bgl with thicknesses ranging between 0.32m and 0.50m; it was described as soft to firm dark grey / light brown sandy, gravelly clay and as grey to dark grey slightly sandy, cobbly gravel of mudstone.

### 2.3.2 Cornbrash Formation

Bedrock deposits of the Cornbrash Formation were encountered within all exploratory holes located within the Plot A Offices site. Both weathered and competent Cornbrash Formation deposits were encountered at depths from 1.00m to 2.80m bgl with thicknesses ranging between 0.20m to 1.25m.

The Cornbrash Formation encountered on site was variable, with deposits of sand, gravel, cobble, and competent limestone. Cornbrash Formation deposits comprised very dense light brown / yellowish brown / orange / grey / dark grey, clayey, sandy gravel of limestone; yellow and grey gravelly, fine to medium sand with cobbles; yellowish grey slightly sandy, slightly gravelly cobble of limestone; and very dense, dark grey weathered limestone recovered as slightly clayey, slightly sandy gravel of mudstone and/or limestone.

# 3 GROUND & GROUNDWATER CONTAMINATION

## 3.1 Ground Contamination

During the BWB 2017 ground investigation environmental chemistry results were compared with a Generic Assessment Criteria for soils with respect to human health for a '*Commercial end use*'. Results showed that all samples sent for chemical analysis had concentrations below the relevant screening criteria for each contaminant.

BWB noted (Ref. 2) that one hotspot of total TPH was recorded in a Made Ground sample from TP102 (0.10 – 0.20m bgl) with a concentration of 1000 mg/kg, against an initial screening criteria of 500 mg/kg. However, speciated analysis on the same sample confirmed that al split aliphatic and aromatic banding concentrations were below the relevant screening criteria and therefore does not represent a risk to human health.

Soil samples were also analysed for the presence of asbestos; two samples of Made Ground returned a positive identification for loose chrysotile fibres (TP102 at 0.10 – 0.20m bgl and TP103 at 0.20 – 0.30m bgl).

## 3.2 Leachable Contamination

BWB collected several superficial water samples from Made Ground for analysis in 2017. Several exceedances of copper, lead, nickel, and zinc were identified against EQS Screening Values, with the exceedances presented in *Table 1* below.

*Table 1 – BWB 2017 Leachable Exceedances against EQS*

| Determinant | Exploratory Hole ID | Concentration Range (µg/l) | EQS Screening Value (µg/l) |
|---|---|---|---|
| Copper | TP101 – 0.20 to 0.30m | 22.0 – 42.0 | 1.0 |
| | TP101 – 0.40 to 0.50m | | |
| | TP102 – 0.10 to 0.20m | | |
| Lead | TP101 – 0.20 to 0.30m | 1.8 – 6.8 | 1.2 |
| | TP101 – 0.40 to 0.50m | | |
| | TP102 – 0.10 to 0.20m | | |
| Nickel | TP101 – 0.10 to 0.20m | 4.2 | 4 |
| | TP102 – 0.10 to 0.20m | | |
| Zinc | TP102 – 0.10 to 0.20m | 12 | 10.9 |

BWB (Ref. 2) noted that several contaminants including cyanide (total) and mercury are indicated to be elevated on the leachate screening sheet, however, the laboratories lowest detection limit is higher than the screening value used, and therefore, these contaminants are considered to represent a low risk.

The risk to groundwater underlying the site (Secondary A Aquifer within the Cornbrash Formation) within the BWB report (Ref. 2) was considered marginal due to the limited concentrations of heavy metals recorded with the soils across the site. The proposed development is understood to comprise significant hardstanding and limited soft landscaping, therefore reducing the risks associated with leachable contaminants.

## 3.3 Groundwater Contamination

BWB collected several groundwater samples from BH101 and BH102, with two exceedances recorded when compared against the EQS Screening Values, exceedances presented in *Table 2* below.

*Table 2 – BWB 2017 Groundwater Exceedances against EQS*

| Determinant | Exploratory Hole ID | Concentration (µg/l) | EQS Screening Value (µg/l) |
|---|---|---|---|
| Copper | BH102 | 8.2 | 1.0 |
| Mercury | BH102 | 0.11 | 0.07 |

BWB (Ref. 2) noted that the exceedance of mercury is only marginally above the screening criteria and therefore considered this unlikely to represent a significant risk to controlled waters.

## 3.4 Ground Gas

BWB completed four gas monitoring visits between the 24th of August and 13th of September 2017 following the ground investigation. Both borehole locations were installed with ground gas monitoring wells, with the response zones targeting the Cornbrash Formation.

Barometric pressures ranging between 991mb and 1013mb were recorded during the monitoring period, with rising, steady and falling atmospheric conditions.

Hydrogen sulphide concentrations were not recorded above the limit of detection during the monitoring period, carbon monoxide was detected within BH101 at a peak concentration of 21ppm.

The BWB report (Ref. 2) states the gas flow within both wells was recorded at 0.1 l/hr throughout the monitoring period; the concentration of methane (CH4) was recorded at <0.1% $^{v}/_{v}$ in both locations throughout the monitoring period; and the steady state and peak concentrations of carbon dioxide (CO2) were recorded at 0.1 – 0.4% $^{v}/_{v}$ and 3.5 – 3.7% $^{v}/_{v}$ respectively.

The GSV for this monitoring period has been calculated as 0.0037 l/hr, corresponding to a CS-1 (Characteristic Situation 1) not requiring any ground gas protection measures.

# 4 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) for the site has been developed as part of the BWB site investigation that was undertaken at the site and considered based on the current works proposed.

The CSM details a number of pollutant linkages at the site, however, based on the risk assessments undertaken, the potential contaminant linkages (PCLs) listed in *Table 3* were identified as requiring remediation to enable the safe re-development of the site.

*Table 3 – Potential Contaminant Linkages*

| PCL | Sources | Receptor | Risk | Potential Pathway | Remediation Recommended |
|---|---|---|---|---|---|
| 1 | Made Ground – presence of asbestos fibres and hotspot of total TPH. | **End Site Users (Office Building)** | **Low** | Inhalation of dust particles and dermal contact. | It is understood that the development is likely to be predominantly covered by buildings and hardstanding surface cover, therefore limiting any potential contact by the future site user.<br><br>A clean soil cover system is recommended in areas of soft landscaping overlying the Made Ground deposits to break the pathway between the asbestos fibres and future site workers.<br><br>The risk to construction and groundworkers can be minimised by the adoption of appropriate PPE and respiratory protective equipment (RPE). It is recommended that the ground surface is kept damp to minimise the movement of free fibres. |
| | | **Construction Workers** | **Moderate / Low** | | |
| 2 | Elevated contaminants (Copper and Mercury) within the groundwater beneath the site. | **Secondary A Aquifer** | **Low** | Migration of contaminated groundwater. | The concentrations recorded are only slightly elevated. Furthermore, it is understood that the development is likely to be predominantly covered by buildings and hardstanding surface cover, therefore limiting leaching and migration of contaminants. |
| | | **Tertiary Rivers on site (drainage ditches)** | **Low** | | |

Section 7.0 presents a strategy for handling unexpected contamination or contaminative incidents. It is further recommended that watching brief/periodic site visits are undertaken by a Geo-Environmental Engineer to record any unexpected contamination as outlined in Section 7.3.

# 5 REMEDIAL WORKS

In this document the term 'remediation' is used to define specific works required to address potential issues arising from contamination in site soils and ground gases, with due account taken of the known history of the site and the proposed end-user.

With reference to the Conceptual Site Model and the potential contaminant linkages detailed in *Table 3* two remedial actions are recommended in order for the site to be brought up to a condition that is deemed 'suitable for use';

- **Remedial Action 1:** Appropriate PPE for all construction workers and suitable asbestos management measures.
- **Remedial Action 2:** Engineered capping to serve as physical barrier between Made Ground and site surface in soft landscaped areas preventing direct contact, dermal uptake and limiting the derivation of dust.

Measures for dealing appropriately to unexpected contamination encountered on site and the recommendation for a watching brief (part time) by an Environmental Engineer during earthworks are outlined within Section 7.3.

## 5.1 Remedial Action 1 – Contamination and Asbestos Management During Construction

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements to address PCL1 (*Table 3*).

CL:AIRE have published guidance to aid in the classification of remediation works on Asbestos Containing Soils (ACS) compliant with Control of Asbestos Regulations 2012 (CAR). This is detailed in CL:AIRE (2016) "Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance.

Any works with asbestos containing soils are required to determine their classification in accordance with Control of Asbestos Regulations 2012. The specialist groundworks contractor is therefore to designate the works based on the investigation results but utilising their own additional testing and delineation if they deem it to be required. Subsequently the specialist groundworks contractor is to compile a method statement to establish an appropriate management, monitoring and supervisory procedure for the movement of soils as part of the required cut and fill (earthworks) operations. The specialist remediation contractor is to be responsible for management and record keeping as detailed in their method statement document.

Where, from the site investigations, materials are known to contain asbestos fibers good practice (JIWG CAR-Soil and CAR 2012) prescribes such material to be segregated to ensure materials would not cross-contaminate other soils and to reduce the risk of further fiber release to site workers.

*Section 3.1* above should be consulted together with BWB's Phase 2 Geo-Environmental Assessment Report, Exploratory Hole Location Plan Drawing and Exploratory Hole Logs (Ref. 2) for the locations, depths and type of asbestos identified during the Ground Investigation.

Materials containing asbestos >0.1% w/w would be classed as hazardous waste.

Good practice prescribes that any fragments or asbestos containing materials where identified should be picked where possible and to be kept separated in line with those from any soil arisings. This is typically carried out by picking visible fragments at the point of excavation. Such operations are carried out by suitably qualified staff, wearing disposal overalls (type 5/6), gloves and fine dust (FPP3) masks in combination with adoption of dust suppression techniques and monitoring or other applicable methods as recommended by the Asbestos Management Specialist. The qualified

staff are to be trained in the identification of asbestos at source. The qualification and competencies of all operatives undertaking monitoring and calibration documentation of equipment should be provided to the Engineer.

Existing Made Ground should not be crushed or in any way treated due to risk of asbestos fibre release. It may be possible to use Made Ground soils as general fill subject to in situ trial tests and where managed appropriately by the Method Statement compiled by the Asbestos Management Specialist.

## 5.2 Remedial Action 2 – Engineered Capping

The primary PCL identified at the site relates to the direct contact, dermal uptake, soil and dust ingestion and inhalation of asbestos fibres in soil and soils and soil derived dust (PCL 1, *Table 3*).

The potential for exposure to asbestos fibres is highest within soft landscaped areas where receptors (maintenance staff and public) at the site are most likely to come in contact with the contaminated Made Ground soils. Drawings are included within *Appendix A.*

Hardstanding, including the building footprints, vehicular tarmac, pedestrian tarmac and concrete and block paving are considered sufficient to break the potential contaminant linkage, PPL 1, detailed in *Table 3* and therefore no specific remediation measures, above activities required for construction, are considered necessary if and where these are installed at the site.

For all soft landscaped areas, a clean cover layer is recommended. It is therefore recommended that verified clean capping, comprising a minimum total thickness of 300mm is incorporated in general soft landscaping areas. This is to be made up of a minimum 150mm imported topsoil and 150mm of sub-soil. Additionally, a high visibility warning geotextile break layer or anti-dig break layer is to be installed beneath the clean cover system.

This is anticipated to provide adequate protection of human health with consideration of likely exposure and should be incorporated in all proposed soft landscaped areas.

# 6 SPECIFICATION FOR SITE WON AND IMPORTED SOILS

This section outlines the required chemical testing specification that the proposed engineered capping must meet to satisfy Remedial Action 2 along with a chemical testing specification. This does not cover general fill materials as it is anticipated this will be covered within the earthwork specification.

## 6.1 Sourcing of Materials

### 6.1.1 Off-Site Sources

It is anticipated that materials may be imported to the site for use in constructing the clean engineered capping across the site's soft landscaping areas. It is strongly recommended that materials are sourced from reputable suppliers and comprise materials that have been suitably processed to produce standardised materials.

It is not recommended that materials are imported directly from 'donor' development sites. Imported material will also require verification testing to ensure suitability for reuse, and it is strongly advised that the Contractor undertake their own independent verification testing if accepting material from a third party, rather than relying on supplier reports.

It is anticipated that crushed hardcore stone and brick may be imported for use in earthworks such as in construction of piling mat.

### 6.1.2 On-site Sources

Based on the findings of the Ground Investigation, it is considered highly unlikely that the general shallow Made Ground could be considered 'uncontaminated', 'clean' or 'suitable' material for re-use as a subsoil or topsoil in soft landscaped areas due to the presence of asbestos fibres at two separate locations across the site.

Within the wider site, the ground investigation found that the topsoil was largely 'suitable for use' when compared to BWBs assessment criteria (Ref. 2). It is possible that under a Materials Management Plan (MMP) topsoil from other areas of the site could be transferred to the Plot A Offices area of site to form part of the engineered capping layer.

## 6.2 Imported Topsoil

Imported Topsoil will invariably be required and should be supplied and placed in accordance with the Architects' specification but generally it is anticipated that all topsoil will be a minimum of 150mm thick in proposed soft landscaped areas (as part of the 300mm overall layer thicknesses as detailed in *Section 5.0*. Where topsoil is imported, it is to be 'Multipurpose' in accordance with BS 3882:2015 'Specification for Topsoil and Requirements for Use'.

The topsoil should also be confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.4.*

## 6.3 Imported Subsoil

Where imported subsoil is required as part of the growing medium this can be cohesive or granular but should be free-draining and confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.4* and compliant with BS 8601:2013 'Specification for subsoil and requirements for use'.

## 6.4 Chemical Composition of Soils

All materials used in capping should not contain concentrations of contaminants that present an unacceptable risk to the health of future site occupants or off-site receptors.

The Contractor shall be responsible for demonstrating that imported material is 'clean' and therefore suitable for use as part of the engineered capping or else as fill material. This will include the recovery of samples for laboratory testing from both the material source and verification testing of material following delivery to site. The required testing frequencies for materials source types are detailed below. Other sources may be applicable, however testing frequencies shall be confirmed with the Engineer prior to acceptance.

*Table 4 – Environmental Chemistry Testing Frequency for Soils*

| Impacted Soils | Testing Frequency |
|---|---|
| Imported Topsoil/Subsoil (Greenfield/ Manufactured) | On Site Verification: One sample every 200m3 used (or a minimum of 4 No. samples, whichever is greater), testing to be undertaken once material is imported to site. |
| Imported Topsoil/Subsoil (Remediated/ Brownfield/ Unknown) | On Site Verification: One sample every 50m3 used (or a minimum of 4 No. samples, whichever is greater), testing to be undertaken once material is imported to site. |
| Topsoil/Subsoil from other areas of the site | On Site Verification: One sample every 50m3 used (or a minimum of 4 No. samples, whichever is greater), testing to be undertaken once material has been placed/stockpiled for use. |

The environmental chemistry testing requirements and frequency are as Table 4 & Table 5. Additions to the suite and frequency of sampling may be required based on the source of imported materials. For example, if the imported Topsoil is not naturally sourced, e.g., recycled soil, further chemical determinants may be added to the chemical analysis suite at the discretion of the Engineer.

*Table 5 – Environmental Chemistry Analysis Suite for Soils*

| Suite Reference | Environmental Chemistry Analysis |
|---|---|
| Greenfield, Brownfield or Manufactured Soils | Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron;<br>pH<br>Soil Organic Matter<br>Asbestos Screening<br>Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound)<br>Total Petrol Hydrocarbons (Full TPHCWG analysis – aromatic/aliphatic split, Detection Limit 0.01mg/kg for each banding C5 to C10 and 1mg/kg for bandings above C10) |

**Assessment criteria:** Concentrations of the above determinants shall not exceed the 'Residential without Home Grown Produce' screening criteria (contained within Appendix B).

**Definition of 'clean':** Where ALL concentrations are less than these values the soils shall be defined as 'clean'.

**Soil organic matter (SOM):** A review of the thresholds may be made for specific soil sources whereby the Soil Organic Matter ranges.

## 6.5 Validation of Capping Thickness in Soft Landscaped Areas

Confirmatory analysis outlined previously is required to confirm the suitability of the capping layer.

Evidence that the specified depth of capping has been provided will be required.

Evidence could either be in the form of topographic surveys at the base of excavations together with material order sheets (geo-textiles) and the final finish levels or hand excavated trial pits advanced in areas where material has been placed.

The pits shall be excavated to the base of the interface between the existing Made Ground and the engineered capping layer with the geo-textile membrane or granular break layer clearly visible.

A photographic record of the hand excavated trial pits would also be required in accordance with the best practice examples.

# 7 STRATEGY FOR HANDLING POTENTIALLY CONTAMINATED SOILS AND CONTAMINATIVE INCIDENTS OF SITE

## 7.1 Contaminated Soils

Surplus soils to be removed from site, which have been identified as unsuitable for re-use should be loaded onto a lorry, covered securely, and transported directly to the landfill facility.

Where stockpiling is unavoidable, the stockpile should be located on an impermeable membrane and be covered also with a low permeability membrane at the end of each working day. Where soils are wet when excavated, measures should be taken to ensure there is no runoff from the soils onto the surrounding soils.

**Duty of Care:** Under his duty of care, the Principal Contractor shall ensure the proper and safe disposal of waste from each site after it has been passed on to another party. In this respect details of the landfill facility to be used and the company disposing of the waste with regard to hazardous and non-hazardous waste shall be provided to the Site Manager. Copies of Consignment Notices for special waste and Waste Transfer Notes for hazardous and non-hazardous waste shall be kept on site for review by Curtins Consulting.

## 7.2 Contaminative Incidents

It is possible, however unlikely, that some below ground features / structures exist that have not been recorded on plans and have not been encountered during the ground investigation works. It is possible that unknown/unrecorded substructures (e.g. fuel tanks) may exist which if ruptured may release materials that could contaminate the surrounding soils and groundwater (petroleum hydrocarbons, solvents, for example). In the unlikely event that this occurs an outline strategy is detailed below.

Where such a tank/pipework is damaged during excavation and the contents are released into the surrounding soil, the tank/pipework should be immediately pumped dry into another suitable container and a trench with a low permeability base formed around the tank/pipework to prevent seepage laterally and to collect the contaminant. Where groundwater is encountered in the trench, it should be pumped into a suitable container and tested for the contaminant. All soils affected shall then be tested and removed from site as appropriate.

Where the damage is caused to the underside of a tank and seepage is vertical, the contaminants may present a risk of polluting the groundwater. In this instance and subject to the findings of a risk assessment boreholes may be required to prove and intercept the contaminant. The contaminant will then be pumped into suitable containers.

The procedure outlined in *Section 7.3* should also be adhered too and the Engineer shall approve all proposals for such remediation.

## 7.3 Unexpected Contamination & Watching Brief

In the event that material is revealed on the site of a nature that does not accord with the previously observed and recorded descriptions the following procedure is to be complied with.

a) Cease and make safe all excavations in this location and report observations to the Site Manager.
b) The Site Manager is to notify the Engineer.
c) Under guidance of the Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.
d) Contaminated Land Planning Officer and if relevant the Environment Agency are to be kept fully informed of any such occurrences. Contaminated Land Planning Officer must agree the strategy for dealing with unexpected contamination before works continue in that area.
e) Await Engineers instructions with respect to re-commencement of the works and or removal from of suspect material to a suitably licensed disposal facility (following guidance outlined in Section 8.1 above).

It is recommended that in addition to the above a 'watching brief' for unexpected contamination is undertaken. It is recommended that this includes periodic site visits undertaken by the engineer during the groundworks phase such during site preparation, removal of contaminated soils from site as well as visiting site as soon as potential contamination is observed by the contractor. Records of any unexpected contamination must be included within the Remediation Completion Report.

## 7.4 Health & Safety

This section details health and safety requirements associated with contaminated land but does not seek to cover all aspects to be managed by the Contractor under CDM Regulations and detailed in Method Statements.

The works are likely to generate soils, dust, groundwater, and other materials that may be impacted with petroleum hydrocarbons and other related chemicals. The Contractor shall incorporate in its health and safety plan provisions for protecting personnel from physical and chemical hazards associated with these materials. The health and safety plan should also incorporate personnel decontamination requirements and facilities.

### 7.4.1 Contractor Method Statements

The Contractor is required to prepare method statements relating to the separate tasks highlighted and provide these to the client or Principal Designer along with the Engineer for review prior to the commencement of the related works.

The Contractor shall induct all its employees and subcontractors into the relevant aspects of their health and safety plan and method statements prior to each employee and/or subcontractor commencing works on site.

No works shall commence until the clients' nominated Principal Designer has approved the task specific method statement.

### 7.4.2 Excavation & Other Works

Before commencement of any excavation or other works, the following minimum precautions should be observed:

- Clearance of services;
- Appropriate 'Danger' notices displayed, and exclusion 'work' zone enforced;
- Exclusion of ignition sources within the work zone;
- Provision of a water supply hose/mist to damp down the area in the event that asbestos fibres are disturbed; and
- Exclusion of personnel from the immediate worksite except for those directly involved with the phase of works.
- The above listed precautions do not override other precautions that will need to be covered by the Contractor's overall Health and Safety Plan, aspects such as firefighting, PPE, excavation stability/shoring (if required) etc.

## 7.5 Environmental Controls

Environmental Controls are the responsibility of the Contractor. However, in general this section details specific requirements for potentially contaminated soils and is not intended to cover all aspects to be managed by the Contractor and detailed within their Method Statements.

Without limiting the Contractor's obligations, it shall be their responsibility to comply with all applicable laws, regulations and rules relating to potential contamination with regard to:

- Surface water run-off.
- Airborne particulates/vapours/odour; and,
- Control of spillage.

Method statements are to be provided to the Engineer and should incorporate the environmental management measures pertaining to the above factors, with further detail given below.

### 7.5.1 Surface Water Run-Off

The Contractor is responsible for ensuring that site surface water run-off does not leave the site.

The Contractor is to provide for necessary surface water diversion systems as required to keep the construction area free from excess surface or groundwater that may interfere with the works.

All personnel engaged by the Contractor should be trained in response techniques (e.g., use of absorbent materials, etc.) to ensure that any surface water run-off with fuel leakage impact or associated potentially contaminated soil is managed appropriately.

## 7.6 Airborne Particles/Vapour/Odour

The Contractor is responsible for the implementation of dust suppression in work areas, using water or other means of suppression that are not considered harmful to the environment. The Contractor should also set out procedures for the mitigation of any potential odours that may arise from exposed contaminated soils that could affect off-site users (adjacent residents).

## 7.7 Control of Spillage

During the phase of works, any type of spillage (including fabricating, hydraulic oils, fuels and/or other materials) should be immediately contained, removed, and disposed of, with any further surrounding areas cleaned.

# 8 VERIFICATION

Validation visits shall be undertaken by an appropriately qualified environmental engineer throughout the construction phase to ensure that the requirements of the Remediation Strategy have been implemented at the site. This includes periodic visits/watching brief during groundworks. It is anticipated records of the following will be taken during the below phases of work:

- Placement of the requisite depths of clean capping material in required areas of proposed soft landscaping
- Documentation of general works including records from watching brief, asbestos management procedures during the works and records of contaminative incidents and any unexpected contamination; and,
- Removal of contaminated soils from site for off-site disposal.

All associated documentation pertaining to the above will be supplied to the Engineer and incorporated within a Completion Report.

Confirmatory analysis is required to confirm the suitability of any imported material, the results of which will be included within the Completion Report. Any additional, confirmatory testing will also be included herein.

Verification through either hand excavated trial pits or comparison of reduced and final level surveys will all be included within the Completion Report to confirm the provision of a requisite depth of clean capping.

The frequency and timing of visits by Curtins shall be determined following confirmation of the construction phase programme and the chosen protection elements.

# 9 REPORTING

A Completion Report will be required on completion of the works confirming that the remedial works have been completed satisfactorily. The report will contain information including the following:

- Confirmation that the capping has been installed as specified within the various proposed soft landscaped areas, including capping thickness validation records and photographs;
- Confirmation of imported capping materials suitability for soft landscaped areas including environmental chemistry testing results;
- Records of waste transfer notes and consignment notes for contaminated material disposed of off-site.
- Details and documentation of asbestos management measures utilised during the works;
- Confirmation that the remediation has been undertaken satisfactorily and in accordance with the Remediation Statement;
- Confirmation that the remediation objective has been achieved (see *Section 5.0*);
- Details of any unexpected contamination encountered on site and appropriate measures taken to respond; and,
- Revised conceptual model showing no potentially significant contaminant linkages remain at the site.

It should be noted that the above list does not include the requirements of an Earthworks Completion report and Materials Management Completion report (where soils are re-used under an MMP) which are also likely to be required in addition to the above remediation completion report.

# APPENDICES

**Appendix A – Drawings & Specifications**

**Appendix B – Screening Criteria for Imported Materials**

# Appendix A - Drawings & Specifications

## TREE PLANTING

Pasted Image #1 6C5F009D.png

1. CLEAR STEM TREE

SYMBOL

QUANTITY
**9 No.**
Planting Height 3.5m

MOUNTAIN ASH ROWAN TREE
*Sorbus aucuparia*
Ultimate Height - 6m
Ultimate Spread - 4m

Pasted Image #2 FA87C2B7.png

2. CLEAR STEM TREE

SYMBOL

QUANTITY
**8 No.**
Planting Height 3.5m

Canadian Red Maple
*Acer Rebrum*
Ultimate Height - 12m
Ultimate Spread - 8m

Pasted Image #1 F515C9D2.png

3. MULTI STEM TREE

SYMBOL

QUANTITY
**4 No.**
Planting Height 2.5m

Himalayan Birch Tree
*Betula Utilis Jacquemontii*
Ultimate Height - 6m
Ultimate Spread - 5m

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4. CLEAR STEM TREE

QUANTITY
**7 No.**
Planting Height 3.5m

Scots Pine
*Pinus Sylvestris*
Ultimate Height - 18m
Ultimate Spread - 5m

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5. CLEAR STEM TREE

QUANTITY
**0 No.**
Planting Height 2.5m

Japaneses Cherry Blossom Tree
*Prunus serrulata 'Kanzan'*
Ultimate Height - 4m
Ultimate Spread - 8m

## ORNAMENTAL PLANTING

Pasted Image #1 9D6CC717.png

NEW LANDSCAPED AREAS
Ornamental Native Planting

Verbena 'Buenos Aires'
*Verbena bonariensis*
1No. 5L pot / 5m²

Pasted Image #2 C3694D89.png

Agapanthus 'White African Lilly'
*Agapanthus africanus 'Albus'*
1No. 5L pot / 5m²

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Lesser Calamint
*Calamintha nepeta ssp. nepeta*
1No. 2L pot / 5m²

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Japanese Shield Fern
*Dryopteris erythrosora*
1No. 3L pot / 8m²

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Tussock Grass
*Deschampsia cespitosa 'Tautrager'*
1No. 5L pot / 4m²

Pasted Image #6 703C0D70.png

Cone Flower
*Echinacea pallida 'Hula Dancer'*
1No. 5L pot / 5m²

Image #19 93079408.png

**MANAGED NATURAL GRASSLAND**

Meadow Grass
*Poa pratensis*
50% coverage of area

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Common Bent Grass
*Agrostis cappilaris*
50% coverage of area

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Great Wood Rush
*Luzula sylvatica*
1No. 5L pot / 5m²

Pasted Image #8 46F5DBC5.png

Lysimachia Ephemerum
*Lysimachia ephemerum*
1No. 5L pot / 5m²

Pasted Image #9 48BA0A43.png

Penstemon Beardtongue
*Penstemon digitalis 'Husker Red'*
1No. 5L pot / 7m²

ted Image #10 38089105.p

Fountain Grass
*Pennisetum alopecuroides 'Hameln'*
1No. 5L pot / 4m²

Pasted Image #11 5045482F.png

Mexican Feather Grass
*Stipa tenuissima*
1No. 5L pot / 4m²

Pasted Image #12 1BE9265F.png

Milk Parsley
*Selinum wallichianum*
1No. 2L pot / 7m²

Pasted Image #13 420FF47E.png

Burnet
*Sanguisorba 'Tanna'*
1No. 2L pot / 8m²

ed Image #14 74641322

Mexican Bush Sage
*Salvia leucantha*
1No. 5L pot / 5m²

Image #15 8A7D6B01.png

**NEW HEDGEROW PLANTING**

Beech Hedgerow
*Fagus sylvatica*
2No. 1m tall stems / linear m

Pasted Image #16 3DA6D29E.png

**NEW SCRUB PLANTING**

Blackthorn
*Prunus spinosa*
40% coverage of area

d Image #17 7A802CB2

Hawthorn
*Crataegus monogyna*
30% coverage of area

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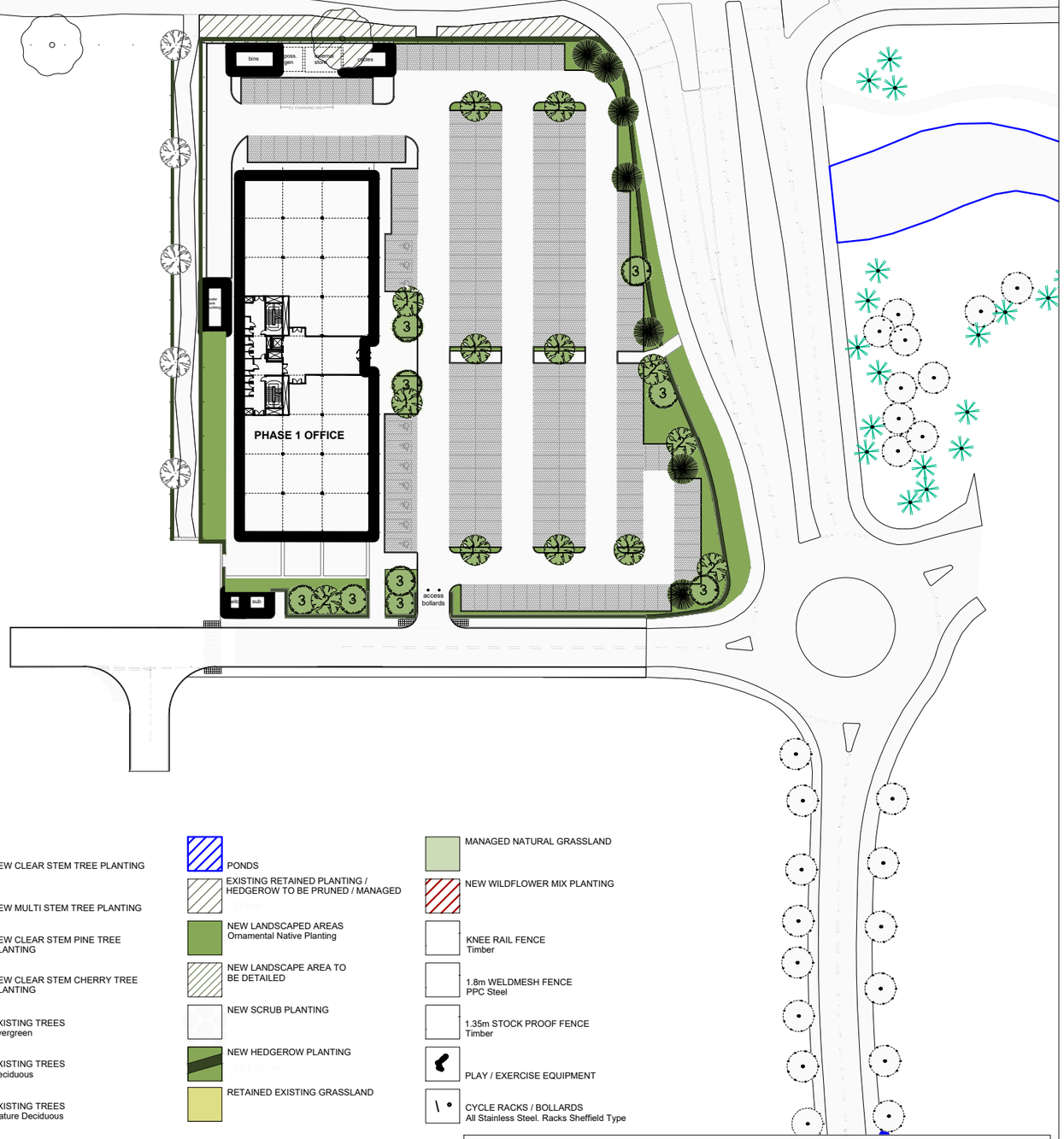
Hazel
*corylus avellana*
30% coverage of area

Pasted Image #1 27272429.png




**KEY:**

- NEW CLEAR STEM TREE PLANTING
- NEW MULTI STEM TREE PLANTING
- NEW CLEAR STEM PINE TREE PLANTING
- NEW CLEAR STEM CHERRY TREE PLANTING
- EXISTING TREES Evergreen
- EXISTING TREES Deciduous
- EXISTING TREES Mature Deciduous
- PONDS
- EXISTING RETAINED PLANTING / HEDGEROW TO BE PRUNED / MANAGED
- NEW LANDSCAPED AREAS Ornamental Native Planting
- NEW LANDSCAPE AREA TO BE DETAILED
- NEW SCRUB PLANTING
- NEW HEDGEROW PLANTING
- RETAINED EXISTING GRASSLAND
- MANAGED NATURAL GRASSLAND
- NEW WILDFLOWER MIX PLANTING
- KNEE RAIL FENCE Timber
- 1.8m WELDMESH FENCE PPC Steel
- 1.35m STOCK PROOF FENCE Timber
- PLAY / EXERCISE EQUIPMENT
- CYCLE RACKS / BOLLARDS All Stainless Steel. Racks Sheffield Type

**BICESTER ARC**

Pasted Image #2 3C4C1D23.png

**PHASE 1**
OFFICE SOFT LANDSCAPE PROPOSAL

1:500

F104

# Appendix B - Screening Criteria for Imported Materials

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 6% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] [*30*] |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *160* | *160* | *3900* | *12000* | *600000* | *180000* |
| $EC_{>6}$ - $EC_8$ | *530* | *530* | *13000* | *40000* | *620000* | *320000* |
| $EC_{>8}$ - $EC_{10}$ | *150* | *150* | *1700* | *11000* | *13000* | *21000* |
| $EC_{10}$-$EC_{12}$ | *760* | *770* | *7300* | *47000* | *13000* | *24000* |
| $EC_{12}$-$EC_{16}$ | *4300* | *4400* | *13000* | *90000* | *13000* | *26000* |
| $EC_{>16}$ - $EC_{35}$ | *110000* | *110000* | *270000* | *1800000* | *250000* | *490000* |
| $EC>_{35}$ - $EC_{44}$ | *110000* | *110000* | *270000* | *1800000* | *250000* | *490000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *300* | *1400* | *57* | *86000* | *56000* | *92000* |
| $EC>_7$ - $EC_8$ | *660* | *3900* | *120* | *180000* | *56000* | *100000* |
| $EC_{>8}$ - $EC_{10}$ | *190* | *270* | *51* | *17000* | *5000* | *9300* |
| $EC_{10}$ - $EC_{12}$ | *380* | *1200* | *74* | *34000* | *5000* | *10000* |
| $EC_{12}$ - $EC_{16}$ | *660* | *2500* | *130* | *38000* | *5000* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *930* | *1900* | *260* | *28000* | *3800* | *7800* |
| $EC_{>21}$ - $EC_{35}$ | *1700* | *1900* | *1600* | *28000* | *3800* | *7900* |
| $EC>_{35}$ - $EC_{44}$ | *1700* | *1900* | *1600* | *28000* | *3800* | *7900* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1900* | *1900* | *3000* | *28000* | 3800 | 7900 |
| *Aromatic* | | | | | | |
| Benzene | **0.33** 0.87 | **1.0** 3.3 | **0.07** 0.18 | **95** 98 | *73* 140 | *110* 230 |
| Ethyl benzene | **350** | **840** | **90** | **2800**[8] [66000] | **2800**[8] [*25000*] | **2800**[8] [*27000*] |
| Toluene | **610** | **2700** | **120** | **4400**[8] [190000] | **4400**[8] [*56000*] | **4400**[8] [*100000*] |
| Xylene[9] | **230** | **290** | **160** | **2600**[8] [32000] | **2600**[8] [*43000*] | **2600**[8] [*31000*] |
| Phenol | **420** | **520** | **280** | **3200**[14] (38000) | **3200**[14] (*10000*) | **3200**[14] (*9300*) |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *13* | *13* | *24* | *1100* | *4900* | *3000* |
| Acenaphthylene | *920* | *6000* | *160* | *100000* | *15000* | *30000* |
| Acenaphthene | *1100* | *6000* | *200* | *100000* | *15000* | *30000* |
| Fluorene | *860* | *4500* | *160* | *71000* | *9900* | *20000* |
| Phenanthrene | *440* | *1500* | *90* | *23000* | *3100* | *6300* |
| Anthracene | *11000* | *37000* | *2200* | *540000* | *74000* | *150000* |
| Fluoranthene | *890* | *1600* | *290* | *23000* | *3100* | *6400* |
| Pyrene | *2000* | *3800* | *620* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *13* | *15* | *13* | *180* | *29* | *62* |
| Chrysene | *27* | *32* | *19* | *350* | *57* | *120* |
| Benzo(b)fluoranthene | *3.7* | *4.0* | *3.9* | *45* | *7.2* | *16.0* |
| Benzo(k)fluoranthene | *100* | *110* | *130* | *1200* | *190* | *440* |
| Benzo(a)pyrene | *3.0* 5.0 | *3.2* 5.3 | *3.5* 5.7 | *36* 77 | *5.7* 10 | *13* 21 |
| Indeno(123cd)pyrene | *41* | *46* | *39* | *510* | *82* | *180* |
| Dibenzo(ah)anthracene | *0.3* | *0.32* | *0.43* | *3.6* | *0.58* | *1.4* |
| Benzo(ghi)perylene | *350* | *360* | *640* | *4000* | *640* | *1600* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.0014* | *0.0015* | *0.0018* | *0.12* | *3.5* | *5.4* |
| Trichloroethene (TCE) | *0.075* | *0.08* | *0.21* | *5.7* | *120* | *120* |
| 1,1,1,2 Tetrachlorethane | *6.4* | *8.2* | *4.4* | *560* | *1400* | *2100* |
| Tetrachlorethene (PCE) | *0.90* | *0.92* | *3.6* | *95* | *1400* | *1500* |
| 1,1,1 Trichlorethane | *39* | *40* | *240* | *3000* | *140000* | *100000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 2.5% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] [*30*] |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *78* | *78* | *1700* | *5900* | *590000* | *130000* |
| $EC_{>6}$ - $EC_8$ | *230* | *230* | *5600* | *17000* | *610000* | *220000* |
| $EC_{>8}$ - $EC_{10}$ | *65* | *65* | *770* | *4800* | *13000* | *18000* |
| $EC_{10}$-$EC_{12}$ | *330* | *330* | *4400* | *23000* | *13000* | *23000* |
| $EC_{12}$-$EC_{16}$ | *2400* | *2400* | *13000* | *82000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| $EC>_{35}$ - $EC_{44}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *140* | *690* | *27* | *46000* | *56000* | *84000* |
| $EC>_7$ - $EC_8$ | *290* | *1800* | *51* | *110000* | *56000* | *95000* |
| $EC_{>8}$ - $EC_{10}$ | *83* | *110* | *21* | *8100* | *5000* | *8500* |
| $EC_{10}$ - $EC_{12}$ | *180* | *590* | *31* | *28000* | *5000* | *9700* |
| $EC_{12}$ - $EC_{16}$ | *330* | *2300* | *57* | *37000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *540* | *1900* | *110* | *28000* | *3800* | *7700* |
| $EC_{>21}$ - $EC_{35}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| $EC>_{35}$ - $EC_{44}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1800* | *1900* | *2100* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.16** | **0.49** | **0.035** | **50** | *72* | *100* |
| Ethyl benzene | **150** | **380** | **39** | **1200**[8] [35000] | **1200**[8] [*24000*] | **1200**[8] [*22000*] |
| Toluene | **270** | **1300** | **51** | **1900**[8] [110000] | **1900**[8] [*56000*] | **1900**[8] [*95000*] |
| Xylene[9] | **98** | **120** | **70** | **1200**[8] [14000] | **1200**[8] [*42000*] | **1200**[8] [*23000*] |
| Phenol | **290** | **420** | **140** | **1500**[14] (35000) | **1500**[14] (*10000*) | **1500**[14] (*8300*) |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *5.6* | *5.6* | *10* | *460* | *4900* | *1900* |
| Acenaphthylene | *420* | *4600* | *69* | *97000* | *15000* | *30000* |
| Acenaphthene | *510* | *4700* | *85* | *97000* | *15000* | *30000* |
| Fluorene | *400* | *3800* | *67* | *68000* | *9900* | *20000* |
| Phenanthrene | *220* | *1500* | *38* | *22000* | *3100* | *6200* |
| Anthracene | *5400* | *35000* | *950* | *540000* | *74000* | *150000* |
| Fluoranthene | *560* | *1600* | *130* | *23000* | *3100* | *6300* |
| Pyrene | *1200* | *3800* | *270* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *11* | *14* | *6.5* | *170* | *29* | *56* |
| Chrysene | *22* | *31* | *9.4* | *350* | *57* | *110* |
| Benzo(b)fluoranthene | *3.3* | *4.0* | *2.1* | *44* | *7.2* | *15* |
| Benzo(k)fluoranthene | *93* | *110* | *75* | *1200* | *190* | *410* |
| Benzo(a)pyrene | *2.7* | *3.2* | *2* | *35* | *5.7* | *12* |
| Indeno(123cd)pyrene | *36* | *46* | *21* | *510* | *82* | *170* |
| Dibenzo(ah)anthracene | *0.28* | *0.32* | *0.27* | *3.6* | *0.57* | *1.3* |
| Benzo(ghi)perylene | *340* | *360* | *470* | *4000* | *640* | *1500* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00087* | *0.001* | *0.001* | *0.077* | *3.5* | *5* |
| Trichloroethene (TCE) | *0.034* | *0.036* | *0.091* | *2.6* | *120* | *91* |
| 1,1,1,2 Tetrachlorethane | *2.8* | *3.5* | *1.9* | *250* | *1400* | *1800* |
| Tetrachlorethene (PCE) | *0.39* | *0.4* | *1.5* | *42* | *1400* | *1100* |
| 1,1,1 Trichlorethane | *18* | *18* | *110* | *1300* | *140000* | *76000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 1% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] *[30]* |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *42* | *42* | *730* | *3200* | *570000* | *95000* |
| $EC_{>6}$ - $EC_8$ | *100* | *100* | *2300* | *7800* | *600000* | *150000* |
| $EC_{>8}$ - $EC_{10}$ | *27* | *27* | *320* | *2000* | *13000* | *14000* |
| $EC_{10}$-$EC_{12}$ | *130* | *130* | *2200* | *9700* | *13000* | *21000* |
| $EC_{12}$-$EC_{16}$ | *1100* | *1100* | *11000* | *59000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| $EC_{>35}$ - $EC_{44}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_7$ | *70* | *370* | *13* | *26000* | *56000* | *76000* |
| $EC_{>7}$ - $EC_8$ | *130* | *860* | *22* | *56000* | *56000* | *87000* |
| $EC_{>8}$ - $EC_{10}$ | *34* | *47* | *8.6* | *3500* | *5000* | *7200* |
| $EC_{10}$ - $EC_{12}$ | *74* | *250* | *13* | *16000* | *5000* | *9200* |
| $EC_{12}$ - $EC_{16}$ | *140* | *1800* | *23* | *36000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *260* | *1900* | *46* | *28000* | *3800* | *7600* |
| $EC_{>21}$ - $EC_{35}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| $EC_{>35}$ - $EC_{44}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1600* | *1900* | *1200* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.08** | **0.3** | **0.017** | **28** | *72* | *90* |
| Ethyl benzene | **65** | **170** | **16** | **520**[8] [17000] | **520**[8] *[24000]* | **520**[8] *[17000]* |
| Toluene | **120** | **610** | **22** | **860**[8] [59000] | **860**[8] *[56000]* | **860**[8] *[87000]* |
| Xylene[9] | **41** | **53** | **28** | **480**[8] [69000] | **480**[8] *[41000]* | **480**[8] *[17000]* |
| Phenol | **180** | **310** | **66** | **760**[14] (31000) | **760**[14] *(10000)* | **760**[14] *(7600)* |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *2.3* | *2.3* | *4.1* | *190* | *4900* | *1200* |
| Acenaphthylene | *170* | *2900* | *28* | *83000* | *15000* | *29000* |
| Acenaphthene | *210* | *3000* | *34* | *84000* | *15000* | *29000* |
| Fluorene | *170* | *2800* | *27* | *63000* | *9900* | *20000* |
| Phenanthrene | *95* | *1300* | *15* | *22000* | *3100* | *6200* |
| Anthracene | *2400* | *31000* | *380* | *520000* | *74000* | *150000* |
| Fluoranthene | *280* | *1500* | *52* | *23000* | *3100* | *6300* |
| Pyrene | *620* | *3700* | *110* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *7.2* | *11* | *2.9* | *170* | *29* | *49* |
| Chrysene | *15* | *30* | *4.1* | *350* | *57* | *93* |
| Benzo(b)fluoranthene | *2.6* | *3.9* | *0.99* | *44* | *7.1* | *13* |
| Benzo(k)fluoranthene | *77* | *110* | *37* | *1200* | *190* | *370* |
| Benzo(a)pyrene | *2.2* | *3.2* | *0.97* | *35* | *5.7* | *11* |
| Indeno(123cd)pyrene | *27* | *45* | *9.5* | *500* | *82* | *150* |
| Dibenzo(ah)anthracene | *0.24* | *0.31* | *0.14* | *3.5* | *0.57* | *1.1* |
| Benzo(ghi)perylene | *320* | *360* | *290* | *3900* | *640* | *1400* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00064* | *0.00077* | *0.00055* | *0.059* | *3.5* | *4.8* |
| Trichloroethene (TCE) | *0.016* | *0.017* | *0.041* | *1.2* | *120* | *70* |
| 1,1,1,2 Tetrachlorethane | *1.2* | *1.5* | *0.79* | *110* | *1400* | *1500* |
| Tetrachlorethene (PCE) | *0.18* | *0.18* | *0.65* | *19* | *1400* | *810* |
| 1,1,1 Trichlorethane | *8.8* | *9* | *48* | *660* | *140000* | *57000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable