

Echo Street, Manchester

Remediation Strategy

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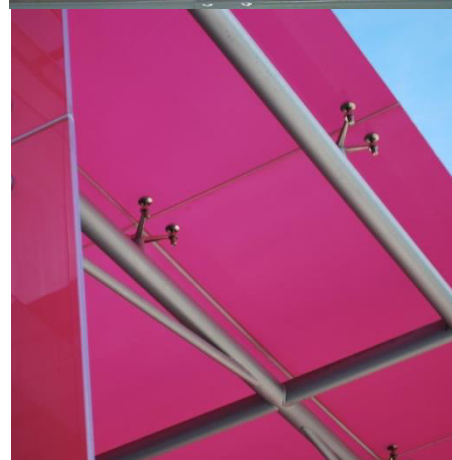
Client Name: iQ Student Accommodation

Client Address: Suite 8a Manchester One, 53 Portland Street, Manchester, M1 3LD

Site Address: Echo Street, Granby Row, Manchester, M1 3QJ

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

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Authors	Signature	Date
L Woods BSc (Hons) MSc Graduate Geo-Environmental Engineer		27 April 2023

Reviewed	Signature	Date
N Farnworth BSc (Hons) MCIWEM Principal Geo-Environmental Engineer		27 April 2023

Authorised	Signature	Date
N Farnworth BSc (Hons) MCIWEM Principal Geo-Environmental Engineer		27 April 2023

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1.0 Introduction

In January 2023 Curtins were instructed to undertake a review and refresh the Remediation Strategy for the site at Echo Street, Manchester, M1 3QJ for the new planning application and revised scheme.

This Remediation Strategy has been prepared by Curtins for iQ Student Accommodation (the Client) to provide guidance with respect to land remediation requirements for the site.

The site is centred on National Grid Reference 384670, 397700 with an area of 0.498Ha.

It is understood that current development proposals for the site comprise the development of 100% Purpose-Built Student Accommodation (PBSA). Ground floor uses will include bedrooms, communal areas and a HV/LV substation and switchroom. A basement is proposed across the central and western extent of the building footprint which will be used for storage and plant. A landscaping plan is not currently available but some small, landscaped areas are anticipated.

The site location plan and current development plans for which can be referred to within *Appendix A*.

This report has been compiled following various stages of pre and post demolition intrusive investigations undertaken across the site in July 2017 through to September 2019, with re-appraisal of findings in 2023.

1.1 Particular Requirements of the Remediation Strategy

The Remediation Strategy is to account for the following;

- A description of the materials likely to be encountered by the developer and their sub-contractors;
- Proposals for excavations with respect to the materials likely to be encountered;
- Any action required to reduce the risk from contaminants on the development site (soil, liquid and gas);
- Any action required to reduce the risk from contaminants entering water supply pipes;
- Advice on the thickness and quality of any cover to soft landscaped areas of the development; and
- Advice on the verification and validation of the cover layer including a regime for sampling and chemical analysis of sub-soil material.

Reference should also be made to Curtins Phase 2 Site Investigation Reports (Ref: 1&2).

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 Current Site Status

Construction commenced in 2019 on the site however, project progression was halted in 2020 following the COVID-19 pandemic and development proposals have changed slightly from a mixed use of Commercial and Purpose-Built Student Accommodation (PBSA) to 100% PBSA (with ancillary and amenity areas).

The site is currently vacant following previous demolition works and commencement of construction works under planning permission LPA Ref. 18267/FO/2017 and subsequent amendments. Piling has been completed across the site and construction of pile caps and ring beams is complete in part.

Gravel surfacing covers the site and some equipment and materials remain on site (barriers, cones, gravel etc). Access gates to the construction site are located on Echo Street.

Site levels are now in region of 37-38.80m on the western and central portions of the site where the basement is proposed, increasing to circa 40-40.50m in the eastern portion.

2.0 Ground Conditions

Ground conditions have been summarised based on the findings from the following reports:

- Curtins (2023) Chandos Hall Phase 2 Site Investigation, Report ref. 065374-CUR-00-XX-RP-GE-80002—P01 (Ref. 1)
- Curtins (2019) Chandos Hall Phase 2 Additional Ground Investigation, report ref. 065374-CUR-00-XX--RP-GE-80003-P01 (Ref. 2)

Borehole and trial pit locations are shown on the ref. 065374-CUR-00-XX-DR-GE-005-V03 and drawing ref. 065374-CUR-00-XX-DR-GE-006-V02 contained within *Appendix A*. The investigations generally revealed the following:

2.1 Made Ground

Made Ground was encountered from ground level to a maximum depth of 3.80m bgl in WS01. It generally comprised Asphalt, Concrete or grass overlying Made Ground of Sand and Gravel (brick and ash fill), underlain by Made Ground of Clay. An initial layer of asphalt was encountered across most of the site, with concrete in the east and grass within the centre-north.

A sub-base was encountered at 0.05m to 1.70m bgl underlying the Asphalt and Concrete, generally dark grey to light brown, cobbly, sandy, angular to sub-angular, fine to coarse Gravel of aggregate, asphalt and concrete. Cobbles are fine, angular to sub-angular of asphalt, limestone and concrete. Directly underlying the grass where encountered, at ground level to 0.20-0.30m bgl was Made Ground of dark brown, sandy, gravelly Clay with frequent rootlets. Gravel is angular to sub-rounded, fine to medium of tile, brick, concrete, sandstone and coal.

Granular Made Ground (brick and ash fill) was encountered (within WS01 – WS10, WS02A, TP03, FP101, BH03, RH02, TP201 – TP208, TP211, TP216, BH201 and BH202) at 0.05m to 1.40m bgl, comprising yellowish-brown, dark brown and dark grey to black, very gravelly, silty, fine to coarse Sand and Gravel with low to medium cobble content. Gravel and cobbles are angular to sub-angular of asphalt, coal, aggregate, glass, concrete, ash, tile, clinker, bitumen, brick and various lithologies including sandstone.

Further granular Made Ground (silty gravelly sand and clayey gravelly sand) was encountered (within TP207 – TP210, TP213 and TP215) at depths of 0.03m to 1.35m bgl comprising brown/red/grey silty gravelly fine to medium sand, clayey gravelly fine to medium sand and silty fine to medium sand. Gravel is subrounded to angular of brick, concrete, limestone, sandstone, slate and wood.

Cohesive Made Ground was encountered (within WS01, WS05, WS07 – WS11, FP101, BH03, RH01, RH03, TP201, TP202, TP204, TP205, TP207, TP213 – TP215, BH201 – BH203) at 0.15m to 3.80m bgl, comprising very soft to firm, grey and brown, sandy, gravelly, silty Clay. Gravel is angular to sub-

rounded, fine to medium of various lithologies including concrete, tile, metal, asphalt, ash, coal, brick and clinker.

Adjacent to the viaduct, Made Ground soils were recorded to maximum depths of between 1.90m and 3.65m bgl. The base of the Made Ground was not encountered in TP101 at 3.65m bgl. Deposits were consistent with those described previously, where dark brown granular soils are underlain by light and dark brown, with grey mottling, sandy gravelly clay, with exception of TP102 where no cohesive soils were recorded. Boulders of concrete and metal sheeting were also reported in TP102. Timber pieces, exhibiting a hydrocarbon odour, were encountered in TP103 between 0.30m and 1.90m bgl.

2.2 Natural Deposits

Natural superficial strata deposits comprised Glacial Till from 0.30m to 13.50m bgl and included Clay interbedded with Sands.

The cohesive soils were encountered across the site at depths of between 0.30-6.70m bgl; comprising firm to very stiff, dark greyish-brown with grey mottling, gravelly, sandy Clay with rare silt lenses containing relic rootlets, rare sand lenses and rounded cobbles of limestone and sandstone. Gravel is fine to coarse, sub-angular to rounded of mixed lithologies including coal, sandstone, mudstone, limestone. Thin sand bands were locally recorded within the generally cohesive soils.

2.3 Weathered Bedrock

Possible weathered bedrock was encountered (within BH01, BH02, BH03, BH201, BH202, BH203, WS01, WS02A, WS03, WS402 and WS404) from depths of 2.90 to 7.45m bgl. It was predominantly recovered as dense to very dense orange red, reddish brown, light brown clayey, slightly gravelly fine to medium sand with occasional fine to medium, sub-rounded to sub-angular gravel of mudstone and siltstone. In BH01, a band of stiff dark brown gravelly clay at 5.80m bgl was encountered.

2.4 Bedrock Deposits

Sandstone bedrock (Chester Formation) was encountered within BH01 to BH03, RH01, BH201 to BH203 and BH401 to BH403 from 7.50-13.50m bgl. The bedrock was recorded as extremely weak to strong, fine to medium grained, arenaceous orange and pinkish orange, fine grained fissile Sandstone.

The base of the sandstone was not proven. The boreholes were terminated at a maximum depth of 25.50m bgl (BH03).

2.5 Groundwater

No groundwater strikes were recorded during siteworks. Water seepages were encountered in a number of boreholes, likely to be perched water within the Made Ground and cohesive natural deposits.

During the monitoring visits, groundwater was recorded at depths of between 0.40m and 15.55m bgl.

2.6 Soil Contamination Concentrations

The proposed use of the site is to comprise multi-storey student accommodation apartment blocks with some bedrooms and amenities located on the ground floor, this is most analogous with a *Residential without Home Grown Produce* end-use scenario. A basement is proposed across much of the building footprint where storage and plant areas are proposed. In these areas, where volatile contamination is identified, this is more analogous with a *Commercial* End use.

Assessment has therefore been undertaken conservatively assessed against a *Residential without Gardens* with further secondary consideration against a *Commercial* End Use where appropriate.

When compared to '*Residential without Homegrown Produce*' thresholds, the Intrusive Investigations reported a number of elevated concentrations of contaminants above GAC thresholds with respect to TPHs, PAHs, Arsenic and Lead, as detailed below in Table 2.6a.

Table 2.6a Location of Tier 1 Exceedances for '*Residential without Homegrown Produce*' End Use

Borehole Ref.	Depth (m bgl)	Stratum	Determinant	Conc. (mg/kg)	GAC (mg/kg)
BH01	0.20	Made Ground	Dibenzo(ah)Anthracene	0.40	0.32
	0.25			0.60	
BH02	0.20	Made Ground	Dibenzo(ah)Anthracene	0.80	0.32
			Benzo(a)Pyrene	3.50	3.20
	0.40		Arsenic	45	35
WS01	0.70 – 1.00	Made Ground	Dibenzo(ah)Anthracene	0.40	0.32
WS02	0.10 – 0.20	Made Ground	Benzo(a)Anthracene	48	15
			Chrysene	43	32
			Benzo(b)Fluoranthene	40	4
			Benzo(a)Pyrene	33	3.2
			Dibenzo(ah)Anthracene	11	0.32
WS02A	0.30 – 0.40	Made Ground	Arsenic	50	35
			Benzo(b)Fluoranthene	14	4
			Benzo(a)Pyrene	10	3.2

Borehole Ref.	Depth (m bgl)	Stratum	Determinant	Conc. (mg/kg)	GAC (mg/kg)
			Dibenzo(ah)Anthracene	2.2	0.32
WS03	0.50 – 0.60	Made Ground	Arsenic	120	35
WS04	0.15 – 0.25	Made Ground	Benzo(a)Anthracene	86	15
			Chrysene	72	32
			Benzo(b)Fluoranthene	52	4
			Benzo(a)Pyrene	54	3.2
			Dibenzo(ah)Anthracene	13	0.32
BH03	0.30 – 0.40	Made Ground	Arsenic	51	35
			Lead	3800	310
			Benzene	4	1
WS08	1.80 – 2.00	Made Ground	Arsenic	140	35
			Lead	6400	310
WS09	0.30 – 0.40	Made Ground	Lead	330	310
TP102	1.50	Made Ground	Lead	857	310
WS401	0.40	Made Ground	Lead	320	310
			Benzo(a)Anthracene	45	15
			Chrysene	36	32
			Benzo(b)Fluoranthene	40	4
			Benzo(a)Pyrene	38	3.2
			Dibenzo(ah)Anthracene	5.7	0.32
BH402	0.60	Made Ground	Benzo(a)Anthracene	44	15
			Chrysene	44	32
			Benzo(b)Fluoranthene	54	4
			Benzo(a)Pyrene	40	3.2
			Dibenzo(ah)Anthracene	7.6	0.32
WS402	0.40	Made Ground	Lead	470	310
			Benzo(b)Fluoranthene	5.7	4
			Benzo(a)Pyrene	4	3.2
			Dibenzo(ah)Anthracene	0.93	0.32
BH402A	0.80	Made Ground	Lead	870	310
			Benzo(b)Fluoranthene	4.6	3.2
			Dibenzo(ah)Anthracene	0.82	0.32
BH201	0.32	Made Ground	Benzo(a)Pyrene	5.4	3.2
			Benzo(b)Fluoranthene	6.9	4

Borehole Ref.	Depth (m bgl)	Stratum	Determinant	Conc. (mg/kg)	GAC (mg/kg)
BH203	0.40	Made Ground	Dibenzo(ah)anthracene	0.51	0.32
TP201	0.45	Made Ground	Amosite loose fibres	0.001%	-
TP202	0.35	Made Ground	Benzo(a)Anthracene	21.4	15
			Benzo(b)Pyrene	15	3.2
			Benzo(b)Fluoranthene	19.5	4
			Dibenzo(ah)Anthracene	1.7	0.32
TP202	0.72	Made Ground	Chrysotile cement solid fragment/tile	-	15
TP204	0.85	Made Ground	Lead	2940	310
TP206	0.50	Made Ground	Lead	3100	310
TP207	1.20	Made Ground	Ali >C8-C10	278	150
			Ali >C10-C12	1920	770
			Ali >C12-C16	7100	4400
			Aro >C8-C9	272	270
			Aro >C10-C12	2190	1200
			Aro >C12-C16	7490	2500
			Aro >C16-C21	6320	1900
			Aro >C21-C35	9730	1900
TP210	1.50	Made Ground	Lead	9280	310
TP215	0.55	Made Ground	Lead	1740	310
	1.50	Silty Sandy CLAY	Naphthalene	286	190
TP216	1.00	Made Ground	Lead	846	310

The majority of exceedances relate to non-volatile PAHs and heavy metals. Isolated occurrences of exceedances for volatile contamination (TP207 & BH03) with respect to benzene and TPH Ali C8-C10 respectively were discounted of them being isolated in extent (vertically and laterally), site ground levels have since been reduced significantly in these areas for the proposed basement and considering the basement end use is considered more analogous with a *Commercial* end use scenario; concentrations of these contaminants recorded were significantly below *Commercial* GAC.

A further exceedance for Naphthalene was recorded in TP215 at 1.50m bgl. However, the impacted soils were subsequently removed through removal of a historic underground fuel storage tank in the area and a reduced level dig, as proven through verification sampling.

Suspected asbestos containing materials (ACMs) were identified in TP202 at 0.72m bgl within the Made Ground as an asbestos tile. Asbestos loose fibres were identified in within TP201 at 0.45m bgl. The laboratory results are detailed in *Table 2.6b*.

Table 2.6b Positive Asbestos ID

Exploratory Hole	Depth (m bgl)	Stratum	Asbestos Type	Concentration in soil (% w/w)	Bulk Fibre % asbestos in ACM (HSG264)
TP202	0.72	Made Ground	Chrysotile cement solid fragment/tile	-	15
TP201	0.45	Made Ground	Amosite loose fibres	0.001%	-

It should also be noted the demolition contractor discovered and removed asbestos containing materials at the northwest of the site, to the northeast of the former Chandos Hall Building, further asbestos may remain.

A **Moderate/Low** risk rating is identified to end-users from direct contact, inhalation and ingestion of non-volatile contaminants within Made Ground soils due to elevated levels of Lead in Made Ground and Natural soils.

A **Low** risk rating is identified to end-users from inhalation of volatile contaminants within Made Ground soils.

A **Low** risk rating is identified to construction workers and adjacent residents at this stage from direct contact, inhalation and ingestion of contaminants associated with Made Ground soils.

A **Moderate/Low** risk rating is identified to end-users from direct contact, inhalation and ingestion of asbestos fibres and ACMs within Made Ground soils present on the site.

A **Moderate/Low** risk rating is identified to construction and maintenance workers from soil dust ingestion/inhalation produced during construction in consideration of asbestos fibres and ACMs within Made Ground soils present on the site.

2.7 Groundwater Contamination Concentrations

The chemical testing results identified slightly elevated concentrations of sulphate, benzo(a)pyrene and multiple PAHs, with respect to EU Drinking Water Standards (EU DWS).

The site is in Manchester city centre, which historically was heavily industrialised throughout the surrounding area. Exceedances recorded may be associated with downward migration of

contaminants from onsite Made Ground soils, leaching into bedrock, it is likely that the contaminants are also indicative of the wider historic, industrial land use of the city centre.

It is also noted that the site is not situated within a Source Protection Zone, there are no potable abstractions within 1km of the site and the predominantly cohesive Glacial Till soils overlying the bedrock anticipated to have a limited infiltration capacity and limit vertical contamination migration into the Principal Aquifer.

A **Moderate/Low** risk rating is identified to the underlying Principal Aquifer associated with the Chester Formation and associated weathered deposits. Where further piling works are proposed a Piling Risk Assessment should be undertaken to determine suitable piling methods to mitigate the risk presented to the underlying Principal Aquifer.

2.8 Ground Gas Assessment

Gas monitoring results recorded a maximum carbon dioxide concentration of 2.4% v/v and a maximum flow of 6.4l/hr. Concentrations of methane were consistently below 0.1% v/v in all monitoring wells. The risk to the end-user of the development site from soil gases is therefore considered to be **Low**. The gas regime for the site is CS1, not requiring gas protection measures.

2.9 Water Supply Pipe Assessment

With reference to the UKWIR Report no. 10/WM/03/21 (Ref.18) advice is given on the appropriate materials for these ground conditions. The exact requirements are to be confirmed with the relevant utility supplier.

PE and PVC pipes are unlikely to be suitable for use for water supply pipes at this site due to concentrations of C5-C10, C11-C20 and C21-40 mineral oils exceeding UKWIR guidelines.

3.0 Relevant Pollutant Linkages

A conceptual site model (CSM) for the site has been developed based on the various Ground Investigations undertaken as detailed in Curtins Ground Investigation reporting (Ref.1 & 2).

The CSM details several pollutant linkages at the site, however, based on the risk assessments undertaken, the potential pollutant linkage (PPL) listed in *Table 3.0* was identified as requiring remediation to enable the safe re-development of the site.

Table 3.0 Potential Pollutant Linkages (Existing)

PPL	Sources	Receptor	Potential Pathway	Remediation Recommended
1	Made Ground soils containing elevated concentrations of PAHs, TPHs, arsenic, lead and asbestos fibres/containing materials.	Construction Workers and Adjacent Residents/Passers-by	Inhalation, ingestion and dermal contact with contaminants in soil and soil-derived dust from on-site Made Ground.	Appropriate PPE for construction staff and suitable asbestos management measures during construction.
2	Made Ground soils containing elevated concentrations non volatile contamination (PAHs, TPHs, arsenic, lead and asbestos fibres/containing materials).	End Users	Inhalation, ingestion and dermal contact with contaminants in soil and soil-derived dust from on-site Made Ground.	Communal Landscape Areas overlying Made Ground - Provide a clean and inert growing medium of 450mm of topsoil/subsoil with underlying geotextile/break layer in soft communal landscaped areas.
3	Made Ground soils containing elevated concentrations of TPHs above UKWIR thresholds.	End Users	Chemical attack of potable water supply pipes and subsequent infiltration from contaminants on site, followed by ingestion.	Ensure appropriate water supply pipes are used. Exact requirements to be confirmed the relevant utility supplier.

The risks to groundwater and surface waters from contamination on site and the risks from ground gas to end users were identified as Low within previous ground investigation reporting (Ref.1&2).

4.0 Remedial Works

With reference to the Conceptual Site Model and the potential contaminant linkages detailed in *Table 3.0* 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; and
- **Remedial Action 3:** Ensure suitable water supply pipes are used on site.

It is further recommended that Curtins Engineer is contacted if any unexpected contamination/contaminative incidents are encountered during construction works or should ground conditions vary from those outlined in Section 2.0. Further advice on handling such incidents is enclosed within Section 6.0.

4.1 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) Regulation, 2015 which require the potential risk to human health and the environment from construction activities are appropriately identified and all the necessary steps taken to eliminate / manage the risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements to address PPL 1 (Table 3.0)

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 utilizing their own additional testing and delineation if they deem it to be required.

Where, from the site investigations, material are known to contain asbestos fibres 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.

Table 2.5b in Section 2.5 above should be consulted together with Curtins Exploratory Hole Plan Drawings in *Appendix A* (Ref. 065374-CUR-00-XX-DR-GE-005-V03) for the locations, depths and concentrations of asbestos was identified during Curtins Ground Investigations (Ref. 2).

Concentrations of asbestos fibres encountered within the Made Ground soil in TP201 was relatively low (<0.01% w/w). In TP202, where chrysotile cement asbestos containing material was encountered, a concentration of 15% w/w of asbestos was recorded within this matrix.

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

Any fragments or asbestos containing materials where identified must be picked where possible and be kept separate in line with those from any soil arisings. This is typically carried out by picking visible fragments at the point of excavation.

On this basis, removal of ACM debris, during enabling works at the site is required.

The following steps should be taken;

- Asbestos Management Plan to be developed by the contractor prior to works. This document will outline procedures to be undertaken during construction to ensure removal of ACM debris.
- Visual inspection of all excavations is to be undertaken by suitably qualified and experienced asbestos professional;
- All identified or suspected ACM debris should be removed from the site and submitted to the laboratory for testing;
- The contractor is responsible for providing appropriate records of ACM identified, along with provision of disposal records;
- Validation should be in the form of collating records of ACM findings (e.g. daily site log, photographs (if appropriate), along with laboratory testing and disposal records, to be included in a validation report.

It is the responsibility of the contractor to make all relevant risk assessments to protect site users and the public during construction. The asbestos management plan should detail the risk assessments completed, mitigation to be employed as well as an assessment of the type of work i.e. notifiable, non-notifiable etc.

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.

4.2 Remedial Action 2 – Engineered Capping

The second PPL identified at the site relates to the direct contact, dermal uptake, soil and dust ingestion and inhalation of PAHs, TPHs, arsenic, lead and asbestos fibres in soils and soil derived dust (PPL 2, *Table 3.0*).

Hardstanding, including vehicular asphalt, pedestrian asphalt and concrete 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.

However, a risk remains in landscape areas of exposure to contaminated Made Ground. It is therefore recommended that verified clean capping, comprising a thickness of imported subsoil and topsoil where directly overlying the Made Ground.

Verified clean capping must comprise a minimum total thickness of 450mm is incorporated in general soft landscaping areas. This may be made up of (450mm) imported soils with a high visibility warning geotextile or granular break layer below.

Where tree pits are to be planted, excavation of 900mm is likely to be required for a sufficient depth to support the shrubs and trees respectively, where capping of this thickness is incorporated a break layer is not considered to required due to the additional depth of clean cover.

This is anticipated to provide adequate protection of human health with consideration of likely exposure and is in accordance with Manchester City Councils Planning & Contaminated Land Technical Guidance Document (2021) and should be incorporated in all proposed soft landscaped areas and proposed tree pits.

Recommended remedial measures are summarised in Table 4.1 below.

Table 4.1 Engineered Capping Details for Soft Landscaping Areas

Location	Further Remedial Measures Required	Rationale
Typical New Soft Landscaped Areas (Where no New Trees are Proposed)	Provision of a minimum 450mm clean capping with underlying high visibility geotextile or 100mm granular break layer. The capping layer may comprise of a combination of suitable subsoil and topsoil but topsoil should be of a minimum 150mm thickness.	Remove potential for exposure of on-site receptors via direct contact, dermal uptake and soil and dust ingestion and inhalation. Geotextile/break layer to prevent soil mixing and obstruct future excavation to made ground soils.

Location	Further Remedial Measures Required	Rationale
	The underlying geotextile should be high visibility to act as a warning to future ground workers. Alternatively, an aggregate break layer (of c.100mm thickness) can be used to act as an anti-dig layer instead of the geotextile. Capping depth may need to be extended accordingly to support root growth, subject to landscape architects requirements.	
Where New Trees are Proposed	Provision of a minimum of 900mm clean capping comprised a minimum of 150mm topsoil over subsoil. No break layer or geotextile needed.	Remove potential for exposure of on-site receptors via direct contact, dermal uptake and soil and dust ingestion and inhalation. Depth sufficient to support tree growth.

The engineered capping must meet the specification outlined in *Section 5.0*.

4.3 Remedial Action 3 – Use of Suitable Water Supply Pipes

The third PPL identified at site relates to the risk to water pipes by chemical attack from contaminants on site which will enable infiltration of contaminated material followed by potential ingestion by the receptor (PPL 3, *Table 3.0*).

UK Water Industry Research (UKWIR) published 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' to ensure the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protection quality of drinking water. An initial review of the site comparing laboratory analysis results for soils against UKWIR thresholds indicates PE & PVC are unlikely to be considered suitable materials for water supply pipes on the site. The exact requirements should however be confirmed with the utility provider, in this case United Utilities.

United Utilities have adopted the guidance to include a Risk Assessment for Water Pipes. At a minimum a desk study shall be provided within the risk assessment in accordance with the framework in Environment Agency publication 'Model Procedures for the Management of Land Contamination' that sets out whether land which the pipes are to be laid may be affected by contamination.

United Utilities require the signatory of the risk assessment to be carried out under the direction of a suitably qualified person e.g. a chartered member of an appropriate professional body or a Specialist in Land Condition (SiLC).

5.0 Engineered Capping Specification

5.1 Sourcing of Materials

5.1.1 Off-Site Sources

It is anticipated that materials are to be imported to the site for use in constructing the growing medium in 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.

5.1.2 On-site Sources

Based on the findings of the Site Investigation, it is considered highly unlikely that the general shallow Made Ground could be considered 'uncontaminated' or 'clean' material for re-use as a subsoil due to the presence of asbestos fibres and other contaminants at a number of locations across the site.

5.2 Imported Topsoil

Imported Topsoil will invariably be required and should be supplied and placed in accordance with the Architects' specification but generally, all topsoil will be a minimum of 150mm thick in soft landscaped areas (as part of the 450mm overall layer thicknesses as detailed in Section 4.0).

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 5.4*.

5.3 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 5.4* and compliant with the British Standard for Subsoil BS 8601:2013.

5.4 Physical Composition of Granular Capping in Soft Landscaped Areas

It is anticipated granular capping used as a granular break layer (minimum 100mm thickness recommended) it will meet the requirements of 'Selected granular material (coarse grading)' as a 6F2/6F5 material, meeting the requirements of Table 6/1 of 'Series 600 of the Specification for Highways Work' (2016).

5.5 Chemical Composition of Soils

Site won and imported subsoil and topsoil should not contain concentrations of contaminants that present an unacceptable risk to the health of future site occupants.

The Contractor shall be responsible for demonstrating that both site won and imported material is 'clean' and therefore suitable for use in soft landscaping areas. 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 5.5a Environmental chemistry testing frequency for imported and re-used soils

Source	Testing Frequency
Virgin Quarried Material	On-site Validation: 1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.
Imported or Site Won Crushed Hardcore Stone & Brick	On-site Validation: one sample every 500m ³ used (or a minimum of 4 No. samples whichever is greater).
Imported Topsoil/Subsoil (Greenfield/ Manufactured)	On Site Verification: One sample every 200m ³ used (or a minimum of 3 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 150m ³ used (or a minimum of 3 No. samples whichever is greater), testing to be undertaken once material is imported to site.

The environmental chemistry testing requirements are as *Table 5.4b*. Additions to the suite and frequency of sampling may be required based on the source of the 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 5.5b Environmental chemistry analysis suite for imported soils.

Suite Reference	Environmental Chemistry Analysis
Virgin Quarried Material	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron.
Crushed Hardcore, Stone, Brick	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Soil Organic Matter Asbestos Screening Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound) Total Petrol Hydrocarbons (Full TPHCWG analysis – aromatic/aliphatic split, Detection Limit
Greenfield or Manufactured Soils Imported to Site and Site Won Soils for Use as Clean Capping	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Soil Organic Matter Asbestos Screening Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound - 16 USEPA speciation) 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 with Home Grown Produce*’ screening criteria; refer to *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 outlined may be made for specific soil sources whereby the Soil Organic Matter is proving to be routinely above 6%.

5.6 Verification and Validation of Capping/Growing Media

Confirmatory analysis outlined previously is required to verify the suitability of any imported and site won topsoil, and where required, subsoil.

Evidence that the specified depth of capping/growing media has been provided will be required including evidence of the underlying geotextile/anti-dig break layer.

Evidence should include hand excavated trial pits advanced in areas where material has been placed to prove a sufficient depth is provided and geotextile/anti-dig layer is present.

The pits shall be excavated to the base of the interface between the imported material and the geotextile/ anti dig layer.

A photographic record of the hand excavated trial pits would also be required.

6.0 Strategy for Handling Potentially Contaminated Soils and Contaminative Incidents on Site

6.1 Surplus 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.

6.2 Unexpected Contamination

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) Await Engineers instructions with respect to re-commencement of the works and or removal of suspect material to a suitably licensed disposal facility (following guidance outlined in *Section 6.1* above).
- e) Manchester City Council Environmental Protection Team and if relevant the Environment Agency are to be kept fully informed of any site such occurrences.

6.3 Contaminative Incidents

It is possible that some below ground features / structures exist that have not been recorded on plans and have not been encountered during the ground investigation works or demolition works. It is possible that unknown/unrecorded substructures (e.g. fuel tanks - two tanks previously removed as part of demolition works) 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 probe and intercept the contaminant. The contaminant will then be pumped into suitable containers.

7.0 Verification, Validation and Reporting

Verification and/or Validation visits shall be undertaken by an appropriately qualified and experienced person throughout the construction phase to ensure that the requirements of this Remediation Strategy have been implemented at the site. It is anticipated records will be taken during the work as identified below:

- During groundworks/construction works should any unexpected contamination be encountered;
- During groundworks/construction works to demonstrate suitable contamination and asbestos management measures have been put in place by the contractor;
- During and after installation of the engineered capping layer to soft landscaped areas;
- Upon installation of suitable water supply pipes on site;

All documentation pertaining to the above will be supplied to the Engineer and incorporated within a completion report.

The Completion Report will be required on completion of the works confirming that the remedial works have been completed satisfactorily.

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

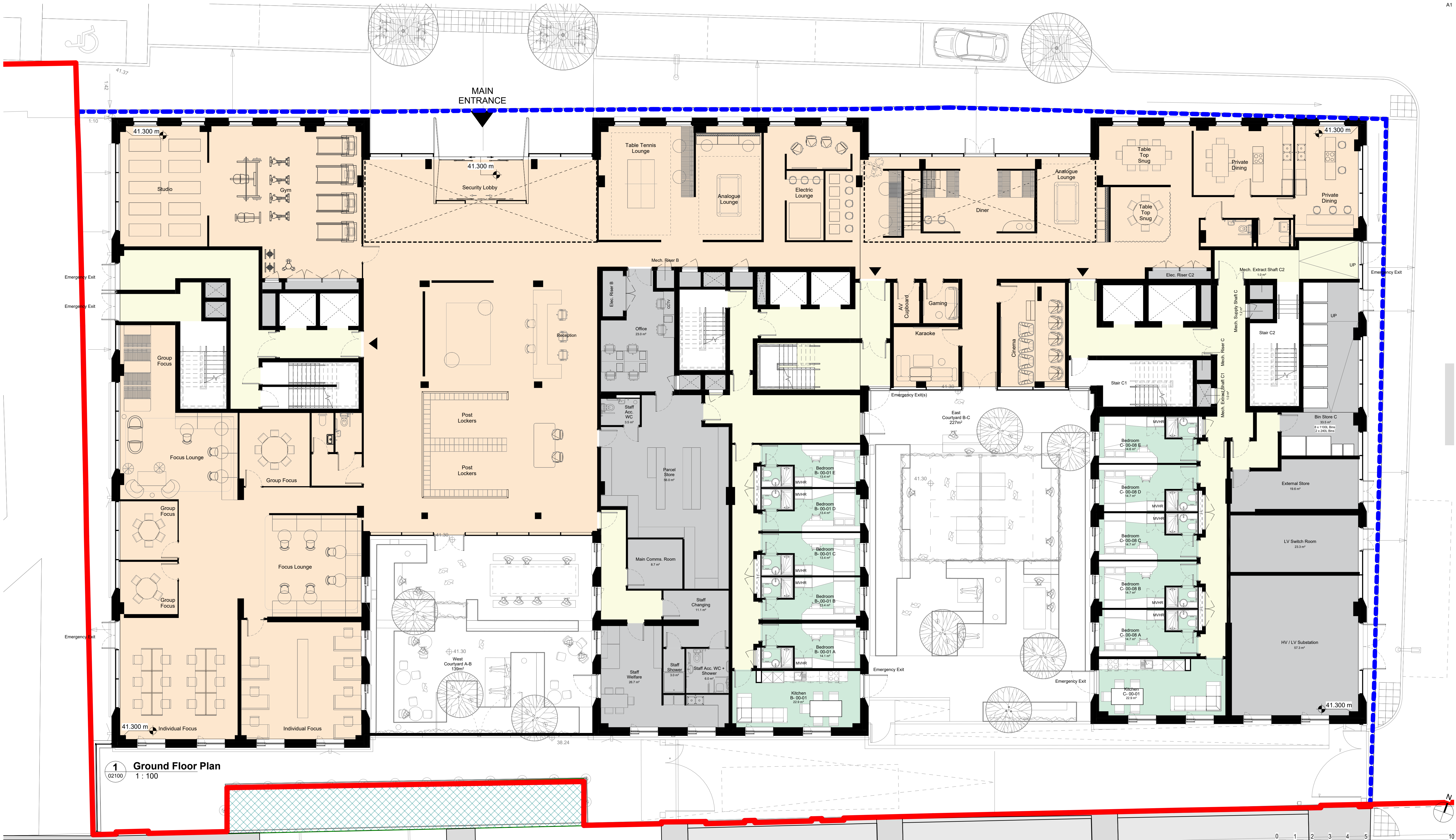
Validation through hand excavated trial pits with photographic record will all be included within the Completion Report to confirm the provision of a requisite depth of clean capping/growing media.

8.0 References

1. Curtins, Phase 2 Site Investigation for Echo Street, Manchester - ref. 065374-CUR-00-XX-RP-GE-80001-P01. (2023)
2. Curtins, Additional Phase 2 Ground Investigation for Echo Street, Manchester – ref. 065374-CUR-00-XX-RP-GE-80003-P01. (2023)
3. Contaminated Land: Applications in Real Environments (CL:AIRE) *The Definition of Waste: Development Industry Code of Practice. Version 2*; March 2011
4. Environment Agency. *Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (1st Edition)*. 2015.
5. Atkins. CatWaste Soil Assessment Tool. [Online] <http://catwastesoil.co.uk>.

Appendix A – Drawings

- Sheppard Robson, General Arrangement Ground Floor Plan ref. ECHO-SRA-ZZ-00-DR-A-02100 P09 (Apr 2023).
- Sheppard Robson, General Arrangement ref. ECHO-SRA-ZZ-00-DR-A-02099 P05 (Apr 2023).
- Curtins, Stage 1, 2, 3 & 5 Exploratory Hole Location Plan, drawing ref. 065374-CUR-00-XX-DR-GE-004-V01 (dated February 2018).
- Curtins Additional SI Exploratory Hole Location Plan, drawing ref. 065374-CUR-00-XX-DR-GE-006-V02 (dated September 2020).



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FOR ELECTRONIC DATA ISSUE

Electronic Data / drawings are issued as "read only" and should not be interrogated for measurement. All dimensions and levels should read, only from those values stated in text on the drawing.

AREA MEASUREMENT

The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions, whether as to project viability, pre-letting, lease agreements or otherwise, should include due allowance for the increases and decreases inherent in the design development and building processes. Existing buildings may present anomalies in relation to surveyed/drawn plans that may also effect the stated areas. All areas are subject to Town Planning and Conservation Area Consent and detailed Rights to Light analysis. Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

PLEASE NOTE:

- The measured areas shown for all en-suite clusters, studios and kitchens do not yet account for any protruding columns and will therefore reduce accordingly to account for these once locations and sizes are fully known.
- Wall lining has been allowed for to solid core walls, shears walls and other structural items however depth of wall lining subject to change dependent on acoustic requirements. This may result in room sizes reducing.
- Areas of ensuite bedrooms and studios include the area of the bathroom and the separating wall between bedroom and pod, but exclude the riser.
- Cluster kitchens will require a riser to provide drainage etc and will reduce the area stated accordingly. The location of this is as yet unknown until full fit outs have been progressed.
- Studio layouts shown are design intent only and follow Client's brief. Escape routes' distance from hobs to be tested and validated by Fire Strategy with fire suppression measures as necessary. Studio layouts in abeyance until signed-off by Building Safety Regulator (HSE), Building Control Officer, and Building Insurer.
- Ground Floor amenity space layout completed by Manalo + White Architects design intent only and follow Client's brief. Subject to further review and co-ordination with SRA and specialist consultants (incl. MEP, structure and fire engineer)

Department Legend

- Amenity Space
- Studios
- 5 Bedroom Cluster (incl Kitchen / Living)
- 6 Bedroom Cluster (incl Kitchen / Living)
- BOH Areas (incl Plant, Services, Stores etc)
- Circulation
- Preferred Structural Column Locations (WIP / Indicative only and subject to change)

REV.	DATE	AMENDMENT
P01	18/01/23	First Issue - Issued for Information
P02	23/01/23	Cores updated following comments from fire engineer (as clouded)
P03	03/02/23	Layouts amended following client + design team comments
P04	27/02/23	Layouts updated following client + design team comments. Preliminary internal fitout layouts included
P05	10/03/23	Minor amendments to layouts to suit DT comments. Bedroom + Studio room tags updated.
P06	24/03/23	Draft Issue for Planning (Incl. minor updates)
P07	11/04/23	Proposed M+W amenity space layout updated
P08	14/04/23	Planning Issue
P09	26/04/23	Planning Issue (minor updates)

KEYPLAN

Plan Key

- Site Boundaries
- Planning Application Boundary
- Applicant Ownership
- Network Rail Ownership

CLIENT

IQ Student Accommodation

Student Accommodation

STATUS

S2

PURPOSE FOR ISSUE

Planning

SHEPPARD ROBSON

27th Floor City Tower Piccadilly Plaza Manchester M1 4BT

T: +44 (0)161 233 8900 E: enquiries@sheppardrobson.com

SCALE@A1 DATE 28/04/23 ORIGINATOR LK CHECKED VC AUTHORISED RG

PROJECT

Echo Street

General Arrangement

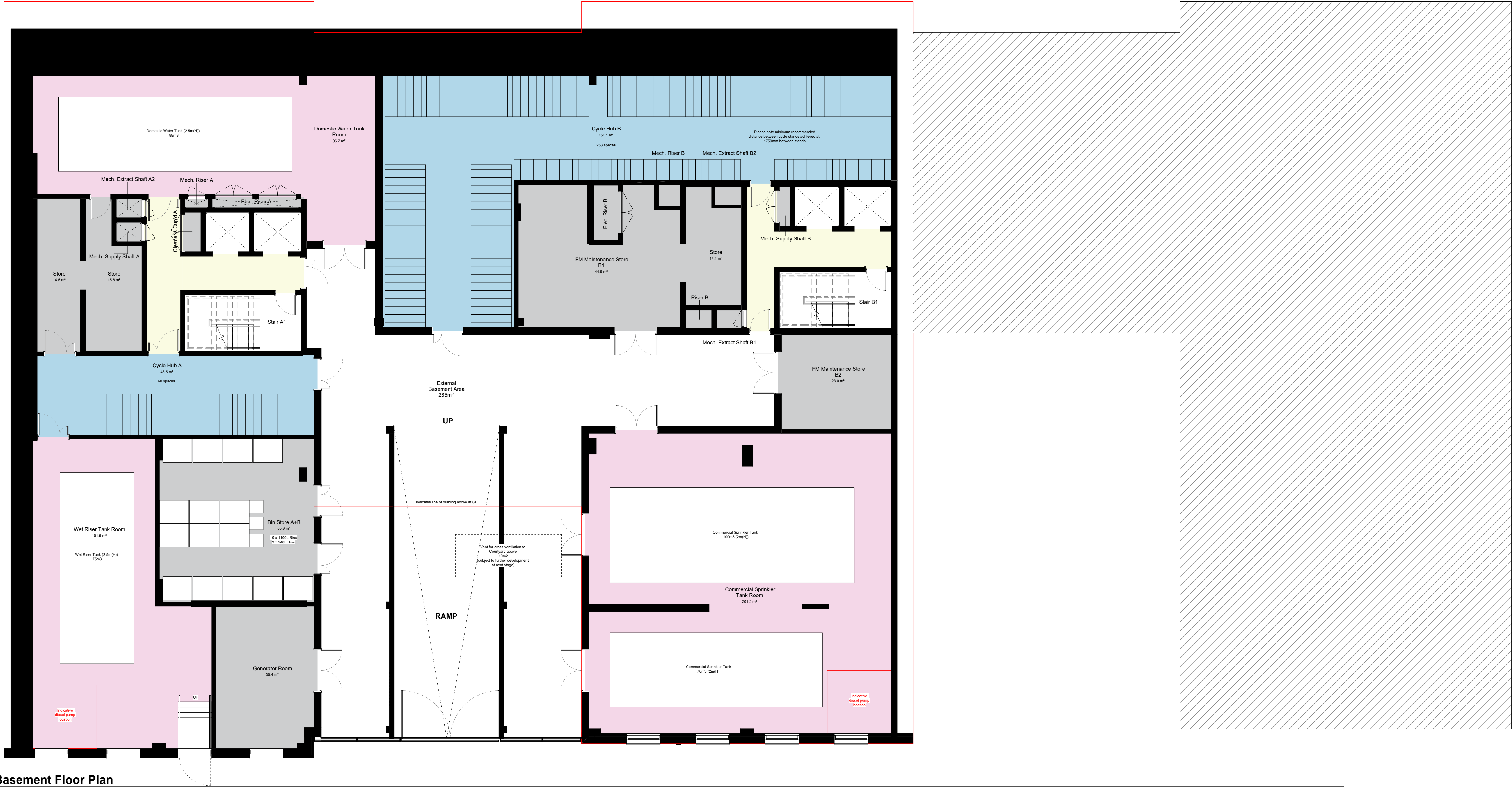
Ground Floor Plan

Stage 2

DRAWING NO. ECHO-SRA-ZZ-00-DR-A-02100

SR NO. 7054

REV. P09



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AREA MEASUREMENT
The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions, whether as to project viability, pre-letting, lease agreements or otherwise, should include due allowance for the increases and decreases inherent in the design development and building processes. Existing buildings may present anomalies in relation to surveyed/drawn plans that may also effect the stated areas. All areas are subject to Town Planning and Conservation Area Consent and detailed Rights to Light analysis. Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

PLEASE NOTE:

1. The measured areas shown for all en-suite clusters, studios and kitchens do not yet account for any protruding columns and will therefore reduce accordingly to account for these once locations and sizes are fully known.

2. Wall lining has been allowed for to solid core walls, shears walls and other structural items however depth of wall lining subject to change dependent on acoustic requirements. This may result in room sizes reducing.

3. Areas of ensuite bedrooms and studios include the area of the bathroom and the separating wall between bedroom and pod, but exclude the riser.

4. Cluster kitchens will require a riser to provide drainage etc and will reduce the area stated accordingly. The location of this is as yet unknown until full fit outs have been progressed.

5. Studio layouts shown are design intent only and follow Clients brief. Escape routes' distance from hols to be tested and validated by Fire Strategy with fire suppression measures as necessary. Studio layouts in abeyance until signed-off by Building Safety Regulator (HSE), Building Control Officer, and Building Insurer.

Department Legend

- Water Tanks (incl. Domestic, Commercial & Wet Riser)
- Cycle Stores (313 spaces)
- BOH Areas (incl Plant, Services, Stores etc)
- Circulation
- Preferred Structural Column Locations (WIP / Indicative only and subject to change)

REV.	DATE	AMENDMENT
P01	23/01/23	First Issue - Issued for Information
P02	03/02/23	Layouts amended following client + design team comments
P03	27/02/23	Layouts updated following client + design team comments. Preliminary internal fitout layouts included
P04	24/03/23	Draft Issue for Planning (Incl. minor updates)
P05	14/04/23	Planning Issue

KEYPLAN

CLIENT

IQ Student Accommodation

Student Accommodation

STATUS PURPOSE FOR ISSUE

S2 Planning

SHEPPARD ROBSON

27th Floor City Tower Piccadilly Plaza Manchester M1 4BT
T: +44 (0)161 233 8900 E: enquiries@sheppardrobson.com

SCALE@A1 DATE ORIGINATOR CHECKED AUTHORISED
1 : 100 14/04/23 LK VC RG

PROJECT
Echo Street
General Arrangement
Basement Plan

Stage 2

DRAWING NO.
ECHO· SRA· ZZ· B1· DR · A · 02099

SR NO.
7054

REV.
P05



Stage 1, 2, 3 & 5 (completed)

-  Window sample borehole location
-  Cable percussive with rotary follow-on
-  Machine excavated trial pits
-  Hand excavated trial pits with hand-held window sample follow-on
-  Micro-rotary borehole location
-  Denotes the borehole is installed

Rev:	Description:	Date:	By:	Chkd:
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Curtins Consulting Ltd.
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

Chandos Hall

Drg Title:
Stage 1, 2, 3, 4 & 5 Exploratory Hole Location Plan

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	09/07/2019	MH	NF

Drg No:	Rev:
065374-CUR-00-XX-DR-GE-005-V03	/

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-  Cable Percussive with Rotary Core Follow-on
-  Machine Excavated Trial Pits
-  Denotes the borehole is installed
-  Window Sample Borehole (September 2019)

Rev:	Description:	Date:	By:	Chkd:
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Curtins Consulting Ltd.
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

Echo Street, Additional SI

Drg Title:

Additional SI Exploratory Hole
Location Plan

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	07/09/2019	AHW	NF

Drg No:	Rev:
065374-CUR-00-XX-DR-GE-006-V02	/

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Appendix B – Chemical Acceptability Thresholds

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> 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 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	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						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - 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
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

- All values above are in mg/kg
- 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**
- Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- 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
- 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
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- 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)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> 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 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
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 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
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
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
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
<i>Aromatic</i>						
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)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
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
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- 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
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- 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
- 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
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- 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)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> 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 (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	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 ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - 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
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

Notes

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- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- 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
- 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
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
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- Lowest of o-, m- and p-xylene
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- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- 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)
- NA: Not applicable

Our Locations

Birmingham

2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol

Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge

50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff

3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas

Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin

39 Fitzwilliam Square
Dublin 2
Ireland
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh

1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow

Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal

28 Lowther Street
Kendal
Cumbria
LA9 4DH
T. 01539 724 823
kendal@curtins.com

Leeds

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool

51-55 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London

40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester

Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham

56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com