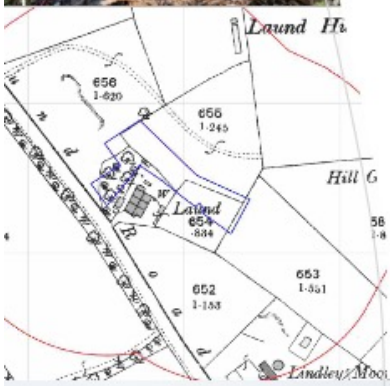








EARTH ENVIRONMENTAL & GEOTECHNICAL

Plot 2 to Plot 8

Remediation Strategy

120 Laund Road

Huddersfield

April 2020

On behalf of

Creative Developments (Huddersfield) Ltd

Earth Environmental & Geotechnical Ltd
Houldsworth Mill Business & Arts Centre
Houldsworth Street
Stockport
SK5 6DA

Tel : 0161 975 6088

Email info@earthenvironmental.co.uk
www.earthenvironmental.co.uk

PLOT 2 TO PLOT8

REMEDIATION STRATEGY

120 LAUND ROAD

HUDDERSFIELD

Report Ref: A0697/19/RMS

APRIL 2020

Prepared on Behalf of:

Creative Developments (Huddersfield) Ltd

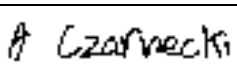
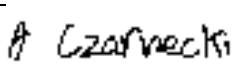
By:

Earth Environmental & Geotechnical Ltd
Houldsworth Mill Business Centre
Houldsworth Street
Stockport
SK5 6DA

www.earthenvironmental.co.uk

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Report Title:	**120 Laund Road, Huddersfield Remediation Strategy**	
Report Reference:	**A0697/19/RMS**	
Client:	**Creative Developments (Huddersfield) Ltd**	
Issue Date:	**8th April 2020**	
Drafted By:	**J Sheridan**	
Reviewed By:	**A Czarnecki**	
Authorised By:	**A Czarnecki**	

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EARTH ENVIRONMENTAL & GEOTECHNICAL

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1.0 INTRODUCTION

Appointment

Earth Environmental and Geotechnical Ltd (EEG Ltd) have been instructed by Creative Developments (Huddersfield) Ltd to prepare a Remediation Strategy for Plot 2 to Plot 8 associated with 120 Laund Road, Huddersfield, HD3 3TY.

Proposed Development

It is understood that the client intends to demolish the existing bungalow (120 Laund Road) and construct 8no. new two-storey detached and semi-detached residential houses with parking, private gardens and associated utility infrastructure.

A new access road into the site will also be constructed from Laund Road, which runs along part of the southwest boundary.

Figure 1 below shows the proposed development layout plan.

Figure 1 Proposed Development Layout Plan



Historical Information

Historically the site underwent several phases of development between the early 1900s and 1990s, with a number of small (presumed agricultural and residential) structures being constructed on-site and subsequently demolished in that time frame.

A single residential dwelling remains on-site (120 Laund Road), which was built c. 1990 and will be demolished to make way for the new development.

There is a history of mining in the surrounding area, associated with an outcropping coal seam (Pot Clay Coal, which is conjectured to outcrop immediately west of the site, adjacent Laund Road (and dip east beneath the site). Excavations are shown adjacent to the northern boundary of the site on historical mapping, which may possibly be coal related.

Objective

The Remediation Strategy is intended to build on the site characterisation information and provide details on the remediation objectives necessary to protect potential receptors and render the site suitable for the proposed development.

In summary this document presents the technical detail behind the proposed remedial activities at the site and includes:

- Clean Cover System in garden areas
- Gas Membrane Specification for Plot 2 to Plot 8

This report has been prepared for the purpose of satisfying the requirements of the Local Planning Authority. Earth Environmental & Geotechnical Ltd reserves the right to amend this Remediation Strategy in the light of further information which may become available or future changes in contaminated land guidance, prior to site activities.

Sources of Information

The following reports have previously been prepared for the site by Earth Environmental & Geotechnical Ltd and should be read in conjunction with this Remediation Strategy:

- Phase I GeoEnvironmental Desk Study (reference A0697/17, November 2017)
- Phase II GeoEnvironmental Site Investigation & Coal Mining Risk Assessment report (reference A0697/19/B.0, October 2019 (Appendix 1)
- Phase 2 Ground Gas Risk Assessment, January 2020 (Appendix 2)
- Asbestos Management Plan (reference A0697/19/RMS)

2.0 SITE LOCATION AND DESCRIPTION

The site is located northeast of Laund Road at postcode HD3 3TY, approximately 4km northwest of Huddersfield City centre, and around 900m east of Junction 23 of the M62 motorway. The site is located within a built-up residential area, with neighbouring properties in very close proximity of the site boundary.

The site is currently occupied by a bungalow (120 Laund Road) in the northwest of the site, which is set back from Laund Road, and a recently constructed two-storey four-bedroom house fronting Laund Road. The new property is currently unoccupied, but it is understood that the bungalow is occupied by a tenant and the dwelling is scheduled to be demolished in early 2020 to make way for the new development.

The remainder of the site comprises the front and rear gardens to 120 Laund Road and a parcel of land in the southeast of the site, which is bordered by mature trees and has become overgrown.

A location plan is shown below as Figure 2.

Figure 2: Site Location Plan



3.0 PREVIOUS SITE INVESTIGATIONS

As mentioned in Section 1, several reports have been prepared for the site by EEG Ltd.

The recommendations in this Remediation Strategy are based primarily on the findings of the Phase II Geo-Environmental Site Investigation (A0697/19/B.0, October 2019) and Phase 2 Ground Gas Risk Assessment (January 2020) which are summarised below.

Scope of Works

The site investigation was conducted between the 12th and 14th June 2019 and comprised:

- 16no. mechanically excavated trial pits (TP1-TP8, TP8A and TP9-TP15) drilled to a maximum depth of 3.1m bgl;
- 7no. window sample boreholes (WS1-WS7) excavated to a maximum depth of 2.8m bgl;
- 2no. rotary open-hole boreholes (RO1-RO2) drilled to depths of 30.0m using water based flush.

Standard Penetration Tests (SPTs) were conducted in the window sampler boreholes, and soil samples were retrieved from the exploratory holes at regular intervals for geotechnical and chemical analysis. Soils were logged by an on-site engineer.

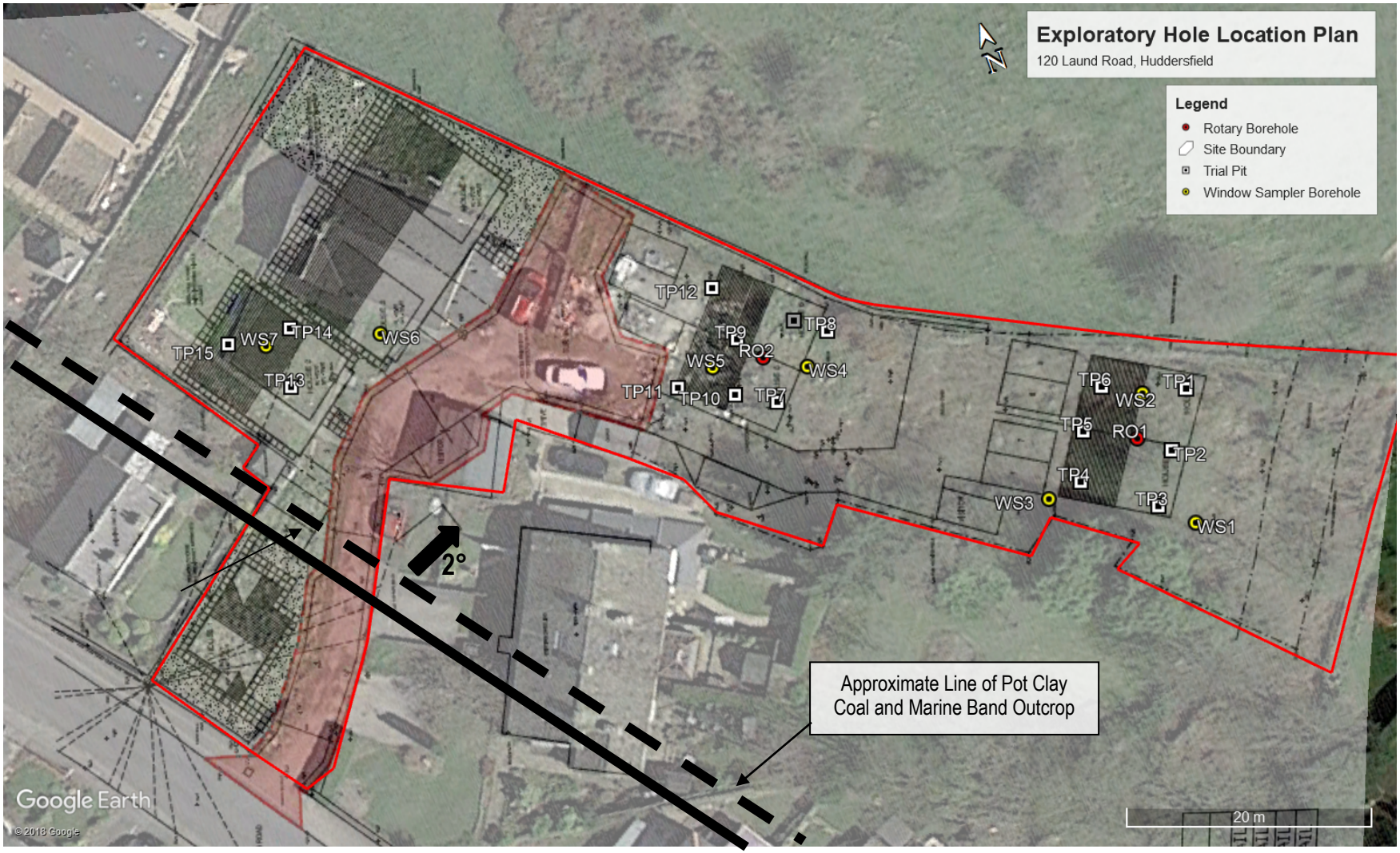
An exploratory hole location plan is presented as Figure 3, overleaf.

Ground Conditions

The recorded ground conditions are summarised as follows:

- **Topsoil –** encountered in WS1, WS3, RO1 and RO2 to depths of 0.20m - 0.80m bgl as brown sandy, gravelly CLAY with roots and gravel of sandstone, mudstone, rare brick and tile inclusions.
- **Made Ground –** encountered in all other exploratory holes to depths of 0.10m - 1.80m as soft greyish brown, sandy, gravelly CLAY or dark brownish black, clayey, gravelly SAND with gravel and cobble sized inclusions of concrete, brick, mudstone, sandstone, coal, clinker, glass, tile, plastic and general miscellaneous fly-tipped waste in variable proportions.
- **Possible Relict Topsoil –** encountered beneath the Made Ground in TP4-TP6 as a 0.40m-0.50m thick horizon of soft brown silty/sandy, slightly gravelly CLAY with roots.
- **Pennine Lower Coal Measures Formation (PLCM) –** encountered beneath the Topsoil or Made Ground in all locations as:
    - Soft to firm greyish brown or orangish brown mottled grey, sandy, gravelly CLAY (destructed/completely weathered).
    - Weakly bedded dark grey mottled orange weathered MUDSTONE recovered as weak shaley gravel with clayey matrix.
    - Yellow, thinly bedded SANDSTONE recovered as silty, sandy gravel.
    - Dull black COAL.
    - Alternating sequence of SILTSTONE and SANDSTONE with depth.
- **Suspected Backfill Material –** encountered in the northwestern part of the site only (TP14, TP15 and WS7) beneath the natural strata at minimum and maximum depths of 1.00m and 2.60m bgl, as loose, wet, dark grey very clayey/silty fine to coarse, subangular GRAVEL of mudstone.

Figure 3: Exploratory Hole Location Plan



Boreholes were terminated at depths of between 2.0m and 2.8m bgl due to SPT refusals (N=50) in the weathered bedrock.

Soil Contamination Assessment

Ten soil samples were retrieved from the site for chemical analysis.

Samples were analysed for the following suite of contaminants: Asbestos, Arsenic, Beryllium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Thiocyanate, Phenol, Sulphate (SO4), Sulphide, pH, Sulphur, Soil Organic Matter and speciated Polyaromatic Hydrocarbons (PAH) and speciated Total Petroleum Hydrocarbons (TPH).

Eight of the ten soil samples were found to contain concentrations of contaminants in exceedance of assessment criteria values relevant to a residential end use with plant uptake, indicating widespread soil contamination. Contaminants in exceedance included a selection of Heavy Metals and Polycyclic Aromatic Hydrocarbons (PAHs).

Asbestos was identified in three samples (TP2, TP8 and TP14) as both Chrysotile and Amosite. Quantification results show that the samples contained < 0.001% (trace) to 0.007 % wt/wt asbestos. The risk to end users was therefore considered to be moderate.

It should also be noted that a fragment of suspected asbestos cement sheeting was also observed within a stockpile comprising site-stripped soils, demolition materials and other miscellaneous fly-tipped items, which was located on-site at the time of the site investigation. Other isolated fragments may therefore be present at the ground surface or buried within the soils at the site.

Soils were generally classified as Non-Hazardous for the purpose of off-site disposal. One soil sample taken from WS06 was classified as Hazardous.

Ground Gas Assessment

Ground gas monitoring has been carried out on the site and has proved an absence of any viable ground gas sources.

It has however been agreed with the local council that as a precautionary measure that Plot 2 to Plot 8 incorporate a gas retardant membrane to prevent the entry of coal mine gases, in particular Carbon Dioxide.

Remedial Recommendations

Soil Contamination

It was recommended that, due to the presence of potential contaminants within the Made Ground deposits, a 600mm chemically suitable cover system should be placed within all residential garden areas where Made Ground remains post construction, reduced to 450mm in front garden areas.

With regards to the encountered asbestos, it was considered that due to the wide spatial distribution of the asbestos, the possibility of asbestos containing materials (ACM) existing away from and in between sampling locations could not be ruled out. It was therefore recommended that an appropriate physical

barrier be incorporated at the base of the capping layer, to act as a no dig layer for future residents and to prevent potential bioturbation.

Ground Gas

Plot 2 to Plot 8 are to incorporate a carbon dioxide retardant membrane.

Ground Stability

Given the presence of loose deposits at or below founding level in the northern part of the site, remedial measures such as deepening foundation to ensure they bear upon competent strata and placing a geogrid over the affected area to stabilise the soils and prevent uneven soil settlement was recommended.

4.0 LICENCES & APPROVALS

Various licences, permits and approvals are required at various stages before certain works can commence. Some activities can start before all such approvals are in place.

(i) Approval of this Remediation Method Statement;

(ii) All documentation in accordance with the CDM 2015 Regulations;

(iii) A signed declaration by qualified person of the Material Management Plan (MMP) in accordance with CL:AIRE Waste Code of Practice, Version 2, March 2011. This would allow for reuse of excavated soils after demonstration of suitability for use; and,

(iv) General condition survey of boundary features.

5.0 PROPOSED WORKS

Aims

The remediation aims are to resolve contamination issues in order to protect human and environmental receptors and render the site suitable for the proposed end use and satisfy the requirements of the Local Planning Authority and Insurance bodies (NHBC).

The remediation strategy for the site has been developed following review and assessment of the site investigation reports previously prepared for the site.

Soil Contamination

Clean Cover Capping System – Specification

Areas of landscaping and private garden areas within the vicinity of identified contamination (following the above recommended additional soil sampling) will need to capped with a suitable thickness of uncontaminated cover soils to break the potential contamination linkage, as follows:

- Placement of a geotextile membrane at the base of the clean cover within affected garden areas to maintain soil separation between the inert growing medium and the residual underlying soils and to act as physical marker for future works.

- A minimum total thickness of clean imported soil of 600mm placed in rear gardens, reduced to 450mm in front gardens.

- Clean cover may comprise a combination of subsoil and topsoil. Topsoil is to comprise no less than the upper 150mm.

Clean Cover Capping System – Verification & Validation

Soils to be used as capping layers (site won or imported) must not contain contaminant concentrations above the assessment criteria for Residential end use (with plant uptake) and be free of deleterious components e.g. glass, plastic, wood, ash and metal solids.

Evidence will be required to demonstrate the suitability of the site won/imported materials to be used and that the capping has been installed in line with the specification outlined above. Validation will require:

- Chemical analysis of soils will be carried out at source to ensure suitability for use, prior to being used/imported.

- Relevant source test data for site won/imported soils will be provided to confirm all determinants are at concentrations below the relevant assessment criteria. Testing should be carried out at a frequency of one sample per 100m^3 batch of soil.

- Imported soils (if applicable) should be stockpiled on receipt and sampled from the stockpile prior to placement and undergo appropriate chemical analysis to confirm it is suitable for use.

- Following confirmation that material is suitable for use, the material is to be placed in line with the above specification.

- Following placement of clean cover system, trial holes will be formed in each garden to confirm the correct implementation. Each pit will be inspected, photographed and the depths/thicknesses of the subsoil and topsoil measured by the consultant engineer.

- A validation report will be provided for approval by the Environmental Health Contaminated Land Officer at the LA.

Ground Gas

Gas Protection Measures - Specification

The gas protection measures installed must comply with a Characteristic Situation 2 in accordance with BS8485:2015, equivalent to Amber 1 as defined by CIRIA C665 and the NHBC Standards traffic light classification for low risk housing.

A scoring system is referred to within BS 8485:2015, whereby each protection measure has an individual score, as summarised in the table below.

Table 1 Gas Protection Point Score Required (BS8485:2015)

Characteristic Situation	Minimum gas protection score (points)			
	High Sensitivity		Medium	Low
	Type A building (private housing)	Type B building (multiple occupancy private or commercial)	Type C building (single occupancy commercial)	Type D building (large industrial)
1	0	0	0	1
2	3.5	3.5	2.5	1.5
3	4.5	4.0	3.0	22.5
4	6.5	5.5	4.5	3.5

The proposed development is for private dwellings, therefore would be classified as Type A building (highest risk). The combined score for such a development must equal or exceed a **gas protection score of 3.5 for Characteristic Situation 2**.

The required 3.5 points must be achieved by installation of a suitable combination of measures. Reference should be made to BS8485:2015 for details, however, as a minimum the following would be expected:

Subfloor

- Pre-cast suspended segmental floor i.e. beam and block (*Score – 0*);

Ventilation

- Passive sub-floor ventilation; a clear void or formed of gravel, polystyrene etc. (Score – 1.5)

Visqueen Gas Barrier Membrane

- Minimum 0.40mm thick reinforced membrane meeting all of the following criteria (*Score – 2*):

- Sufficiently impervious to gases with a methane gas transmission rate <40.0ml/day/m^2/atm (average) for sheet and joints;
- Sufficiently durable to last for the anticipated life of the building and duration of gas emissions;
- Sufficiently strong to withstand in-service stresses and installation process together with ongoing construction until covered.
- All penetrations and joints sealed (welded not glued) to achieve complete integrity across entire building footprint.

After installation, the membrane should be capable of providing a complete barrier to gas entry.

Service entry locations and physical penetrations through the subfloor pose a potentially high risk to the continuity and integrity of any waterproofing and/or gas protection system. The reduction of service penetrations through a slab by relocation through the outer wall above ground level will reduce the detailing required if laying a membrane and therefore reduce the risk of failure.

The gas membrane should be installed correctly by a competent contractor. Appropriate specification, supervision and control will be needed during design and construction, including validation and verification of the construction accordance with CIRIA C735.

Ground Stability

Where loose wet collapsible deposits have been encountered in the northern part of the site, deepening of foundations or treatment of the loose deposits by grout injection will be required to mitigate any potential ground stability issues.

It is considered likely that short bored piles would be the most feasible/economically viable solution and should be incorporated into the structural design of affected plots (subject to the outcome of the supplementary investigation).

In addition, a competent geogrid placed over the affected area should be sufficient to stabilise the soils and prevent uneven soil settlement.

Geogrids can be used to increased bearing capacity, control differential settlement and span underlying potential voids that may develop in mining areas. This application may highlight the presence of subsidence or void formation, whilst supporting the ground above.

The extent of the geogrid will be confirmed following the outcome of the supplementary site investigation.

Advice should be sought from a specialist contractor regarding the above ground stability recommendations.

6.0 SITE WORKS

Outlined below are some of the main task and activities associated with the remediation works.

Site Organisation

Site works will be supervised throughout by a suitably qualified Engineer, who will report to a Project Manager. Supervision may be part-time for certain activities but will be full-time during the removal of any contaminated soil/fill and any placement of fill to an engineering specification.

Welfare Facilities/Security

Initial mobilisation works will include the establishment of appropriate office and welfare facilities. Such facilities may include but are not restricted to; office accommodation, canteen facilities, washroom/drying room, toilets, wheel wash, car parking, stores and security unit.

The site should be secured by fencing to prevent unauthorised access onto the site during the enabling works.

Health & Safety

All site personnel will undergo a site-specific health and safety induction prior to commencement of work on site.

The Engineer will be informed prior to any proposed entry of a confined space or deep excavation. Entry will be restricted to suitably qualified and equipped personnel.

Works will be carried out with regard to current statutory requirements and guidance by the Health & Safety Executive "Protection of workers and the general public during the redevelopment of contaminated land". Protective clothing, footwear and gloves will be required with hand washing and boot-washing facilities made available. Smoking will be limited to designated areas.

Site Clearance

Any trees currently under a preservation order should be identified and agreed with relevant authorities prior to the commencement of the works. All trees subject to a Tree Preservation Order should be clearly identified and protected by chestnut paling with fluorescent tape.

The site should then be cleared of all residual debris, fly tipped materials, any vegetation, shrubs, bushes and unprotected trees as instructed by the client.

Excavation of Subsurface Obstructions

During the site investigation, obstructions were not identified within the made ground, which could pose obstacles during excavations and construction. However, obstructions may be present in the southwest of the site.

Any material identified as potentially contaminated should be stockpiled on a non-permeable membrane, and tested for suitability for either re-use on site, or offsite disposal.

Should the material be removed from site, waste acceptance criteria testing should be undertaken, and the material disposed of in a suitably licensed facility. The development of a Materials Management Plan (MMP) in line with the CL:AIRE Code of Practice may be required to remove or re-use soils.

Unexpected Contamination

If during site clearance works or other excavations, material with visual or olfactory evidence of previously unrecorded contamination is encountered, the principal contractor should contact the environmental consultant.

These soils should be then sampled, and chemical analysis carried out. The environmental consultant shall decide upon the chemical suitability of the material, to either remain on site or if it is likely to present a risk to receptors.

If the soils present a risk, the materials should be removed from site or remediated as per the specification in Section 5.0.

Any excavated material identified as potentially contaminated should be stockpiled on a non-permeable membrane, and tested for suitability for either re-use on site, or disposed offsite.

If prolonged stockpiling is unavoidable, these soils should be covered with a non-permeable membrane at the end of each working day, to prevent the possibility of leachate migrating from the soils due to infiltration.

Should the material be removed from site, waste acceptance criteria testing should be undertaken, and the material disposed of in a suitably licensed facility. The development of a Materials Management Plan (MMP) in line with the CL:AIRE Code of Practice may be required to remove or re-use soils.

Backfill of Excavations

All excavations shall, prior to backfilling, be surveyed to ascertain their spatial extent and depth. Excavations (to remove relict structures, contamination etc) should be backfilled with suitable materials as agreed with the Engineer and subjected to nominal compaction.

However, where an excavation conflicts with the footprint of a proposed highway, compaction in general accordance with the Specification for Highway Works Table 6/1 will be required.

Control of Perched Groundwater

The regional groundwater table is unlikely to be encountered during remediation earthworks; however, discontinuous perched groundwater may be present within Made Ground. If encountered during the excavation works this perched water will be recovered by pumping from open excavations. Dependant on volumes recovered, some form of temporary storage may also be required.

Provision should be made for pumping from sumps and appropriate excavation support for all excavations.

7.0 ENVIRONMENTAL MONITORING & CONTROLS

General

All works should be carried out in a manner that minimises impact on the environment and generates adequate and accurate records to demonstrate remediation works have been carried out to the required standard and in accordance with all applicable legislation. All such records should be collated on contract completion (or sooner as required) and included within the contract completion report. Appropriate progress reports should be provided in a format and at a frequency as agreed with the client and project manager including on-going monitoring/validation information.

Comprehensive records should be maintained throughout the project. These should be collated on contract completion into a completion and validation report, which should be submitted to the appropriate regulators for approval. It will be presented in an appropriate manner so as to allow interested third parties to fully understand the whole remediation process.

The records should include correspondence with the regulators & other third parties, environmental monitoring data, validation testing, comprehensive as-built drawings, photographs, collation of all site investigation reports, operational method statements & risk assessments, construction phase health & safety plan and confirmation of post remediation considerations especially in respect of interaction with initial construction (groundwork's).

Noise Control

Earthworks will only take place during normal working hours 8.00am – 6.00pm Monday to Friday and 8.00am to 13:00pm on Saturdays with no working on Sundays or Bank Holidays. The site manager shall assess noise and its impact upon neighbours through the working day and to ensure the following mitigation measures are being utilised:

All plant and machinery will be fitted with adequate silencers and will not be operated unless in good condition.

Noise levels will be as per normal for a project of this nature. Pneumatic breakers will be used but location and hours of use controlled whenever possible.

Should local residents make any complaints regarding noise associated with the works, the site manager shall investigate. Such investigation may include the use of portable monitoring equipment to record noise levels at the location of the complainant. The nature of the complaint and findings of the investigation shall be discussed with the local EHO. If the complaint is upheld appropriate remedial action shall be taken. Such action may include the adjustment of working hours or the alteration of site practices and working methods.

Odour Control

Works may produce odours, but good site practice and associated mitigation measures should ensure fugitive odours are kept to an absolute minimum. Such controls may include:

- Additional covers will be applied to stockpiles, if they are contributing to fugitive odours.

- Areas of excavation i.e. area of exposed contaminated soils, will be kept to a minimum and covered/re-instated as soon as is practicably possible.

- Odour suppressing equipment shall be utilised at appropriate locations at appropriate times.

In the event that a complaint is made regarding odours from nearby residents, the site manager shall respond by attending the complainant's property to assess the nature and level of odour nuisance including monitoring where appropriate. Appropriate mitigation measures as described herein shall than be enforced including if necessary, suspension of excavation works until the prevailing weather conditions become more favourable.

Dust Control

Earthworks may produce dust during prolonged periods of dry weather. The site manager shall assess dust and its impact upon neighbours through the working day and ensure the following mitigation measures are being utilised to control dust:

- The use and maintenance of good quality site roads;
- Enforcing speed limits of site plant and;
- Dust suppression via water applied by towed bowser, particularly in the vicinity of locations where trace asbestos fibres have been detected in soils.

8.0 VALIDATION REPORT

A Validation Report would be developed for Plot 2 to Plot 8 that would detail the design and installation of the garden cover system and ground gas protection measures.

The ground gas element of validation report should include:

- a description of any measures installed – this could be presented in textual form, as photographic records or by as-built construction drawings (any variations to the pre-construction design should be fully detailed and justification(s) presented);
- details of who installed the measures;
- details of who inspected or verified the installation/s and a description of how this took place, together with any constraints (i.e. areas that could not be inspected or tested) or other issues of uncertainty;
- verification test results, outcome of inspections and compliance data should be provided, either within the main text or as an Annex to the report; and
- any defects identified, together with corrective actions and subsequent verification checks. Where appropriate, the report content should also include:
- copies of regulatory correspondence/sign off;
- manufacturers' specifications, warranties and/or guarantees;
- personnel details (such as relevant qualifications); and
- maintenance requirements and/or limitations of the system.

The report should provide a concluding comment about the suitability (or otherwise) of installed gas measures and include the name of the author, company details and date of issue.

The cover system element of validation report should include:

- chemical testing of imported soils:
- thickness measurement of emplaced cover system;
- photographs of trial holes to determine soil cover thickness;
- trial hole logs in accordance with BS5930 Code of Practice for Site Investigations.

APPENDIX 1

EEG PHASE II GEOENVIRONMENTAL SITE INVESTIGATION REPORT OCTOBER 2019

APPENDIX 1

PHASE 2 GROUND GAS RISK ASSESSMENT, JANUARY 2020

APPENDIX 3

ASSESSMENT CRITERIA FOR CLEAN COVER SYSTEM

Assessment Criteria Based on Residential with Homegrown Produce End Use

Inorganic Compounds	Assessment Criterial - Residential with Homegrown Produce (mg/kg)		
Arsenic	37		
Cadmium	11		
Chromium (III)	910		
Chromium (VI)	6		
Lead	200		
Mercury	1.2		
Nickel	180		
Selenium	250		
Copper	2400		
Zinc	3700		
Organic Compounds	**1% SOM**	**2.5% SOM**	**6% SOM**
Naphthalene	2.3	5.6	13
Acenaphthene	210	510	1100
Acenaphthylene	170	420	920
Fluorene	170	400	860
Phenanthrene	95	220	440
Anthracene	2400	5400	11000
Fluoranthene	280	560	890
Pyrene	620	1200	2000
Benzo(a)anthracene	7.2	11	13
Chrysene	15	22	27
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(k)fluoranthene	77	93	100
Benzo(a)pyrene	2.2	2.7	3.0
Dibenz(a,h)anthracene	0.24	0.28	0.3
Indeno(1,2,3-cd)pyrene	27	36	41
Benzo(g,h,i)perylene	320	340	350
Benzene	0.087	0.17	0.37
Toluene	130	290	660
Ethylbenzene	47	110	260
o-Xylene	60	140	330
m-Xylene	59	140	320
p-Xylene	56	130	310
TPH Fractions	**1% SOM**	**2.5% SOM**	**6% SOM**
Aliphatic EC 5-6	42	78	160
Aliphatic EC >6-8	100	230	530
Aliphatic EC >8-10	27	65	150
Aliphatic EC >10-12	130 (48)[vap]	330 (118)[vap]	760 (283)[vap]
Aliphatic EC >12-16	1100 (24)[sol]	2400 (59)[sol]	4,300 (142)[sol]
Aliphatic EC >16-35	65,000 (8.48)[f,sol]	92,000 (21)[f,sol]	110,000[f]
Aliphatic EC >35-44	65,000 (8.48)[f, sol]	92,000 (21)[f,sol]	110,000[f]
Aromatic EC 5-7	70	140	300
Aromatic EC >7-8	130	290	660

	Assessment Criterial - Residential with Homegrown Produce (mg/kg)		
TPH Fractions	**1% SOM**	**2.5% SOM**	**6% SOM**
Aromatic EC>8-10	34	83	190
Aromatic EC >10-12	74	180	380
Aromatic EC >12-16	140	330	660
Aromatic EC >16-21	260[f]	540[f]	930[f]
Aromatic EC >21-35	1,100[f]	1,500[f]	1,700[f]
Aromatic EC >35-44	1,100[f]	1,500[f]	1,700[f]
Asbestos Fibres	< 0.001%		

The site-specific risk-based criteria are based upon DEFRA/EA CLEA 1.07 modelling assuming a sandy loam with 1% Soil Organic Matter and pH of 7.

Purpose	Classification	Testing Frequency	Chemical Analysis
Source Testing & Suitability For Use	Topsoil	1 sample per 50m^3 [Minimum of 3 per source]	➢ Inorganic Compounds; ➢ Speciated Polycyclic Aromatic Hydrocarbons; ➢ Speciated Petroleum hydrocarbons; ➢ Asbestos Identification.
	Sub-Soil	1 sample per 250m^3 [Minimum of 3 per source]	
Validation Testing	Topsoil	1 sample per 3 plots	
	Sub-Soil	1 sample per 3 plots	

The sampling frequency for materials intended for gardens is to be managed under the Remediation Strategy.

APPENDIX 4

REPORT LIMITATIONS

LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2020 and should be read in light of any subsequent changes in legislation, statutory requirements and industry best practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.