info@calabrian.co.uk www.calabrian.co.uk

Geotechnical Engineering | Geoenvironmental Consultants

Doc Ref: MAUBS-CLB-XX-XX-RP-OT-000003
Doc Title: Remediation Strategy & Verification Plan **Rev:** P01
Status: S2 For Information

REMEDIATION STRATEGY & VERIFIACTION PLAN

for land at

UPPER BROOK STREET, MANCHESTER, M13 9QD

Prepared on behalf of McLaren Property Limited

Report 7293/2

November 2024

FOREWORD (Geoenvironmental Investigation Report)

This report has been prepared for the sole internal use and reliance of the McLaren Property Limited. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Calabrian Limited (Calabrian); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

The report should be read in its entirety, including all associated drawings and appendices. Calabrian cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from a variety of sources as detailed within this report, and which Calabrian believes are reliable. All reasonable care and skill has been applied in examining the information obtained. Nevertheless, Calabrian cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geoenvironmental consultants. Calabrian does not provide legal advice and the advice of lawyers may also be required.

Calabrian cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

Calabrian reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

calabrian

TABLE OF CONTENTS

1 INTRODUCTION _____ 1

1.1 The Commission and Brief _____ 1

1.2 The Proposed Development _____ 1

2 BACKGROUND _____ 1

2.1 Site Description _____ 1

2.2 Ground Investigation _____ 2

3 RISK ASSESSMENT & TARGET CONCENTRATIONS _____ 2

4 REMEDIATION STRATEGY (General) _____ 3

4.1 Aims _____ 3

4.2 Overview _____ 3

4.3 Site Set-up, Organisation and Safety _____ 3

4.4 Contractor's Responsibilities _____ 4

4.5 Engineering Supervision and Verification _____ 4

5 REMEDIATION STRATEGY (specific Objectives) _____ 5

5.1 Contingency for Unknowns _____ 5

5.2 Site Clearance _____ 5

5.3 Asbestos _____ 5

5.4 Demolition _____ 6

5.5 Excavation of Contaminated Soil/Fill _____ 6

5.6 Control of Water _____ 6

5.7 Removal of Below Ground Obstructions _____ 7

5.8 Crushing _____ 7

5.9 Backfill of Excavations _____ 7

5.10 Boundary Issues _____ 8

5.11 Surveying _____ 8

5.12 Export to Landfill _____ 8

6 PLACEMENT OF SOIL COVER _____ 9

6.1 Verification _____ 9

6.2 Sampling Frequency (to check Soil Quality) _____ 10

6.3 Inspection Frequency (to check Soil Thickness) _____ 10

6.4 Soil Material Suitability _____ 10

6.5 Laboratory Analysis _____ 11

6.6 Verification Report _____ 13

7 Hazardous Gas Protection _____ 14

7.1 Membrane Installation _____ 14

7.2 Verification _____ 15

calabrian

DRAWINGS	
7293/1	Site Location Plan
7293/2	Proposed Site Layout
7293/7	Geoenvironmental Summary
APPENDIX A	**PROTOCOL FOR IMPORTATION & USE OF SOIL COVER**
APPENDIX B	**TIER 1 SCREENING VALUES**
APPENDIX C	**Visual Inspection of Gas Protection Measures**

calabrian

1 INTRODUCTION

1.1 THE COMMISSION AND BRIEF

Calabrian Limited (Calabrian) has been commissioned by McLaren Property Limited to prepare a Remediation Strategy for land at Upper Brook Street, Manchester, M13 9QD.

Calabrian have already issued the following report:

- Geoenvironmental Appraisal of land at Upper Brook Street, Manchester, M13 9QD. Report No. 7293/1, dated June 2024.

The appointed Remediation Contractor will need to familiarise themselves with the above Reports and comply with all relevant recommendations contained therein.

This document outlines the remediation objectives necessary to protect environmental receptors and render the site suitable for the proposed development. A Method Statement should be prepared, in order to detail how the objectives will be achieved.

The Method Statement should be accompanied by a Designer's Risk Assessment in accordance with the CDM Regulations, 2015. The Method Statement and Risk Assessment should be submitted to, and approved by, the Engineer.

1.2 THE PROPOSED DEVELOPMENT

The proposed redevelopment of the site with comprise two blocks of student accommodation of twenty-two and eleven storeys with a single storey podium linking them together. A proposed site layout has been provided by McLaren and is copied as Drawing 7293/2.

Lower load structures could be founded at shallow depth within the cohesive or granular glacial deposits. Higher loads will be required to found on or in the Chester Formation sandstone at depth either on deep pad or short piled foundations.

2 BACKGROUND

2.1 SITE DESCRIPTION

Details of the site are given below:

- Location: 1.5km south-east of Manchester City Centre
- National Grid Reference: SJ 848 969
- Nearest Postcode: M13 9QD
- Area: 0.45 hectares.

A location plan is shown on Drawing Nos 7293/1.

2.2 GROUND INVESTIGATION

Made Ground

A veneer of asphalt was found across all of the external site areas with concrete of around 200mm inside the building; this was typically underlain by a sandstone sub-base of approximately 300mm thickness. The made ground comprised a variable mixture of cohesive and granular soils with gravel and cobble sized anthropogenic fragments .

Natural Ground

Natural ground comprised medium dense sand becoming sand and sandstone gravel to approximately 3m depth where sandstone was encountered. Thin horizons of sandy clay were found immediately beneath the made ground at some locations.

Groundwater

Based on the results of the investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.

Hazardous Gas

There are no known or suspected areas of landfilling within 250m, and the site is not in area considered susceptible to mines gas, nor is it underlain by shallow mineworkings.

The site is in an area where less than 1% of homes are estimated to be above the radon action level and protective measures are not required.

Given the limited gas generation source (on site made ground) and monitoring results to date the site is likely to be classified as Characteristic Situation 2 (CS2) where gas protection measures are required.

Contamination

Three samples yielded concentrations of lead above its Tier 1 criteria, two additional samples yielded elevated benzo(a)pyrene. Where residual made ground remains beneath landscaped areas (i.e. not beneath buildings or hardstanding) a 600mm thick surface cover of “clean” soil is recommended.

3 RISK ASSESSMENT & TARGET CONCENTRATIONS

Clean-up criteria relevant to the limited contamination encountered at this site are not driven by risks to controlled waters, therefore in the absence of a site-specific Quantitative Risk Assessment, it is conservatively proposed that Calabrian’ generic soil screening values for a CSM that assumes residential apartments with landscaping (public open space) end-use (Calabrian Scenario C).

Information on the derivation and use of these screening values is presented in Appendix B.

4 REMEDIATION STRATEGY (GENERAL)

4.1 AIMS

Remediation aims are to:

- Resolve contamination issues in order to protect environmental receptors and render the site suitable for the proposed development;
- provide a stable development platform (to agreed levels and gradients) for subsequent construction of the proposed development and associated infrastructure; and,
- satisfy requirements of the Local Planning Authority.

4.2 OVERVIEW

The following remediation works are required:

- General site clearance of surface materials and vegetation;
- demolition of buildings;
- break-up of slabs and hardstand;
- crushing of all suitable artificial hard material (ie. concrete/brick etc);
- installation of hazardous gas protection measures; and,
- provision of a minimum 600mm thick cover layer of 'clean' soils in all garden and landscaped areas.

4.3 SITE SET-UP, ORGANISATION AND SAFETY

During the remediation works, all personnel on site will comply with guidance provided in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

If at any time during the works personnel begin to feel unwell, they are to inform the Engineer, who will determine appropriate action.

Access into excavations etc. must be controlled and only undertaken in accordance with the Confined Spaces Regulations 1997. The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.

4.4 Contractor's Responsibilities

Prior to the commencement of any works the Contractor, in agreement with the Engineer, should:

- Comply with any requirements of McLaren's contract documentation;
- establish the boundaries of the site and the working areas;
- undertake a dilapidation survey of site boundaries, adjacent properties, and highways, via dated photographs or video footage;
- complete a full services search and liaise with all relevant utility companies regarding work in close proximity to their apparatus;
- obtain a pre-demolition (formerly Type 3) asbestos survey report for all buildings to be demolished;
- prepare a detailed Method Statement outlining how the objectives of this Remediation Strategy will be achieved (and obtain approvals); and,
- prepare the necessary COSHH statements and Health & Safety Plan in accordance with CDM regulations.

The Contractor should satisfy the Health & Safety Executive with regard to all matters concerning the health, safety, and welfare of persons on the site.

The Contractor should ensure that:

- Personnel, plant, materials, and other equipment related to the contract are confined within the boundaries of the site;
- any live services lying within the site boundary are marked and protected, or appropriate arrangements made to truncate them;
- good practices relating to personal hygiene are adopted;
- Suitable precautions are implemented at all times to prevent off-site migration of pollutants via airborne dust and vapours;
- suitable precautions are taken to prevent the spread of mud and debris on public highways;
- refuelling of mobile plant is undertaken in a designated area. Above ground oil storage tanks should comply with the requirements of Pollution Prevention Guideline PPG2. A spill kit should be kept on site, adjacent to the designated refuelling area.

4.5 Engineering Supervision and Verification

On satisfactory completion of all the works the Engineer will prepare a Verification Report, in accordance with Stage3 of the UK Governments 'Land contamination risk management'. Copies of the Verification Report will be issued to the Client and the Local Authority.

The Verification Report will stand as certification that the remediation has been carried out in accordance with this Remediation Strategy.

5 REMEDIATION STRATEGY (SPECIFIC OBJECTIVES)

5.1 CONTINGENCY FOR UNKNOWNS

Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the remediation works.

If unanticipated ground is encountered during the remediation works, the Contractor should immediately seek further advice from the Engineer.

Where appropriate any unanticipated grossly contaminated soil/fill should be placed in temporary stockpiles on hardstand or Visqueen, suitably covered and bunded.

Analysis of at least six samples, for an appropriate range of determinands should be undertaken. On receipt of the results, the Engineer will liaise with the Contractor regarding the most appropriate remediation option.

5.2 SITE CLEARANCE

Any trees currently under a Tree Preservation Order (TPO) should be identified and agreed with relevant authorities prior to the commencement of the works. All trees subject to a TPO should be clearly identified and protected by fencing in accordance with BS5837: 2012.

The site should then be cleared of all residual debris, any vegetation, shrubs, bushes, and unprotected trees as instructed by McLaren.

5.3 ASBESTOS

Current legislation (as outlined in HSG 264) requires a pre-demolition (formerly Type 3) asbestos survey to be undertaken, immediately prior to demolition of any building. The Contractor should request a copy of the survey report from McLaren or the Engineer. If no survey report is available, the Contractor will instruct an asbestos survey.

The licensed contractor should submit a Method Statement detailing how the works will be carried out in accordance with the Control of Asbestos Regulations 2012.

Asbestos was identified in four samples of made ground. Supplementary analysis (asbestos quantification) yielded only two results above the limit of measurement (<0.001%), with a maximum percentage of 0.041% per mass.

Provided soils are kept damp the risk of airborne fibre release, even during disturbance associated with excavation, should be negligible, and certainly below the control limit (as set by the Control of Asbestos Regulations 2012) of 0.1 f/cm^3 airborne fibres averaged over a 4-hour period.

If localised fragments of asbestos cement sheeting are encountered during the site remediation and preparatory works. All suspected asbestos-containing material should be recovered by hand and placed in double sealed bags, within a sealed skip for off-site disposal at a suitably licensed landfill site. Personnel involved in this activity should be equipped with appropriate personal protective equipment, including dust masks (minimum FFP3).

5.4 Demolition

Demolition works will commence on completion of any asbestos removal and a "soft-strip" of the existing buildings.

Existing buildings will be demolished in a safe and controlled manner.

All demolition operations should conform to BS 6187:2000 Code of Practice for Demolition. All personnel working on these operations should be fully qualified to do so.

A detailed Method Statement specific to the project must be prepared by the Contractor and submitted to McLaren. The Method Statement should also be submitted to, and approved by, the Engineer and the Local Authority.

Once buildings have been demolished, all surface hardstand and floor slabs should be grubbed-up and stored in a location on site, to be agreed with the Engineer, prior to crushing. Any unsuitable materials should be removed to a suitably licensed landfill site.

5.5 Excavation of Contaminated Soil/Fill

Due to its combustibility near-surface Ash & Clinker might be removed from site or placed beneath buildings or areas of hardstand.

Redistribution will satisfactorily isolate the Ash & Clinker from both end users and potential heat sources.

5.6 Control of Water

Groundwater should be controlled in accordance with CIRIA report 113 “Control of Groundwater for Temporary Works”.

Arrangements should be made to prevent ponding in any excavation “hollows”; the Contractor should ensure that ground levels are of sufficient gradient to enable the collection of surface water run-off in sumps or grips.

Pumping from over-excavated sumps may be required to maintain satisfactory working conditions.

A Silt Management Plan should be prepared by the Contractor, describing the mitigation measures that will be put in place to intercept direct run-off from any disturbed areas, stockpiles etc, thereby preventing any potential impact of adjacent land and nearby watercourses. Surface water run-off will probably require treatment (as a minimum to allow settlement of fines) prior to consented discharge.

Any potentially contaminated water should not be allowed to escape to other areas until the results of the analysis are available and, if required, a suitable means of water treatment has been agreed.

Water collected in sumps should be passed through a series of oil/water separators to remove any oily contamination. Oils trapped in the absorbent medium should be disposed of to a suitably licensed landfill site.

Treated water should then be tankered off-site, or be discharged to sewer, subject to analytical results and local water treatment company consent.

5.7 Removal of Below Ground Obstructions

All foundations associated with existing buildings and other relict structures will be chased out and grubbed-up, in order to remove potential obstructions to new foundations and infrastructure.

Where relict structures are found to retain fluid contaminants, they should be drained first. The drained fluids should be stored in appropriate, sealed tanks/containers and analysed for a range of determinands to be agreed with the Engineer. Fluids may then be tankered off-site, or be discharged to sewer, subject to analytical results and local water treatment company consent.

Deep excavations for the removal of structures etc will be unstable in the short term and continuous side support will be necessary.

Where significantly deep foundations (eg. piles) cannot be removed by conventional means, they are to be cut at a depth to be agreed with the Engineer and the position of the remaining lower section is to be accurately recorded by survey.

Suitable materials derived from grubbing-up should be stored in a location on site, to be agreed with the Engineer, prior to crushing. Any unsuitable materials should be removed to a suitably licensed landfill site.

5.8 Crushing

Production of a selected granular fill should be possible if suitable materials (generated by demolition operations and grubbing-up of floor slabs, foundations, and other relict structures) are crushed.

The crushed product should be screened to remove any unsuitable elements and stockpiled for re-use during the subsequent construction works. Generation of a Class 6 material as defined in the Highways Agency Specification (Series 600) should be possible.

6F2 graded material can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters). Recycled tarmac can be crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-102).

5.9 Backfill of Excavations

Excavations (to remove relict structures, etc) should be backfilled as necessary to achieve the desired levels, with suitable materials and compacted.

5.10 Boundary Issues

McLaren's Designer should ensure that proposed levels tie in with the surrounding infrastructure, and ground levels of adjacent properties (after allowance for the placement of any required soil cover).

Advice should be sought from the Engineer if mobile contamination is encountered close to the site's boundaries.

5.11 Surveying

The Contractor should arrange for the following survey work as directed by the Engineer:

- All setting out necessary to allow the works to proceed;
- recording of the depth and lateral extent of excavations to remove obstructions, contaminated soils etc;
- recording of the positions of any relict obstructions (ie. piles) left in-situ;
- recording of natural ground levels, where natural ground encountered during the earthworks;
- recording the locations and volumes of all stockpiles of suitable materials left on site for McLaren's use during the development works; and,
- as-built survey of the finished surface on completion of the remediation contract

The Contractor should supply the results of this survey work to the Engineer for inclusion in the Verification Report.

5.12 Export to Landfill

Excavation arisings that are unsuitable for retention and re-use on site should be placed in temporary stockpiles on hardstand or polythene sheeting and be suitably covered to minimise the potential for dust/odour nuisance and prevent surface water run-off.

Any material exported from site to landfill should be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991 and the Landfill (England & Wales) Regulations 2002.

A transfer note should be completed, signed, and retained by the parties involved. The transfer note should include the volume of waste, the nature of the material and a statement of its chemical composition, details of the source and destination sites, and details of the haulier.

In order to protect the general public from dust and vapour emissions, wagons that are to be used for the haulage of the contaminated material from the site must be sheeted. In addition, the Contractor must ensure that no fluids seep from the wagons.

In order to provide the landfill facility with information regarding chemical composition of the waste, further analysis of any material that requires removal from site may be required.

In addition to the above, Waste Acceptance Criteria testing will be required if the material is classified as inert or hazardous waste.

6 PLACEMENT OF SOIL COVER

Clean inert soil will be placed over any residual made ground in proposed landscaped areas (but not beneath hardstanding). This cover layer is to comprise 600mm of “clean” subsoil and topsoil.

Any material imported for use as cover should be validated in accordance with Calabrian’s Protocol for Soil Importation, copied in Appendix A. This Protocol includes chemical assessment criteria which should not be exceeded.

6.1 VERIFICATION

Isolation of made ground in landscaped areas beneath a cover of “clean” subsoil, and topsoil is often recommended as a remediation solution; most notably when the made ground contains inorganic (and non-volatile organic) contaminants at concentrations above guidance threshold values. A cover solution is not appropriate for volatile or semi-volatile organic contaminants (fuels, solvents etc); removal or treatment will usually be required.

The thickness of cover is dependent on the nature and degree of contamination (and sometimes the Local Authority whose area the site lies within), but typically between 600mm and 1,000mm is required. However, if the made ground is essentially "clean", but contains materials generally considered undesirable as a near-surface material in garden areas (colliery spoil, construction\demolition rubble etc) then a 300mm thick cover should be adequate. If the made ground is essentially "clean" and comprises reworked natural soil, the only cover likely to be required is topsoil.

The “clean” soil cover blocks potential linkages between the contaminated made ground and future residents. Soil cover is not required beneath hardstand or structures.

Soil cover is usually placed many weeks after completion of the preparatory\remediation works, and issue of the associated Verification Report, typically at a relatively late stage in the construction programme.

Prior to placement of soil cover, the appointed remediation contractor and\or groundworker should ensure that ground levels are low enough to accommodate the required cover thickness, taking account of any boundary issues, and without compromising any damp proof course/membranes.

Ideally soil quality should initially be determined by sampling of the source at least seven working days before importation to the development site; this may be achieved by supplier sampling and analysis.

Clearly, if soil cover is imported and placed before confirmation of its suitability, Calabrian cannot guarantee that our validation work will yield the desired results. In which case, it may be necessary to excavate and export the placed soil cover and\or import further "clean" soil.

Where samples have been tested at source, and on receipt of laboratory results, Calabrian will issue confirmation of soil suitability to the Client, who in turn will instruct his Contractor to commence importation. It will probably be necessary to stockpile soil cover materials prior to placement in garden\landscaped areas. Calabrian should inspect the stockpiled material prior to placement, to confirm that it is the same material as previously tested, and

it has not been cross-contaminated with miscellaneous arisings generated during the construction works.

Soil thickness and final quality can only be checked after placement; this should be done before turfing, fencing etc, but ideally after scaffolding has been dismantled.

6.2 Sampling Frequency (to check Soil Quality)

The number of samples taken will be dependent on the nature of the source, and the quantity of material to be imported as detailed below:

- Virgin Quarried Material sampling needs to be 1 or 2 samples depending on the type of stone utilised, to confirm the inert nature of the material.
- Crushed Hardcore, Stone, Brick (excluding asphalt) a minimum of 1 sample per 500m^3 .
- Greenfield/ Manufactured Soils a minimum of 3 samples or, dependent on source and receptor, between 1 per 50m^3 and 1 per 250m^3 .
- Brownfield/ Screened Soils a minimum of 6 samples or dependent on source and receptor, between 1 per 50m^3 and 1 per 100m^3 .

It should be noted that the thickness of placed topsoil is only 100mm to 150mm (compared with subsoil thicknesses of around 500mm). Consequently, where samples are collected after placement (although testing at source is always preferable) testing one topsoil sample per 50m^3. This is not unreasonable anyway, since from a potential contaminant perspective, topsoil, being present at surface, is more important than underlying subsoil.

Occasionally a developer just places 600mm of topsoil (i.e. no subsoil is used). In such circumstances, assuming the topsoil is from a single source, Calabrian would test a minimum of six samples.

A less frequent sampling rate may be appropriate for soils from a greenfield source or where large volumes (say > 5,000m^3) of soil are imported from a single, relatively homogenous source.

6.3 Inspection Frequency (to check Soil Thickness)

The number of inspection pits to check cover thickness and collect samples, should be one pit per 50m^2 plan area and at least one pit per landscaped area if the landscaping is in multiple parcels; a plan of proposed inspection pits may be provided within a site-specific Remediation Strategy where necessary.

6.4 Soil Material Suitability

Inspection pits should be excavated through the entire thickness of any proposed in-situ source material, or cover material (if inspection is post-placement). Stockpiles should be assessed from both the surface and by digging into the “core”, to ensure the material is reasonably homogenous.

The soil material should:

- Be clean and free of foreign debris, building waste materials, glass sharps, or contaminants;
- topsoil should not have a gravel content of greater than 30% by dry weight and should generally have a maximum stone size of 50mm in any one direction;
- subsoil should generally have a maximum stone size of 150mm in any one direction; and,
- not have been sourced from an area within 7m laterally, or 3m vertically, of Japanese Knotweed plants, and not contain any Japanese Knotweed fragments (rhizomes, leaves, stems etc).

6.5 Laboratory Analysis

Whether samples are taken at source, from stockpiles on site, or from landscaped after placement, they should be forwarded to an analytical laboratory for testing in accordance with one of the Schedules detailed in Table 1.

Imported topsoil should be subject to such testing, wherever it is *not* being sourced from a reputable supplier; soil transfer stations would not usually be classed as a reputable supplier. In addition, some analysis in accordance with BS3882 may occasionally be appropriate.

Table 1 – Test schedule

Source	Definition	Test Schedule	Other requirements\Remarks
Greenfield	No 'source' of contamination present i.e. undeveloped; absence of made ground.	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC & Speciated PAH.* *Asbestos ID*	
"Low-risk" Brownfield	Development site (on former greenfield land) with excess soils, or a "low-risk" brownfield site (eg former school, offices, housing estate etc).	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC, BTEX, speciated TPH & Speciated PAH.* *Asbestos ID*	
Soil Transfer Stations & Other Brownfield	Source is a soil transfer stations. Potential source anticipated i.e. current or historical industrial or commercial use; evidence of bonfires; presence of made ground.	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC, Speciated PAH BTEX, and speciated TPH.* *Asbestos ID*	

***NB** The schedules detailed above have been prepared in accordance with the Secondary Model Procedures. This document states that analysis should be relevant to potential sources and not merely a set list of parameters applied to each site.*

Additional determinands could be scheduled, although if considered necessary, would probably suggest the material is unlikely to be suitable for use as clean cover in gardens.

Chemical assessment (Tier 1) criteria for imported soils are provided in Table 2.

Table 2 - Chemical Assessment Criteria for Imported Soils

Contaminant	Residential End Use Without Home Grown Produce (mg/Kg) in Soil (1% SOM)	Comments/Notes
Inorganic Arsenic	40	
Cadmium	85	
Chromium (III)	910	
Chromium (VI)	6	
Copper	100 (pH<6), 135 (pH6-7), 200 (pH>7)	
Lead	310	
Inorganic Mercury	56	
Nickel	60 (pH<6), 75 (pH6-7), 110 (pH>7)	
Selenium	430	
Zinc	200 (300 if pH >7.0)	
Total PAH	50	
Speciated PAH		
Acenaphthene	3,000	
Acenaphthylene	2900	
Anthracene	31,000	
Benzo(a)anthracene	11	
Benzo(a)pyrene	3.2	
Benzo(b)fluoranthene	3.9	
Benzo(k)fluoranthene	110	
Benzo(g,h,i)perylene	360	
Chrysene	30	
Dibenzo(a,h)anthracene	0.31	
Fluoranthene	1,500	
Fluorene	2,800	
Indeno(1,2,3-cd)pyrene	46	
Naphthalene	2.3	
Phenanthrene	1,300	
Pyrene	3,700	
TPH Speciated		
Aliphatic C5-C6	42	
Aliphatic C6-C8	100	
Aliphatic C8-C10	27	
Aliphatic C10-C12	130	
Aliphatic C12-C16	1,100	
Aliphatic C16-C21	65,000	
Aliphatic C21-C35	65,000	
Aromatic C5-C7	370	
Aromatic C7-C8	860	
Aromatic C8-C10	47	
Aromatic C10-C12	250	
Aromatic C12-C16	1,800	

Contaminant	Residential End Use Without Home Grown Produce (mg/Kg) in Soil (1% SOM)	Comments/Notes
Aromatic C16-C21	1,900	
Aromatic C21-C35	1,900	
Others		
Asbestos	Should not be detected	
Water soluble sulphate	0.5g/l	
Acidity (pH)	Not less than 5	

It should be noted that many of the compounds detected by laboratory analysis for TPH and PAH are naturally occurring in coal, humic acid, bark, leaf litter etc; these are clearly not 'sources' within the legal definition. Calabrian can undertake further risk assessment where PAH screening values are exceeded, *but* inspection of the soils has not identified any petroleum or combustion derived material.

6.6 Verification Report

The purpose of verification documentation is to provide transparent reasoning why the remediation was required, a methodology about how it was to be undertaken and proof that the specified works have been undertaken and to provide confirmation that the site is "suitable for its intended use".

The report will include supporting documentation such as laboratory analysis results, delivery tickets for material, certificates for imported material (or if unavailable, documented evidence of the source of the Greenfield material), trial pit logs etc.

The report should include details of any measures required to maintain the cover system integrity in the future e.g. successive construction phases (management plans) and longer term (restrictive covenants on title deeds).

Photographs will also be included to evidence soil cover placement and quality, these will include (where appropriate):

- Photographs of any stockpiles and quarantine areas;
- depth of soi cover installed including survey staff as a scale;
- quality of the material to be used as cover eg absence of large stones;
- location of geotextile separator and visual warning membranes;
- method of placement and different layers if appropriate;
- inclusion of background features which will aid locating the photograph; and,
- inclusion of site identification boards within the photos which show the date, position taken i.e. corner of plot 3 and the site name.

The presence of good quality photographs is essential to prove beyond doubt that the remediation has been undertaken as specified both by method and position, and that the images have been taken from the specific area stated.

7 HAZARDOUS GAS PROTECTION

Based on the site characterisation discussed above, the proposed foundation solution, and with reference to the gas protection "scoring" system outlined in BS 8485:2015 + A1:2019 for Building Type B[1], Calabrian consider that the following protective measures should be incorporated in all new structures:

Characteristic Situation (Wilson & Card, 1999)	Gas "score" req'd by BS 8485	Protective Measures		
		Floor Slab (BS8485 "score")	Sub-floor ventilation (BS8485 "score")	Membrane Type (BS8485 "score")
2	3.5 (Type B)	'Beam and Block' segmental suspended subfloor – **(0)**. Reinforced ground bearing slab – **(0.5)**. Reinforced, cast in-situ suspended slab (well reinforced with minimal service penetrations & water bars around all slab penetrations & at joints) – **(1.5)**. Basement floor and walls conforming to BS8102:2009, Grade 2 waterproofing – **(2.0)**. Basement floor and walls conforming to BS8102:2009, Grade 3 waterproofing – **(2.5)**.	Layer of low permeability and/or is not terminated in a venting trench (or similar). **(0)** Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building) - **(0.5)**. For smaller commercial units, passive sub-floor ventilation; venting layer could be: i. A min. 200mm clear void **(2.5)**, or ii. A proprietary void former (expanded polystyrene shuttering) providing an equivalent clear void depth of 60mm **(2.5)**, or iii. Min. 300mm thick blanket of 20mm single size gravel, not MOT Type 1 **(0.5)**. Min. ventilation = 2,500 mm²/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 2m centres or honeycombing of any sub-floor sleeper walls.	Gas resistant membrane meeting criteria of Table 7 BS8485:2019 with verification in accordance with CIRIA C735 [N1]. **(2.0)** ***Vented CS2 this will comprise independent visual inspection. ***Unvented this will comprise independent visual inspection and air lance integrity testing.

7.1 MEMBRANE INSTALLATION

Installers

[1] ***Type B building***: *private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.*

Installation of gas protection measures must be executed to National Occupational Standards (VR612 and VR613) and installers should ideally hold a level 2 NVQ diploma in Sub-structure Work Occupations (Construction) – Installation of Gas Membranes.

Installation Process

The Installer will provide a detailed Method Statement to the Verifier detailing the membrane installation process and approximate programme of works. This should include reference to the details of the extent of overlap and method of sealing (these must be in line with manufacturer's instructions).

Membrane Damage Protection

Prior to installation of the floor construction (placement of insulation, concrete slab etc) is it essential that the integrity of the installed is not compromised.

For the ventilation system this would include blocking of the system by debris, detachment of telescopic vents or vent pipes and contamination of vent clean materials with fine particles.

The membrane is particularly susceptible to damage from the following (not an exhaustive list):

- Degradation of membrane due to prolonged exposure to UV light;
- damage to a gas membrane from a mesh reinforcement tie wire;
- prevent trafficking of the membrane by vehicle, plant and where possible the labour force;
- debris above or below membrane causing damage (consider use of sand blinding layer below and careful cleaning above and below). This could include debris created by follow-on trades, installation of scaffolding etc;
- damage where membrane becomes stressed (consider use of bitumen reinforced strips on corners or other critical junctions).

The use of protective boards/geotextile or insulation between the membrane and reinforcement should be considered immediately post placement and inspection to prevent damage. Particular attention should also be given to pipe penetrations, as often when insulation is laid, large gaps are left due to the time it takes to cut around pipes, which may expose the gas membrane to damage.

Such measures should be communicated to all site personnel during the site induction and should be stated in the gas membrane installer's method statement.

7.2 VERIFICATION

Verifier

Formal qualifications/experience/training of the person carrying out the verification. Full details of what the verification process will comprise and at what stage verification will be carried out.

Visual Inspection – Venting System

Venting measures, both passive and active controls, should be subject to a visual verification inspection to establish that installation is adequate and complies with the design and the

specification. If a granular layer is used, the material should be tested to ensure the grading will enable it to function as a venting layer.

The inspection should cover floor areas, paying particular attention to walls and any other locations where venting systems might be positioned. Any discrepancies with the design drawings should be highlighted. These may include missing air vents and air bricks, inadequate grading of gravel vent layers, and incorrect types of geocomposite or polystyrene vent layers. The size of connecting pipes, venting through sleeper walls, and voids and void formers should also be checked. Particular attention should be paid to venting through sleeper walls, the location of vents in relation to final ground levels and the potential for debris to block air bricks.

Visual Inspection – Gas Membrane

The gas membrane installation should be subject to a visual verification inspection to establish the adequacy of the ground preparation and subsequently possible damage to the installed gas membrane.

inspections should cover both the ground prepared for the gas membrane and the gas membrane itself over the whole floor area, paying particular attention to laps, edges and the sealing of service entries and penetrations such as vent pipes and pile caps.

Any discrepancies with the membrane installation method recommended by the gas membrane supplier should be highlighted. These may include small or large holes and rips, tears and punctures, absence of tape (double sided or single sided tape) on the lapped areas, loose or unstuck tape, inadequate corner details, and unbounded seams such as loose edges and 'fish mouths' in the gas membrane. Tapes used to join gas membranes should be inspected to make sure they are compatible with the gas membrane being joined and are as specified by the gas membrane supplier or specifier. If a gas membrane has a third-party accreditation, eg BBA certificate, the installation requirements should be checked against it, including the need for protection boards or similar. Where welded joints are used, the verifier should ensure they are correctly tested.

Air Lance Testing - Joints

Air lance testing identifies unbonded areas of seam by directing a high-pressure jet of air at the seam. The air is at a minimum pressure of 345kPa (3.45 Bar) via a 4.8 mm nozzle and it is located no more than 50 mm from the seam being tested.

Seams will be checked to ensure a good seal.

Non-Conformance and Defect Rectification

Any discrepancies from the ventilation system design as highlighted by the points in Section 6.2 above should be corrected and confirmed by visual inspection before further construction continues.

Repairs to the membrane as required by the points in Section 6.3 above should be instructed and observed on the same day as the site visit or inspected at a later date.

Verification, Checklist and Watchpoints

Verification should be undertaken in accordance with CIRIA C375 using the 'Visual Inspection Checklist' provided in Appendix C.

Photographs showing the ventilation system (clear void, sleeper walls, vent pipe etc) and installed membrane including examples of specific key installations such as lapped areas,

DPC connections, corner details and service/stanchion/column penetrations will be included in the Verification Report.

Verification Report

On completion of gas protection measures installation a Gas Protection Measures Verification Report will be issued confirming that the gas protection measures were installed as agreed and that the membrane was free from tears and punctures and was lapped and sealed as agreed at joins and around services and sub floor voids were clear and free from debris.

The verification report will include copies of the signed 'Visual Inspection of Gas Protection Measures' check list(s).

DRAWINGS	
7293/1	Site Location Plan
7293/2	Proposed Site Layout
7293/7	Geoenvironmental Summary

calabrian



Reproduced from OS Explorer map 1:25,000 scale by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. a Crown copyright. All rights reserved. Licence number 100056352.

client	MCLAREN PROPERTY LIMITED
project	UPPER BROOK STREET, MANCHESTER, M13 9QD
drawing title	SITE LOCATION
drawing number	7293/1
revision	–
drawing status	Final
scale	1:25,000 @ A4
date	18/04/2024
drawn by	RJH
checked by	–

calabrian
GEOTECHNICAL | GEOENVIRONMENTAL
info@calabrian.co.uk

notes

Proposed layout reproduced from Reform Landscape Architecture drawing referenced 0967-RFM-XX-00-DR-L-0001, Rev P02.

N
W E
S

rev. description

MCLAREN PROPERTY LIMITED

client

UPPER BROOK STREET,
MANCHESTER, M13 9QD

project

PROPOSED LAYOUT

drawing title

drawing number 7293/2

revision –

drawing status Final

scale 1:400 @A3

date 18/04/2024

drawn by RJH

checked by –

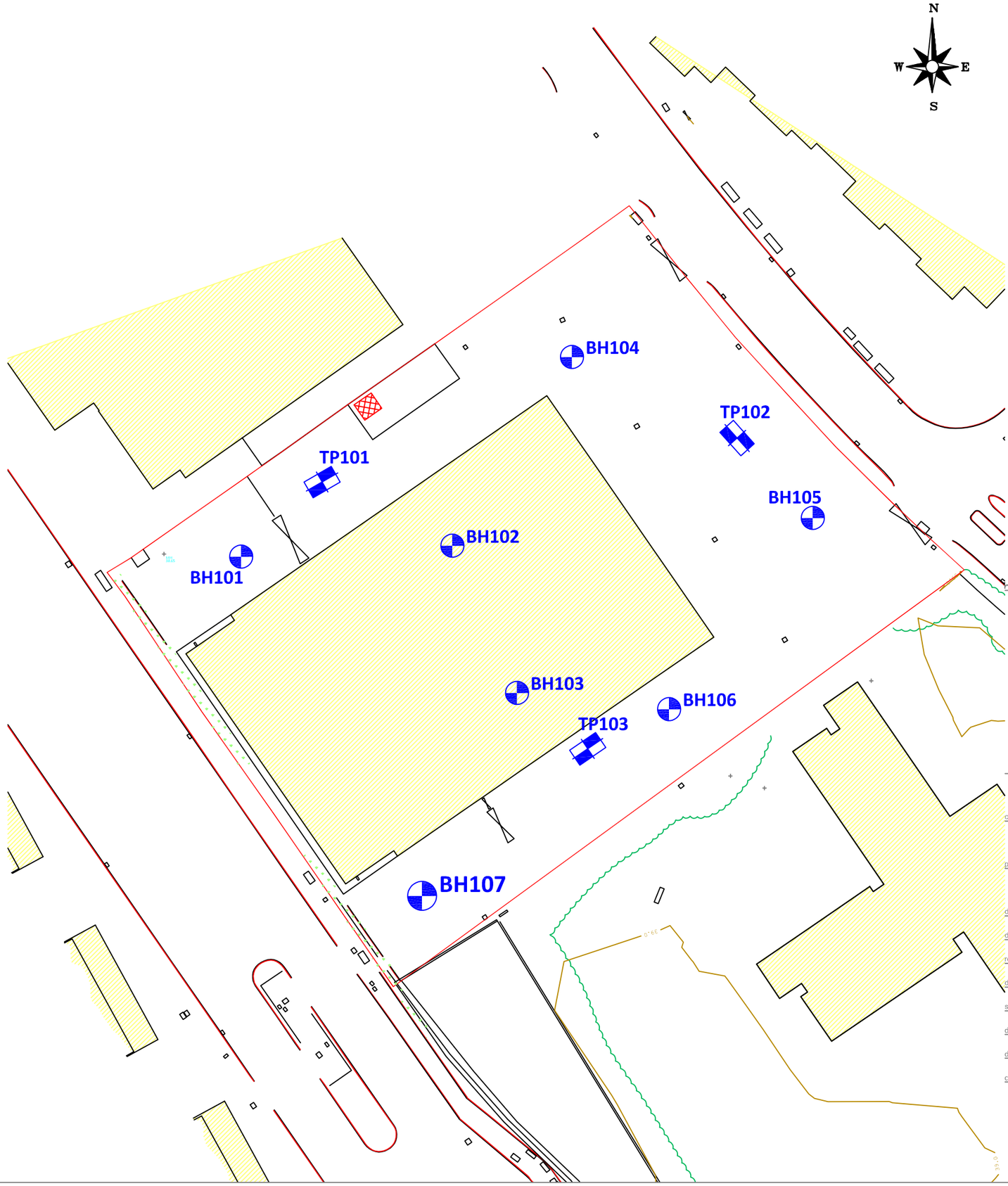
calabrian
GEOTECHNICAL | GEOENVIRONMENTAL
info@calabrian.co.uk

GEOENVIRONMENTAL SUMMARY

Site Description	The site comprises a former car dealership and servicing centre. A single storey building lies in the central area of the site. External areas are all tarmac surfaced. In the north lies a small lean-too building formerly used for car cleaning and valeting. To the west of this is a small structure that houses waste materials and what appears to be a small above ground waste oil tank.
History	The site was developed with likely residential properties from at least the mid 19th Century until the mid 20th Century when a 'works' building occupied the site. The exiting building was likely constructed in the late 1980's.
Made Ground	Made ground was found across the site and was typically around 1.0m in thickness. A veneer of asphalt was found across all of the external site areas with concrete of around 200mm inside the building; this was typically underlain by a sandstone sub-base of approximately 300mm thickness. The made ground comprises a mixture of cohesive and granular soils with occasional thin horizons of ashy soil.
Natural Ground	Typically comprised medium dense sand becoming sand and sandstone gravel to approximately 3m depth where sandstone was encountered. Thin horizons of sandy clay were found immediately beneath the made ground at some locations.
Contamination & Remediation	Three samples yielded concentrations of lead above its Tier 1 criteria, two additional samples yielded elevated benzo(a)pyrene. Where residual made ground remains beneath landscaped areas (i.e. not beneath buildings or hardstanding) a 600mm thick surface cover of "clean" soil is recommended.
Hazardous Gas	There are no significant sources of hazardous gas generation within influencing distance of the site; however, on-site made ground does present a very low risk. initial gas monitoring has not yielded any elevated concentrations or flows of hazardous gas.
Mining & Quarrying	The site is located within a Coal Mining Reporting Area; however, there are no shallow coal seams beneath the site that could effect its stability. There are no quarries within 250m.
Foundations	Made ground is not generally considered a suitable founding material and foundations should be taken through it, into underlying natural in-situ strata of adequate bearing capacity. Weathered Chester Formation sandstone should provide sufficient bearing capacity to enable the adoption of deep spread foundations or short piles dependent upon proposed loads.
Groundwater & Excavations	To date monitoring has not identified any shallow groundwater although the use of water as a rotary drilling flush medium will have masked groundwater. The stability of excavations within both made and natural ground was generally good.
Flooding & Drainage	The EA indicate that the site is located within an indicative floodplain and is at risk from surface water flooding. Infiltration testing suggests that soakaways may provide a suitable means of surface water disposal.

Significant developer abnormals relating to geoenvironmental issues at the site are:
- Soil cover in any landscaped areas.
- Short piles.

This brief summary should not be assumed to represent a complete account of all the potential geoenvironmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.



notes

Proposed layout reproduced from Reform Landscape Architecture drawing referenced 0967-RFM-XX-00-DR-L-0001, Rev P02.

CALABRIAN 2024 INVESTIGATION

TRIAL PIT LOCATION

BOREHOLE LOCATION

APPROXIMATE SITE BOUNDARY

rev. description

client	MCLAREN PROPERTY LIMITED
project	UPPER BROOK STREET, MANCHESTER, M13 9QD
drawing title	GEOENVIRONMENTAL SUMMARY
drawing number	7293/7
revision	–
drawing status	Final
scale	1:500 @A3
date	24/06/2024
drawn by	RJH
checked by	–

calabrian
GEOTECHNICAL | GEOENVIRONMENTAL
info@calabrian.co.uk

APPENDIX A PROTOCOL FOR IMPORTATION & USE OF SOIL COVER

calabrian

IMPORTATION & USE OF SOIL COVER

Introduction.

Isolation of made ground in landscaped areas beneath a cover of "clean" subsoil, and topsoil is often recommended as a remediation solution; most notably when the made ground contains inorganic (and non-volatile organic) contaminants at concentrations above guidance threshold values. A cover solution is not appropriate for volatile or semi-volatile organic contaminants (fuels, solvents etc); removal or treatment will usually be required.

The thickness of cover is dependant on the nature and degree of contamination (and sometimes the Local Authority whose area the site lies within), but typically between 600mm and 1,000mm is required. However, if the made ground is essentially "clean", but contains materials generally considered undesirable as a near-surface material in garden areas (colliery spoil, construction\demolition rubble etc) then a 300mm thick cover should be adequate. If the made ground is essentially "clean" and comprises reworked natural soil, the only cover likely to be required is topsoil.

The "clean" soil cover blocks potential linkages between the contaminated made ground and future residents. Soil cover is not required beneath hardstand or structures.

Soil cover is usually placed many weeks after completion of the preparatory\remediation works, and issue of the associated Verification Report, typically at a relatively late stage in the construction programme.

Prior to placement of soil cover, the appointed remediation contractor and\or groundworker should ensure that ground levels are low enough to accommodate the required cover thickness, taking account of any boundary issues, and without compromising the DPC.

Ideally soil quality should initially be determined by sampling of the source at least 7 working days before importation to the development site; this may be achieved by supplier sampling and analysis.

Clearly, if soil cover is imported and placed before confirmation of its suitability, Calabrian cannot guarantee that our validation work will yield the desired results. In which case, it may be necessary to excavate and export the placed soil cover and\or import further "clean" soil.

Where samples have been tested at source, and on receipt of laboratory results, Calabrian will issue confirmation of soil suitability to the Client, who in turn will instruct his Contractor to commence importation. It will probably be necessary to stockpile soil cover materials prior to placement in garden\landscaped areas. Calabrian should inspect the stockpiled material prior to placement, to confirm that it is the same material as previously tested, and it has not been cross-contaminated with miscellaneous arisings generated during the construction works.

Soil thickness and final quality can only be checked after placement; this should be done before turfing, fencing etc, but ideally after scaffolding has been dismantled.

Sampling Frequency (to check Soil Quality): The number of samples taken will be dependant on the nature of the source, and the quantity of material to be imported as detailed below:

End-Use	Greenfield Soils	Remediated Soils	Brownfield Soils	Unknown Soil Source
Residential Gardens	1:200m^3	1:100m^3	1:50m^3	1:50m^3
Soft Landscaping	1:200m^3	1:150m^3	1:150m^3	1:150m^3
Other	1:200m^3	1:200m^3	1:200m^3	1:200m^3

Calabrian Limited
9 Millwood | Ingleton | LA6 3HY | Tel: 07957 335307
email: info@calabrian.co.uk

IMPORTATION & USE OF SOIL COVER

It should be noted that the thickness of placed topsoil is only 100mm to 150mm (cf subsoil thicknesses of around 500mm). Consequently, where samples are collected after placement (although testing at source is always preferable) testing one topsoil sample per 50m^3. This is not unreasonable anyway, since from a potential contaminant perspective, topsoil, being present at surface, is more important than underlying subsoil.

Occasionally a developer just places 600mm of topsoil (i.e. no subsoil is used). In such circumstances, assuming the topsoil is from a single source, Calabrian would test a minimum of 6 samples.

A less frequent sampling rate may be appropriate for soils from a greenfield source or where large volumes (say > 5,000m^3) of soil are imported from a single, relatively homogenous source.

Inspection Frequency (to check Soil Thickness): The number of inspection pits to check cover thickness and collect samples, should be 1 pit per 50m^2 plan area and at least 1 pit per landscaped area if the landscaping is in multiple parcels; a plan of proposed inspection pits may be provided within a site specific Remediation Strategy where necessary.

Soil Material Suitability: Inspection pits should be excavated through the entire thickness of any proposed in-situ source material, or cover material (if inspection is post-placement). Stockpiles should be assessed from both the surface and by digging into the "core", to ensure the material is reasonably homogenous.

The soil material should:

- Be clean and free of foreign debris, building waste materials, glass sharps, or contaminants;
- topsoil should not have a gravel content of greater than 30% by dry weight and should generally have a maximum stone size of 50mm in any one direction;
- subsoil should generally have a maximum stone size of 150mm in any one direction; and,
- not have been sourced from an area within 7m laterally, or 3m vertically, of Japanese Knotweed plants, and not contain any Japanese Knotweed fragments (rhizomes, leaves, stems etc).

Laboratory Analysis: Whether samples are taken at source, from stockpiles on site, or from landscaped after placement, they should be forwarded to an analytical laboratory for testing in accordance with one of the Schedules detailed in Table 1.

Imported topsoil should be subject to such testing, wherever it is *not* being sourced from a reputable supplier; soil transfer stations would not usually be classed as a reputable supplier. In addition, some analysis in accordance with BS3882 may occasionally be appropriate.

Calabrian Limited
9 Millwood | Ingleton | LA6 3HY | Tel: 07957 335307
email: info@calabrian.co.uk

Table 1 – Test schedule

Source	Definition	Test Schedule	Other requirements\Remarks
Greenfield	No 'source' of contamination present i.e. undeveloped; absence of made ground.	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC & Speciated PAH.* *Asbestos ID*	
"Low-risk" Brownfield	Development site (on former greenfield land) with excess soils, or a "low-risk" brownfield site (eg former school, offices, housing estate etc).	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC, BTEX, speciated TPH & Speciated PAH.* *Asbestos ID*	
Soil Transfer Stations & Other Brownfield	Source is a soil transfer stations. Potential source anticipated i.e. current or historical industrial or commercial use; evidence of bonfires; presence of made ground.	*pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron.* *TOC, Speciated PAH BTEX, and speciated TPH.* *Asbestos ID*	

NB The schedules detailed above have been prepared in accordance with the Secondary Model Procedures. This document states that analysis should be relevant to potential sources and not merely a set list of parameters applied to each site.

Additional determinands could be scheduled, although if considered necessary, would probably suggest the material is unlikely to be suitable for use as clean cover in gardens.

Chemical assessment (Tier 1) criteria for imported soils are provided in Table 2.

Table 2 - Chemical Assessment Criteria for Imported Soils

Contaminant	Residential End Use Without Home Grown Produce (mg/Kg) in Soil (1% SOM)	Comments/Notes
Inorganic Arsenic	40	
Cadmium	85	
Chromium (III)	910	
Chromium (VI)	6	
Copper	100 (pH<6), 135 (pH6-7), 200 (pH>7)	
Lead	310	
Inorganic Mercury	56	
Nickel	60 (pH<6), 75 (pH6-7), 110 (pH>7)	
Selenium	430	
Zinc	200 (300 if pH >7.0)	
Total PAH	50	
Speciated PAH		
Acenaphthene	3,000	
Acenaphthylene	2900	
Anthracene	31,000	
Benzo(a)anthracene	11	
Benzo(a)pyrene	3.2	
Benzo(b)fluoranthene	3.9	
Benzo(k)fluoranthene	110	

Contaminant	Residential End Use Without Home Grown Produce (mg/Kg) in Soil (1% SOM)	Comments/Notes
Benzo(g,h,i)perylene	360	
Chrysene	30	
Dibenzo(a,h)anthracene	0.31	
Fluoranthene	1,500	
Fluorene	2,800	
Indeno(1,2,3-cd)pyrene	46	
Naphthalene	2.3	
Phenanthrene	1,300	
Pyrene	3,700	
TPH Speciated		
Aliphatic C5-C6	42	
Aliphatic C6-C8	100	
Aliphatic C8-C10	27	
Aliphatic C10-C12	130	
Aliphatic C12-C16	1,100	
Aliphatic C16-C21	65,000	
Aliphatic C21-C35	65,000	
Aromatic C5-C7	370	
Aromatic C7-C8	860	
Aromatic C8-C10	47	
Aromatic C10-C12	250	
Aromatic C12-C16	1,800	
Aromatic C16-C21	1,900	
Aromatic C21-C35	1,900	
Others		
Asbestos	Should not be detected	
Water soluble sulphate	0.5g/l	
Acidity (pH)	Not less than 5	

It should be noted that many of the compounds detected by laboratory analysis for TPH and PAH are naturally occurring in coal, humic acid, bark, leaf litter etc; these are clearly not 'sources' within the legal definition. Calabrian can undertake further risk assessment where PAH screening values are exceeded, *but* inspection of the soils has not identified any petroleum or combustion derived material.

Verification Reports

The purpose of verification documentation is to provide transparent reasoning why the remediation was required, a methodology about how it was to be undertaken and proof that the specified works have been undertaken and to provide confirmation that the site is "suitable for its intended use".

The report will include supporting documentation such as laboratory analysis results, delivery tickets for material, certificates for imported material (or if unavailable, documented evidence of the source of the Greenfield material), trial pit logs etc.

IMPORTATION & USE OF SOIL COVER

The report should include details of any measures required to maintain the cover system integrity in the future e.g. successive construction phases (management plans) and longer term (restrictive covenants on title deeds).

Photographs will also be included to evidence soil cover placement and quality, these will include (where appropriate):

- Photographs of any stockpiles and quarantine areas;
- depth of soi cover installed including survey staff as a scale;
- quality of the material to be used as cover eg absence of large stones;
- location of geotextile separator and visual warning membranes;
- method of placement and different layers if appropriate;
- inclusion of background features which will aid locating the photograph; and,
- inclusion of site identification boards within the photos which show the date, position taken i.e. corner of plot 3 and the site name.

The presence of good quality photographs is essential to prove beyond doubt that the remediation has been undertaken as specified both by method and position, and that the images have been taken from the specific area stated.

APPENDIX B TIER 1 SCREENING VALUES

calabrian

Soil Screening Values used by Calabrian

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration- CL:AIRE, 2020
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software (Version 1.05) Handbook Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

The approach set out in these documents represents current scientific knowledge and thinking; and includes the Contaminated Land Exposure Model (CLEAv1.06). The Environment Agency are in the process of using this updated approach to regenerate a selection of Soil Guideline Values (SGVs).

CLEA SGVs were derived for standard land use scenarios predominantly in the context of Part IIA, using a conceptual site model (CSM) defined in SR3. Calabrian have incorporated amendments to the CSM used to derive SGVs that more accurately reflect redevelopment within the planning regime; consequently, Calabrian have not necessarily adopted any published SGV as a screening value.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). Calabrian consider it reasonable to adopt the CLEA default TOC for made ground. However, where the average TOC value for a particular soil type is significantly lower than the 3.5%, Calabrian adopt refined Screening Values.

In March 2014 DEFRA published Category 4 Screening Levels (C4SLs) for six substances (arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene) for four generic land-uses comprising residential, commercial, allotments and public open space.

The methodology for deriving both the previous Soil Guideline Values and the new Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of Category 4 Screening Levels has been achieved by modifying the toxicological and\or exposure parameters used within CLEA (while maintaining current exposure parameters).

The Part 2A Statutory Guidance was developed on the basis that Category 4 Screening Levels could be used under the planning regime. However, policy responsibility for the National Planning Policy Framework falls to the Department for Communities and Local Government. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Calabrian consider C4SLs to be suitable for use as Tier 1 Screening Values. Calabrian have discussed this matter with both NHBC and YAHPAC (collection of Yorkshire & Humberside local authorities) and received confirmation that they are satisfied with this approach.

In general Calabrian have adopted the use of the LQM/CIEH Suitable 4 Use Levels (S4ULs) as Tier 1 Screening Criteria. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3373. All rights reversed.

Calabrian have adopted Tier 1 Screening Criteria for five different CSMs (Scenarios); these are:

- A - Residential with homegrown produce.
- B - Residential without homegrown produce.
- C – Residential apartments with landscaping/public open space (POS).
- D - Commercial/industrial with landscaping.
- E - Dedicated sports grounds or parkland/ public open space (POS).

The **exposure** pathways considered for each scenario are detailed in the Table below.

Scenario	Land use	Pathways	Justification
A	Residential with homegrown produce, but no cover (or only up to 300mm)	• Direct ingestion of soil • Dermal contact • Consumption of vegetables and soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant
B	Residential apartments with landscaped areas and minimum 300mm cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.
C	Grassed area or play park in close proximity to housing. Assumes minimum 300mm cover (growing medium).	• Direct ingestion of soil • Dermal contact • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumes an area where some children play regularly and others less.
D	Commercial/ industrial with landscaped areas no cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Dedicated sports grounds. Assumes minimum 300mm cover (growing medium).	• Direct ingestion of soil • Dermal contact • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumes an where exposure only occurs to players and grounds staff

The Soil Screening Values referred to in this document are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part IIA of the Environment Protection Act 1990;
- end uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- controlled waters.

With respect to **inorganic** determinands, Calabrian derived Tier 1 values for the four Scenarios A to E are presented below:

Inorganic Contaminant	Source	C4SL*	LQM/ CIEH S4UL	Tier 1 Assessment Criteria (mg/kg) for Scenarios A to E					Comments/Notes
				A	B	C	D	E	
As	CLEA	37	37	37	40	79	640	170	LQM/CIEH S4UL adopted.
Cd	CLEA	26	11	11	85	120	190	532	LQM/CIEH S4UL adopted.
Cr	CLEA		910	910	910	1,500	8,600	33,000	LQM/CIEH S4UL adopted. Assumes Cr is CrIII.
Pb	CLEA	200		200	310	630	2,330	1,300	C4SLs adopted.
Ni	CLEA		130	130	180	230	980	3,400	LQM/CIEH S4UL. Assessment of health risk only.
				60 (pH<6), 75 (pH6-7), 110 (pH>7)					*Phytotoxicity.*
Se	CLEA		250	250	430	1,100	12,000	1,800	LQM/CIEH S4UL adopted.
Hg	CLEA		40	40	56	120	11,000	240	LQM/CIEH S4UL. Assumes in an inorganic compound.
B	Drinking		290	290	11,000	21,000	240,000	46,000	LQM/CIEH S4UL adopted.
Cu	EPA		2,400	2,400	7100	12,000	68,000	44,000	LQM/CIEH S4UL adopted. Assessment of health risk only.
				100 (pH<6), 135 (pH6-7), 200 (pH>7)					*Phytotoxicity.*
Zn	DoE		3,700	3,700	40,000	81,000	73,000	170,000	LQM/CIEH S4UL adopted. Assessment of health risk only.
				200 (300 if pH >7.0)					Phytotoxicity.
Cyanide	CLEA			527	530		14,000		SSV

* *For a residential end use*

With respect to **organic** determinands, Calabrian derived Tier 1 values (assuming 6% SOM) for the four Scenarios A to E are presented below:

Organic Contaminant (all sourced via CLEA)	Tier 1 Assessment Criteria (mg/kg) for Scenarios A to E					Comments/Notes
	A	B	C	D	E	
Benzene	0.37	1.4	73	90	110	LQM/CIEH S4UL adopted.
Toluene	660	3900	56,000	180,000^{VAP} (4,360)	100,000^{vap} (4,360)	LQM/CIEH S4UL adopted.
Ethyl Benzene	260	440	25,000	27,000^{VAP} (2,840)	27,000^{VAP} (2,840)	LQM/CIEH S4UL adopted.
Xylenes	310	430	43,000	30,000^{sol} (3,170)	31,000^{sol} (3,170)	LQM/CIEH S4UL adopted (assumes worst-case p-xylene).
Phenol	412	557	557	38,700		
PCBs	1.7	1.8	1.8	1.8		Based on toxicity of EC7.
Benzo(a)pyrene	3.0	3.2	5.7	36	13	LQM/CIEH S4UL adopted.
Naphthalene	13	13	4,900	1,100	3,000	LQM/CIEH S4UL adopted.
Gasoline Range Organics#	42	42	1,000	1,000	1,000	See **3-step** assessment of TPH below.
Diesel Range Organics#	130	130	5,000	5,000	1,000	
Lubricating Range Org#	1,000	1,000	5,000	5,000	1,000	

* *For a residential end use*

LQM/CIEH S4UL adopted, 6% SOM

Note: **PAH** cannot be assessed as a single "total" value, as each individual PAH compound has different toxicity and mobility in the environment. Speciated analysis is required to determine the concentrations of the various compounds, most notably the key PAHs: Benzo(a)Pyrene (considered the most toxic of the PAHs); and Naphthalene (the most mobile and volatile of the PAHs).

Similarly, **TPH** cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "*The UK approach for evaluating human health risks from petroleum hydrocarbons in soils*". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into thirteen representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the thirteen bandings. The significance of speciated TPH results can be assessed by following the 3 steps outlined in the below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, Naphthalene, Benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or DQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or DQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or DQRA required
	No	TPH compounds pose no significant risk

Step 1 *- Assessing indicator compounds*

TPH fraction Indicator compound	End use specific screening value (mg/kg)			
	A: Residential with produce	B: Residential without produce	C: Residential with POS	D: Commercial\ Industrial
Benzene	0.37	1.4	1.4	90
Toluene	660	3900	3900	180,000^{VAP} (4,360)
Ethyl Benzene	260	440	440	27,000^{VAP} (2,840)
Xylenes	310	430	430	30,000^{sol} (3,170)
Naphthalene	13	13	13	1,100

Step 2 *- Assessing individual TPH fractions*

TPH fraction		End use specific screening value S4UL (mg/kg) assuming 1% SOM				
		A	B	C	D	E
Aliphatic 5-6	GRO	42	42	5,000^	5,000^	5,000^
Aliphatic 6-8	GRO	100	100			
Aliphatic 8-10	GRO	27	27			
Aliphatic 10-12	DRO	130	130			
Aliphatic 12-16	DRO	1,100	1,100			
Aliphatic 16-21	DRO	5,000^	5,000^			
Aliphatic 21-35	LRO					
Aromatic 5-7	GRO	70	370			
Aromatic 7-8	GRO	130	860	1,000^	1,000^	1,000^
Aromatic 8-10	GRO	34	47	5,000^	5,000^	5,000^
Aromatic 10-12	DRO	74	250			
Aromatic 12-16	DRO	140	1,800			
Aromatic 16-21	DRO	260	1,900	3,800		
Aromatic 21-35	LRO	1,100	1,900			

^ Calculated Screening Value close to soil saturation limit, screening value selected by Calabrian considering visual and olfactory impacts.

S4UL LQM/CIEH S4UL adopted, 1% SOM

Step 3 *- Assessing Cumulative Effects*

$$HI = \sum_{F_i=1}^{16} HQ\ F_i = \frac{Measured\ concentration\ F_i\ (mg\,kg^{-1})}{SGV\ F_i\ (mg\,kg^{-1})}$$

where HI = Hazard Index
HQ = Hazard Quotient
F_i = Fraction $_i$
SGV = Soil Guideline Value

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that:

"In general … it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn".

Tier 1 **groundwater** risk assessments are undertaken by comparing leachate or groundwater concentrations with the appropriate water quality standard. Tier 1 Screening Values have been discussed with the Environment Agency, and typically those in **bold** below are adopted.

Analyte	Source of Tier 1 Screening Value (µg/l)			
	Surface Water (Abstraction for Drinking) 1996	Water Supply Regulations. 2000	Water Framework Directive	Environment Agency Advice
Arsenic	50	10	**50**	
Selenium	10	**10**		
Cadmium	5	5	**1.5**	
Chromium	50	50	**32**	
Copper	50	2,000	**28**	
Lead	50	10	**7.2**	
Nickel		20	**20**	
Zinc	3,000		**125**	
Boron		**1,000**		
Mercury	1	1	**0.05**	
Polyromantic Hydrocarbons		0.01~	**0.002#**	
Petroleum Hydrocarbons				10
1,1,1-Trichloroethane			100	
1,1 Dichloroethane				100
1,2-Dichloroethane		3	10	
1,1-Dichloroethene				100
Benzene		1	10	
Ethylbenzene				10
Tetrachloroethene		10	10	
Toluene			50	
Trichloroethene		10	10	
Vinyl Chloride		0.5		
Trichloromethane			2.5	
Xylenes			30	
Chloroethane				**100**

~ sum of benzo(g,h,i)perylene + indeno(1,2,3-cd)pyrene

sum of Benzo(b)fluoranthene + Benzo(k)fluoranthene + Benzo(g,h,i)perylene + Indeno(1,2,3-cd)pyrene

Possible Action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in "*Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration- CL:AIRE, 2020*" in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. The CL:AIRE\CIEH document still refers to CLR 7, which suggests averaging area should reflect receptor behaviour and therefore might be a single garden, or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Calabrian consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Calabrian gather and analyse sample results by fill type, and\or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass; ie contamination would normally be more pervasive and significant in granular soils than cohesive soils.

calabrian

APPENDIX C Visual Inspection of Gas Protection Measures

calabrian

VISUAL INSPECTION OF GAS PROTECTION MEASURES

Site name:	Gas characteristic situation:
Job number:	Type of development and building/block checked: (residential/
Date:	Building description:
Visit by:	Foundation type: (suspended floor/raft/other)
Weather at time of inspection:	Gas protection type: passive/active

No.	Item	Comments (see notes)
1 Gas membrane		
1.1	Condition of sub-grade and underside of gas	
1.2	Gas membrane type	
1.3	Gas membrane condition	
1.4	Joining tape product	
1.5	Lapping design	
1.6	Laps, welds and joints seals	
1.7	Service entries seals	
2 Passive venting		
2.1	Sub-floor void	
2.2	External wall airbricks	
2.3	Internal sleeper walls	
2.4	External vent trenches/ducts	
3 Active venting		
3.1	System details	
Additional notes:		

calabrian

Notes: inspection checklist

1.1	Underside of gas membrane	Check that the sub grade does not contain rough/uneven surfaces, is appropriately clean and that there are no hard/sharp objects. That protective sand blinding or geotextile (if specified) is present and meets the design criteria.
1.2	Gas membrane type	Manufacturer and product specification, gauge, colour, brand/name, material batch/roll numbers, storage arrangements (protected from dirt/damage?)
1.3	Gas membrane condition	Open punctures, tears, rips, stretching? Excessive footprints/evidence of traffic? Presence of debris? Repairs? Signs of weakness such as raised or sunken indentations? Protection plan in place to restrict access to lain gas membrane?
1.4	Joining tape product	Product type, brand, thickness, material, width, colour? Use of double-sided tape?
1.5	Lapping design	Joints lapped and sealed in accordance with manufacturer's requirements/ specification? Minimum overlap insured? Sections taped twice?
1.6	Laps and joints sealed	Welds complete? Appropriate joining/double sided tape used?
1.7	Service entries sealed	Top hats seal arrangements fixed around service entries? Use of Jubilee clips?
2.1	Sub-floor void	Is a check possible? Void former? Gravel (type/specification)? Height of void space? Is it clear?
2.2	External wall airbricks	Numbers, size, positions as design drawing?
2.3	Internal sleeper walls	Ventilation holes (honeycomb brickwork/pipe crossings?) – size, spacing, location in accordance with design?
2.4	External vent trenches/ducts	Located and constructed in accordance with design drawings? If open-topped gravel – gravel type/presence of fines? If pipe or other vent, check position and construction for functionality and absence of blockages. Ability of void former to withstand bearing of the superstructure?
3.1	Active venting	Type of air supply: mechanical, natural, combined? Location/condition/number of fans and vents? Location and size of inlets? Provision of air-cleaning devices and air heaters? Supply and exhaust ductwork? Alarm provision/installation? Gas monitoring system in under-floor void?

Photographs

No.	**Description**

The gas protection measures inspected:	a Are acceptable and comply with the specification
	b Are acceptable but attention is drawn to issues related to item no. xxx
	c Are not acceptable due to the issues related to item no. xxx

Name: **Signature:** **Date:**

calabrian