

# Remediation Implementation Plan

Glasspool Farm, Part Lane, Riseley

Wroxton Group Holdings Limited

6 November 2024

## REMEDIATION IMPLEMENTATION PLAN

### GLASSPOOL FARM, PART LANE, RISELEY

### FOR

### WROXTON GROUP HOLDINGS LTD



46383-ECE-XX-XX-RP-C-004

6 November 2024

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## REMEDIATION IMPLEMENTATION PLAN

**GLASSPOOL FARM,  
PART LANE, RISELEY**

**FOR**

**WROXTON GROUP HOLDINGS LTD**

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## 1.0 INTRODUCTION

This Implementation Plan has been produced by Eastwood Consulting Engineers Limited, on behalf of Wroxton Group Holdings Ltd, for the site at Glasspool Farm, Part Lane, Riseley. The purpose of this document is to detail the procedure for the implementation and subsequent verification of remedial works to deal with contamination found within the ground at the site.

This is to ensure that upon completion of the proposed residential development, the site can be shown to be suitable for its intended use and that it will not pose unacceptable risks to future receptors. This therefore covers the protective measures to be installed during the construction phases of the redevelopment for a residential end use.

This document is a working publication and may need to be updated, in agreement with the relevant regulatory bodies, at any stage during development dependent on what is encountered. This document is also subject to the approval of the regulatory parties; the Local Authority and your warranty provider. This version constitutes Issue 1. Please contact Eastwood Consulting Engineers if you are unsure of the current issue.

## 2.0 RATIONALE FOR REMEDIAL WORKS

Eastwood Consulting Engineers (ECE) produced a 'Geotechnical and Geo-Environmental Site Investigation Report' reference 46383/002, dated 4 July 2022. This comprised:

- Ten trial pits to depths of up to 3 m bgl;
- Three infiltration tests;
- Six window sample holes to between 3 and 4 m bgl, all installed with a gas and groundwater monitoring wells; and
- A programme of gas and groundwater monitoring

Subsequent to the programme of gas and groundwater monitoring ECE produced a 'Gas Monitoring Summary' 46383/0003, dated 21 February 2024, specific to a small part of the site.

These reports are therefore to be read in conjunction with this Implementation Plan.

## The Site

The site covers an area of around 1.7 hectares located north of Part Lane, approximately 0.7 km east of Riseley in Berkshire. It is rectangular on plan and is centred on grid reference 472890, 163490.

During the site investigation in October 2021, the site was noted to comprise a disused farmhouse and yard with a number of derelict barns. Some of these were observed to have potential asbestos roofing. The majority of the external areas in the western half of the site were surfaced with concrete which appeared to be in a poor condition. Vegetation was present in the east and was recorded as dense towards the north east.

The site is relatively level at between around 49 and 52 m AOD.

This report is based on the assumption that the proposed development is limited to conversion of two of the existing barns to form 10no. residential dwellings with associated private gardens. The proposed layout is shown on the Proposed Block Plan, drawing ref GP/07/24 rev F, a copy of which is included in the Appendix. No development is currently proposed across the remainder of the site, should this not be the case, further advice may be needed.

## Ground Conditions

Made ground was encountered in four of the ten trial pits and two of the window sample holes to depths of between 0.6 and 2.0 m, with the deeper depths being encountered in the east and south east areas of the site. Topsoil, described as brown silty sand, was present beneath a cover of grass and scrub vegetation, and encountered in six of the ten trial pits to depths of between 0.3 and 0.9 m.

Underlying the topsoil or made ground, natural ground of the superficial River Terrace Deposits (RTD) were encountered on the western half of the site. This generally comprised sandy flint gravel or gravelly sand between 2 m and >4 m bgl. Underlying this in two of the window samples was a slightly sandy clay at around 2.0 to 2.8 m bgl, which could be associated with the London Clay Formation.

Natural granular soils were also noted in the north east to around 1.8 m overlying clay. In holes to the centre-east and south, the London Clay Formation was recorded below the made ground which comprised slightly sandy, silty clay.

ECE completed a groundwater monitoring program which demonstrated that groundwater was encountered in all of the monitoring wells and varied in depth between 0.47 and 2.26 m bgl due to seasonal changes.

## **Chemical Testing Assessment**

Seven samples of topsoil, four samples of made ground, and three samples of natural ground were dispatched for chemical testing.

### ***Topsoil***

None of the samples of topsoil recorded any elevated concentrations of determinants.

The topsoil was therefore considered suitable for reuse on site.

### ***Made Ground***

One sample of made ground recorded elevated concentrations of a number of metals/metalloids and PAHs when compared against the generic human health assessment criteria for a residential end use with homegrown produce. Localised areas of made ground are present across the site and a variable level of contamination was expected.

Where made ground is in place below gardens and landscaped areas, a clean 600 mm capping (including at least 100 mm of clean topsoil) was considered to be required.

### ***Natural Ground***

None of the samples of natural ground that were tested recorded any elevated concentrations of determinants.

The natural ground was therefore considered suitable for reuse on site.

## **Construction Materials Assessment**

Based upon the results of the pH and sulphate testing undertaken sulphate precautions are not required for below ground concrete in contact with the natural ground. However, concrete in contact with the made ground should meet the requirements of DS-2 AC-2 in terms of sulphate resistance.

The results of the chemical testing will need to be forwarded to the water company so that appropriate water supply pipes can be selected.

## **Radon and Ground Gas**

No radon precautions are required at the site. Made ground was encountered in four of the ten trial pits and two of the window sample holes to depths of between 0.6 and 2.0 m bgl, with the deeper depths being encountered in the east and south east areas of the site. The made ground was not found to contain a significant amount of organic material and as such would not be considered capable of producing ground gas. One registered landfill site has been identified within 50 m of the site. The landfill was noted to include construction and demolition materials with controlled wastes.

The gas monitoring program completed by ECE recorded elevated concentrations of methane and carbon dioxide near the eastern site boundary. The wells located further west did not record any elevated concentrations, despite being located closer to the historical landfill site located to the south west of the site. It is therefore concluded that this is not the source of the elevated gas concentrations recorded on site.

The majority of the response zones of the monitoring wells were flooded over the period during which the monitoring was undertaken. During the final round of monitoring, five out of six of the wells recorded the water level within, but not above the top of the response zone. This monitoring round is therefore considered to be most representative of the gas present in the unsaturated zone, and no elevated concentrations or positive flow rates were recorded in any of the wells. However, WS05, located in the east of the site, was not found to have a fully flooded response zone during any of the monitoring visits. This recorded concentrations of carbon dioxide in excess of the 5% limiting value for 'green' classification under the NHBC traffic light system during four of the six monitoring visits. These were not however recorded in conjunction with any positive flow rates.

The high groundwater level is considered to prevent migration of ground gas through the soil. Ground gas can however be dissolved in the groundwater and from there can partition into the unsaturated zone above, but any generation would be at very low rates and as such wouldn't be considered to pose a significant risk at the site.

As elevated concentrations of both methane and carbon dioxide were recorded in the eastern part of the site, it was recommended that Amber 1 gas protective measures are installed in

plots located in the easternmost 25% of the site. These recommendations were made when the development proposals included demolition of the existing barns and construction of a number of new residential properties across the whole site. As the current development proposals do not include any properties in the east of the site, no gas precautions are currently considered to be required within the development.

Should the development proposals change, further advice would be required.

## Remedial Proposals

Due to the elevated concentrations of metals/metalloids and PAHs within the made ground, a minimum 600 mm thick clean capping layer, including at least 100 mm of topsoil, is considered to be required where made ground is to remain in place below gardens and landscaped areas. This is to mitigate the risk of site end users coming into contact with the made ground.

At this stage it should be assumed that made ground is present across all of the proposed garden areas, unless independent verification confirms that this is not the case.

### 3.0 REMEDIATION OBJECTIVES

The remedial objectives for this site are therefore:

1. To ensure that a minimum 600 mm thickness of clean, inert, physically suitable material, including 100 mm of topsoil, is present within gardens and areas of soft landscaping where made ground remains;
2. To ensure that appropriate sulphate precautions and water supply pipes are installed\*;
3. Upon identification of any additional or unexpected contamination, a suitable strategy to determine any remedial action is to be in place; and
4. To reduce the risks to construction workers, they should be made aware of the presence of elevated levels of contaminants within the materials to be excavated and ensure that the requisite working practices are adhered to\*.

\*No further guidance with regards to this is considered necessary as part of this document.

## 4.0 WORKING METHOD

During the works, procedures to protect site neighbours, the environment and amenity, and to control dust, noise and odours should be put in place by the contractor, in addition to the required site health and safety procedures that apply. Control of surface runoff over areas of potentially contaminated ground should also be taken into consideration.

The procedures for implementation of the mitigation measures identified in Section 2, to ensure that the objectives detailed in Section 3 are met, are outlined in Sections 5 to 8. All remediation works are to be overseen by suitably experienced site staff. Periodic visits will be made by a suitably qualified independent consulting Engineer, to undertake the necessary verification works detailed.

## 5.0 CAPPING MATERIALS

### 5.1 Sourcing of Material

The site won topsoil and natural ground are considered suitable for re-use in the development. However, if additional material is found to be required, this will need to be imported.

Any topsoil and subsoil considered for importation should be from a source not expected to be contaminated and meet both physical and chemical criteria as detailed in the Sections 5.2 and 5.3.

Prior to importation, certification should be obtained from the supplier detailing the source site, its previous and current land use and relevant test results. A copy of this information should also be forwarded to the Engineer.

For imported materials, copies of the carrier's consignment notes should be retained with the documentation detailed in Section 5.4 and a copy forwarded to the Engineer.

For imported or site won material, soil should be stockpiled separately and away from areas designated for storing other materials or potential sources of contamination. Separate stockpiles should also be created for each different source. All stockpiles should be suitably quarantined and identified as such until deemed suitable for use.

The following soil handling procedures should also be adhered to:

- Topsoil and subsoil should not become mixed;

- Capping should not be laid during or immediately following heavy rain;
- Double handling of material should be avoided;
- Stockpiles of topsoil should be shaped to shed water;
- Topsoil stockpiles should be low and narrow to ensure that the core is within 1 m of the surface; and
- Over tracking by machinery used to place soils should be avoided.

Imported and site won stockpiles should not be mixed. Site won stockpiles considered as suitable for reuse in gardens and site won stockpiles considered to be impacted with contaminants must not be mixed.

## 5.2 Physical Requirements

Topsoil and subsoil to be placed within 600 mm of the surface in gardens and landscaped areas should comprise clay or sand. Topsoil should have a maximum of 30% of fragments in excess of 2 mm, a maximum of 10% in excess of 20 mm and nothing greater than 50 mm. Subsoil should comprise clay or sand and should have a maximum of 65% of fragments in excess of 2 mm, a maximum of 60% in excess of 20 mm, a maximum of 40% in excess of 50 mm and only occasional pieces in excess of 100 mm.

Material should be free of fragments of glass and wire or other potentially hazardous foreign material which could cause traumatic injury. Significant quantities of extraneous material such as brick and concrete should also not be present within the topsoil. Following the topsoil strip, any topsoil containing extraneous material should be screened to remove the unsuitable non-soil-forming materials before being stockpiled. Reasonable judgement should be taken with respect to the presence of extraneous material in subsoil. In addition, all materials should be free from propagules of aggressive weeds and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems.

## 5.3 Chemical Requirements

Testing should be carried out for the following general suite of contaminants:

| Type of Material                         | Frequency of Testing                                                                                       | Testing Schedule                                                                                                                          |
|------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Site won topsoil and made ground         | Minimum 3<br>1 per 500 m <sup>3</sup>                                                                      | Standard metals/metalloids<br>PAHs (16 USEPA speciation)<br>Asbestos<br>pH<br>TPH CWG<br>BTEX<br>Soil organic matter/Total organic carbon |
| Site won natural soils                   | Minimum 3<br>1 per 1,000 m <sup>3</sup>                                                                    |                                                                                                                                           |
| Imported greenfield / manufactured soils | Minimum 3<br>Dependent on source and receptor between 1 per 50 m <sup>3</sup> and 1 per 250 m <sup>3</sup> | Standard metals/metalloids<br>PAHs (16 USEPA speciation)<br>Asbestos<br>pH<br>TPH CWG<br>BTEX<br>Soil organic matter/Total organic carbon |

The sampling is to be undertaken by a suitably qualified Geo-environmental Engineer and depending on the source or variability of imported material, the Engineer may, at their discretion, request additional testing to be undertaken.

A table of assessment values is included in the Appendix. If any of the assessment values are exceeded, the material shall be considered to be unsuitable unless further testing and risk assessment shows it to be satisfactory.

## 5.4 Documentation

Each stockpile of imported material should be given a clear reference number and designated sheet recording the following:

- Identification reference (e.g. Stockpile A, B, C etc.);
- Material type (e.g. Topsoil);
- Source site;
- The carrier's consignment note reference numbers;
- The approximate volume (or number of loads); and
- Which plots the material is to be used on and where (i.e. Plot number and landscaped area to the front or rear garden);

Each entry shall be signed and dated by the Site Manager or their assistant. These sheets should be available for inspection by the Engineer, Warranty Inspectors, Local Authority staff and others involved with this development. A copy should also be given to the Engineer when verification visits are made.

## **6.0 INSTALLATION AND VERIFICATION OF CAPPING**

### **6.1 Installation**

Where made ground is to remain or be placed below gardens and landscaped areas, a minimum 600 mm thick capping, including at least 100 mm of topsoil will be required.

Where no made ground is present, a minimum 100 mm topsoil growing medium will be sufficient. No verification of the placement of this would be required, however verification that made ground is absent would be necessary.

The capping installation should be undertaken by site staff in the following steps:

1. Establish the finished ground levels over each garden or landscaped area and from this determine the required level of the underside of the capping.
2. Where present ground levels are above the level of the underside of the capping, re-grading of the ground is to be undertaken to accommodate the capping. This excavated material may be placed in areas where ground levels are to be raised, such as beneath hard-standing or used to raise levels beneath other capped areas (see 3 below). Failing this the material can be removed from site (see 4 below).
3. Where the present ground levels are below the underside of the capping, the ground level may be made up to the underside of the capping layer using material from 2 (above) or imported material where no suitable fill exists.
4. All arisings should be regarded as contaminated until proven otherwise. If they cannot be used on site, they are to be removed to a licensed waste management facility. The waste is to be taken by a registered waste carrier in accordance with the Waste Management Duty of Care Code of Practice. Copies of all waste transfer notices are to be retained.
5. Check the level of the ground surface to ensure that it is at the correct level for the underside of the capping.

6. Install the subsoil, if required.
7. Install private services, where applicable. Where materials from above and below the capping are excavated these should be kept separate. Capping materials can be reused but the material below the cap should be placed as detailed in 3 or removed from site following the procedures set out in 4.
8. Place a minimum of 100 mm topsoil.

## 6.2 Verification of the Capping

Upon completion of the capping, verification pits shall be dug by an independent Engineer in order to measure the thickness of topsoil and subsoil, where present. Verification pits will be dug at a rate of 1 pit per 3 plots.

Prior to placement of the capping materials, the formation layer shall be inspected by the Site Manager and photographed. Verification pits shall be dug by an independent Engineer in order to measure the thickness of the capping.

Each verification pit shall be photographed. The photograph will include reference of depth and location of the pit.

If the capping is deemed to be insufficient, the Site Manager will be informed and advised on how much more material is needed for the capping to be adequate. Verification of capping can only be carried out on areas where the capping has been completed. All gardens and landscaped areas which have had the capping layer completed will be photographed by the Engineer.

A verification report is to be produced by the Engineer, which includes:

- The documentation detailed in Section 5.4;
- The chemical test results for imported subsoil and topsoil;
- Confirmation of the capping thicknesses, including photographs of the verification pits with a scaled marker; and
- Confirmation of the physical suitability of the material.

The submission of verification reports is covered in Section 9.

No verification of the growing medium thickness is considered necessary.

## 7.0 UNEXPECTED CONTAMINATION

There is the potential for areas of unexpected contamination, as is the case with any 'Brownfield' site. Any unusual, brightly coloured, oily or odorous material should be considered in this category. Significant amounts of material suspected of containing asbestos or potential tanks should also be included.

If unexpected contamination is found the following procedures should be adhered to:

1. All site works at the position of the suspected contamination should stop, and visual and olfactory observations of the condition of the ground and the extent of contamination should be made. Notification shall be given to an independent consultant and the Local Authority not later than 24 hours after discovery. Should the contamination be likely to affect controlled waters the Environment Agency should also be informed.
2. During the presence of a suitably qualified Engineer, investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, accurately delineate the area over which contaminated materials are present.
3. Should the Consultant deem it appropriate, the affected material may be excavated and placed in a stockpile on a suitable impermeable surface. This should be suitably quarantined with no addition to or removal of the stockpile while chemical analysis is being undertaken. Alternatively, the material should remain in-situ until laboratory test results have been obtained.
4. The testing suite will be determined by the Consultant on the basis of visual and olfactory observations.
5. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
6. If after testing the ground is found to be contaminated, the Local Authority shall be informed. After consultation with the Local Authority, and if necessary, the Environment Agency, materials should either be removed for disposal to a licensed waste management facility or remediated to agreed clean-up criteria.

A report will be prepared by the Engineer and submitted to the Local Authority and where groundwater may potentially have been impacted, the Environment Agency.

## **8.0 COMPLETION DOCUMENTATION**

On completion of the verification works the appropriate verification documentation, detailing the works that have been completed in accordance with the agreed Implementation Plan, will be forwarded to the Local Authority and warranty provider. Should any remediation affecting controlled waters have been required and consequently undertaken, verification documentation will also need to be issued to the Environment Agency for their approval.

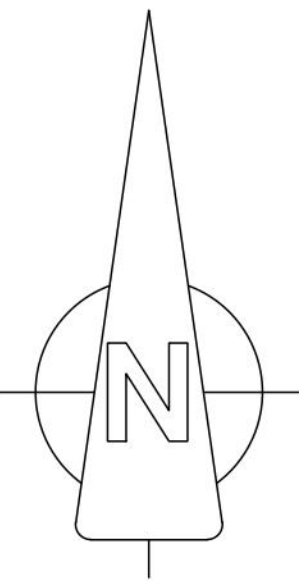
The verification report for the capping will include photographs of the capping materials within validation pits and of the garden and landscaped areas, as well as the pertinent chemical test results.

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority and warranty provider prior to being undertaken on site.

## APPENDIX

Proposed Block Plan, drawing ref GP/07/24 rev F

Soil Assessment Values – Residential with Homegrown Produce



Metres

|                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                           |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------|
| Drawing title                                                                                                                                                                                                                                                                                                                                                                                                                                     | Proposed block plan                                                       |       |
| Project                                                                                                                                                                                                                                                                                                                                                                                                                                           | Proposed conversions of barns A and B to each form 5 3 bedroom dwellings. |       |
| Address                                                                                                                                                                                                                                                                                                                                                                                                                                           | Glasspool Farm Part Lane, Riseley, RG7 1RU                                |       |
| Client                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |       |
| Scales                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1:500                                                                     |       |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                              | Aug 2024                                                                  |       |
| Drawing Number:                                                                                                                                                                                                                                                                                                                                                                                                                                   | GP/07/24                                                                  | Rev F |
| <div>Architectural elements</div> <div>Imagion Designs Ltd<br/>La Caverna, Morarville, Riseley, Normandy, France 27255<br/>Tel: office 0333 22041289   mobile 07711 822139<br/>email: <a href="mailto:imagiondesigns@live.co.uk">imagiondesigns@live.co.uk</a></div> <div>Registered Company no. 7111887   2001<br/>Address: Suite 2, Hasegha, 185 Luntway Road, Luton, Bedfordshire LU1 3DY<br/>© Imagion Designs Limited 2024</div> <div></div> |                                                                           |       |

| Inorganic Compounds | Human Health - 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      | Human Health - Residential with Homegrown Produce (mg/kg) |          |        |
|------------------------|-----------------------------------------------------------|----------|--------|
|                        | 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    |

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|                 |    |                |    |             |            |               |       |
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| <b>Prepared</b> | KB | <b>Checked</b> | KE | <b>Date</b> | 06/11/2024 | <b>Job No</b> | 46383 |
|-----------------|----|----------------|----|-------------|------------|---------------|-------|

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|
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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|

| Contaminant | Phytotoxicity (mg/kg) |                  |                  |            |
|-------------|-----------------------|------------------|------------------|------------|
|             | pH<br>5.0 to 5.5      | pH<br>5.5 to 6.0 | pH<br>6.0 to 7.0 | pH<br>>7.0 |
| Arsenic     | 50                    |                  |                  |            |
| Cadmium     | 3                     |                  |                  |            |
| Chromium    | 400                   |                  |                  |            |
| Lead        | 300                   |                  |                  |            |
| Mercury     | 1                     |                  |                  |            |
| Nickel      | 50                    | 60               | 75               | 110        |
| Copper      | 80                    | 100              | 135              | 200        |
| Zinc        | 200                   | 200              | 200              | 300        |

The assessment concentration for lead is the Category 4 Screening Level produced by Contaminated Land: Applications in Real Environments (CL:AIRE) and outlined in Appendix H of their report SP1010. The others have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, Nottingham. The metals/metalloids are based on a sandy loam soil and 6% soil organic matter. The assessment values are not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. Instead, the modified mean value should be compared with the assessment concentration.

The assessment values for phytotoxicity are the levels at which plant growth is thought to be affected. They are taken from the maximum permissible and advisable concentrations in soil after application of soil sludge given in the *'The Code of Good Agricultural Practice for the Protection of Soil'*, MAFF, 1998.

The assessment of sulphate, water soluble sulphate, elemental sulphur and sulphide is to determine the aggressive nature of the ground with respect to concrete and consequently the results are compared with BRE Special Digest 1:2005 *'Concrete in Aggressive Ground'*.

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| <b>Prepared</b> | KB | <b>Checked</b> | KE | <b>Date</b> | 06/11/2024 | <b>Job No</b> | 46383 |
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| TPH Fraction        | Intended Land Use Residential (mg/kg) |                               |                            |
|---------------------|---------------------------------------|-------------------------------|----------------------------|
|                     | 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) <sup>vap</sup>               | 330 (118) <sup>vap</sup>      | 760 (283) <sup>vap</sup>   |
| Aliphatic EC >12-16 | 1100 (24) <sup>sol</sup>              | 2400 (59) <sup>sol</sup>      | 4,300 (142) <sup>sol</sup> |
| Aliphatic EC >16-35 | 65,000 (8.48) <sup>f, sol</sup>       | 92,000 (21) <sup>f, sol</sup> | 110,000 <sup>f</sup>       |
| Aliphatic EC >35-44 | 65,000 (8.48) <sup>f, sol</sup>       | 92,000 (21) <sup>f, sol</sup> | 110,000 <sup>f</sup>       |
| Aromatic EC 5-7     | 70                                    | 140                           | 300                        |
| Aromatic EC >7-8    | 130                                   | 290                           | 660                        |
| 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 <sup>f</sup>                      | 540 <sup>f</sup>              | 930 <sup>f</sup>           |
| Aromatic EC >21-35  | 1,100 <sup>f</sup>                    | 1,500 <sup>f</sup>            | 1,700 <sup>f</sup>         |
| Aromatic EC >35-44  | 1,100 <sup>f</sup>                    | 1,500 <sup>f</sup>            | 1,700 <sup>f</sup>         |

<sup>f</sup> oral, dermal, and inhalation exposure compared with oral HCV

<sup>sol</sup> S4UL presented exceeds the solubility saturation limit, which is presented in brackets

<sup>vap</sup> S4UL presented exceed the vapour saturation limit, which is presented in brackets

The assessment criteria for each of the petroleum hydrocarbon fractions have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, Nottingham. These are also all based on a sandy loam soil.

Within the Environment Agency Science Report P5-080/TR3, Askari, K. & Pollard, S., 2005 *'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils'* it is stated that the assessment values should not be considered individually; instead the potential additive effects should be calculated. This is achieved by calculating an individual Hazard Quotient (HQ) for each fraction. The HQ is the proportion of the assessment concentration represented by the recorded concentration. The HQs are then added together to form a Hazard Index (HI) and where this exceeds unity a potential significant risk to human health may exist.

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