

# Pell Frischmann

Longhurst Road

Land contamination risk management

**Remediation strategy**

Includes remediation options appraisal

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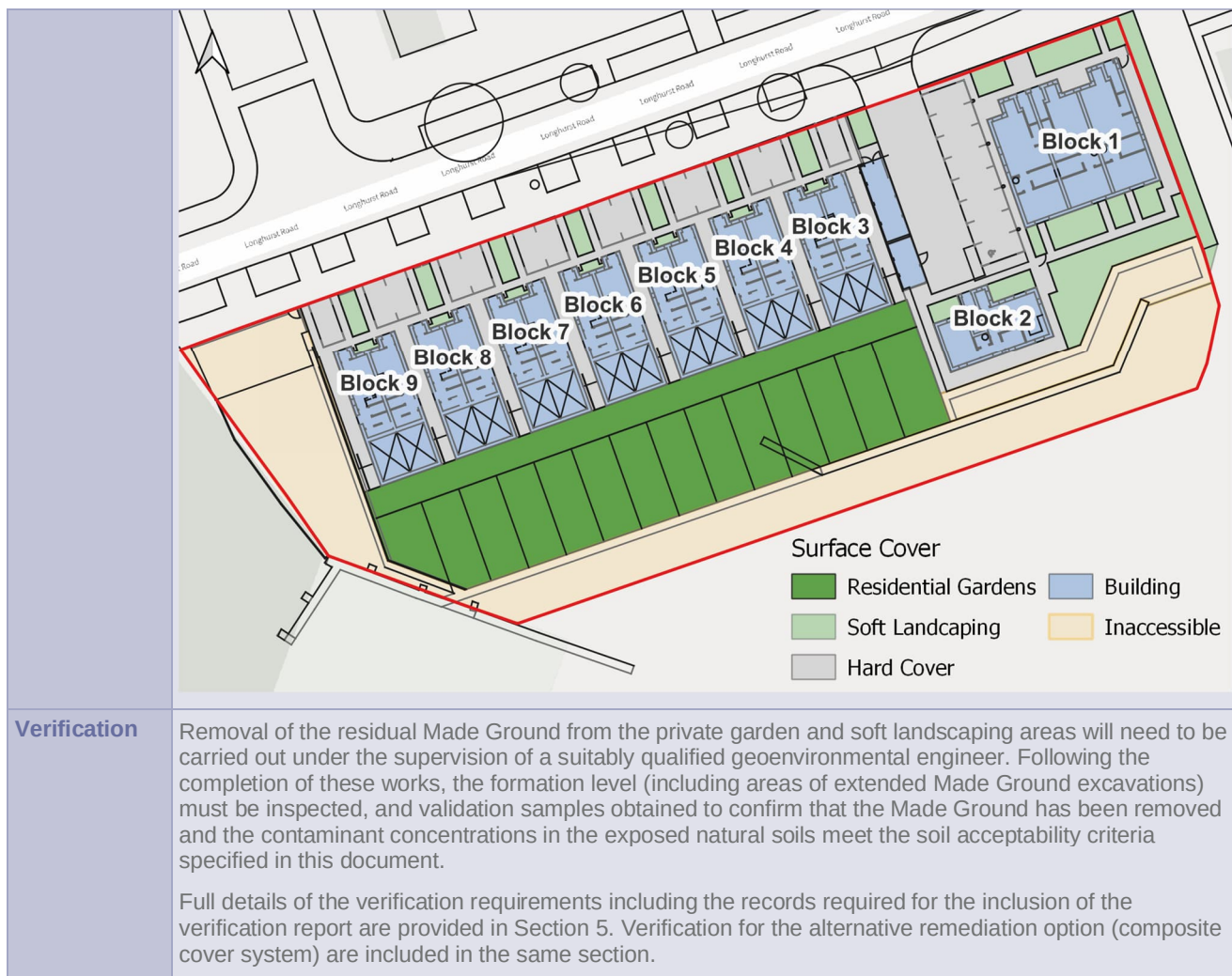
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## Executive Summary

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|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Site name and location           | Longhurst Road, Higher Blackley Manchester<br>National Grid Reference: 384774, 403956                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                              |                                           |                                                                                                                                 |
| Development proposals            | The proposed development comprises 22No. new residential dwellings including 2No. apartment blocks with car parking and soft landscaping, and 7No. blocks of private semi-detached houses with rear gardens and front lawns constructed on new benched development platforms to be cut into the existing landform.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                              |                                           |                                                                                                                                 |
| Aims of the remediation strategy | <p>The aims of this report are to summarise the ‘remediation options appraisal’ process and describe the ‘remediation strategy’ for the proposed development.</p> <ul style="list-style-type: none"><li>➤ Remediation options appraisal includes setting remediation objectives and criteria and identifying a suitable remediation option that ‘can be implemented in practice’.</li><li>➤ The remediation strategy is a record ‘of how you will meet and carry out the remediation objectives’ and includes a verification plan setting out compliance criteria and the records and ‘lines of evidence’ that need to be captured during and/or after remediation.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                              |                                           |                                                                                                                                 |
| Reason for remediation           | The following relevant contaminant linkages associated with the Made Ground onsite have been identified based on the findings of the generic quantitative risk assessment (GQRA) undertaken by Pell Frischmann in 2023.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                              |                                           |                                                                                                                                 |
|                                  | CL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Source                                                                                                       | Pathway                                   | Receptor                                                                                                                        |
|                                  | 101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Arsenic, lead, PAH compounds (benzo(b)fluoranthene and dibenzo(a,h)anthracene) within the Made Ground onsite | Ingestion, inhalation, and dermal contact | Human health of end users - private residential gardens (RwHP)                                                                  |
|                                  | 102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Lead within the Made Ground onsite                                                                           | Ingestion, inhalation, and dermal contact | Human health of end users - areas of accessible soft landscaping public open space (POS <sub>resi</sub> )                       |
|                                  | 201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Asbestos in soils (AiS) within the Made Ground onsite                                                        | Inhalation of liberated respirable fibres | Human health of end users – accessible soft landscaping (including private gardens and areas of public/shared soft landscaping) |
| Remediation strategy             | <p>Independent of remediation requirements, reprofiling of the site is required to meet the proposed levels and facilitate redevelopment of the Longhurst Road site. The proposed houses and apartments will be built on a series of new development platforms that will be cut/benched back into the existing hillside to the south. Most of the existing Made Ground (i.e. contamination source) will be removed as part of the cut and fill earthworks.</p> <p>The remediation strategy involves undertaking further excavation works, where required, to completely remove any Made Ground that remains in the private garden and soft landscaping areas of the development following the completion of the cut and fill. Most of the soil arisings generated during the cut and fill and remediation works including all the Made Ground, will require off-site disposal. Site-won natural soils will be re-used locally to make up site levels.</p> <p>If a substantial thickness of Made Ground (exceeding that estimated from the site investigation data) is encountered during the earthworks and/ or remediation works, an alternative remediation option involving installation of a composite cover system has been provided within Section 4.4 of this report.</p> |                                                                                                              |                                           |                                                                                                                                 |

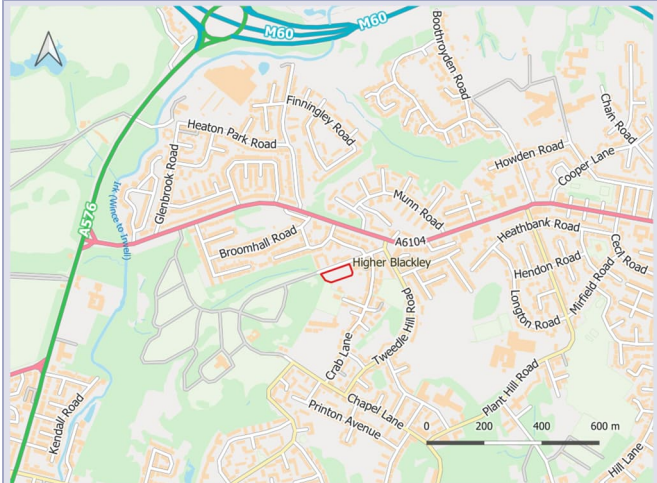


# 1 Introduction

## 1.1 Commission

Pell Frischmann have been commissioned by Great Places Housing Group (the client) to prepare this land contamination Remediation Strategy (LCRS) for the proposed Longhurst Road development (the site), in Higher Blackley, Manchester (as shown in Figure 1-1). The proposed development comprises 22No. new residential dwellings including 2No. apartment blocks with carparking and soft landscaping, and 7No. blocks of semi-detached houses with rear and front gardens.

Figure 1-1 Site location

|                                                                                    |                                                                                     |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Site location                                                                      |                                                                                     |
|  |  |
| Ordnance Survey (OS) Open Mapping                                                  | Google Satellite Image                                                              |
| Site information                                                                   | Details                                                                             |
| Site area                                                                          | 0.35 ha                                                                             |
| National Grid Reference (centre of the site) (NGR)                                 | 384774, 403956                                                                      |
| Nearest (central) postcode                                                         | M9 8NS                                                                              |

This land contamination Remediation Strategy report follows on from Generic Quantitative Risk Assessment (Site Investigation and Risk Assessment) Report prepared by Pell Frischmann (2023). The report determined that remediation would only be required in areas of proposed soft landscaping (i.e. only across parts of the site not covered by hardstanding, such as roads, buildings, pavements etc.).

## 1.2 Scope of work

When quantitative land contamination risk assessment identifies unacceptable risks for one or more contaminant linkages, then remediation or mitigation will be required. The aims of this report are to summarise the remediation option appraisal process and to describe the 'remediation strategy' for the proposed development.

- Remediation options appraisal includes setting remediation objectives and criteria and identifying a suitable remediation option that *'can be implemented in practice'*.
- The remediation strategy is a record of *'how you will meet and carry out remediation objectives'* and includes a verification plan setting out compliance criteria and the records and 'lines of evidence' that need to be captured during or after remediation.

### 1.3 Proposed development overview

The proposed development comprises 22No. new residential dwellings including 2No. apartment blocks with carparking and soft landscaping (Blocks 1 and 2), and 7No. blocks of private semi-detached houses with rear gardens, front lawns (Blocks 3 to 9).

The drawings showing the proposed development layout, site sections and 3D model images (prepared by the Architects) are shown in Figure 1-2.

**Figure 1-2 Proposed development**



## Development Proposals



View from Longhurst Road towards the apartments

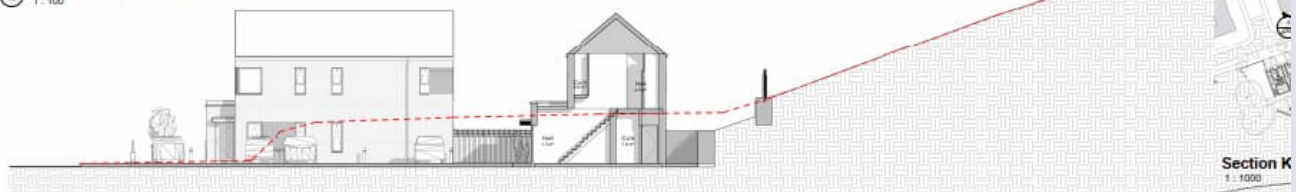


View from Longhurst Road towards semi-detached houses

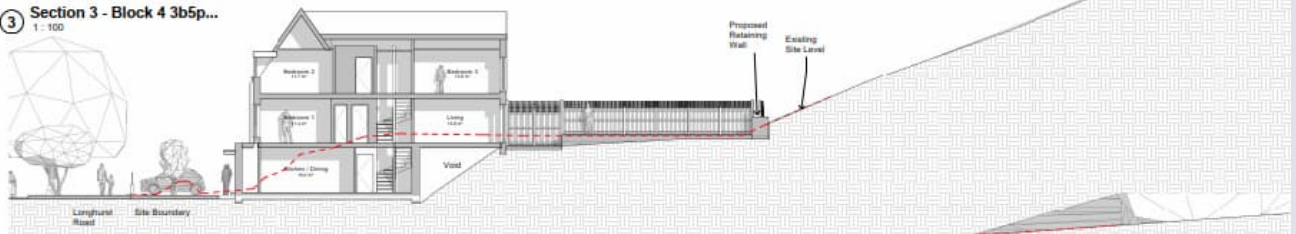
### ① Section 1 - Block 1 Apartments 1 : 100



### ② Section 2 - Block 2 Apartments 1 : 100



### ③ Section 3 - Block 4 3b5p... 1 : 100



### ④ Section 4 - Block 7 3b5p 1 : 100



Proposed site sections

## 1.4 Previous reports

Table 1-1 summarises the previous land contamination reports for the proposed development that have informed the remediation strategy.

**Table 1-1 Previous reports**

| Report title and reference                                                                                                                                             | Source                     | Date     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------|
| Generic Quantitative Risk Assessment Site Investigation and Risk Assessment Report, Longhurst Road. (Report ref. 106240-PEF-XX-XX-RP-GG-600001_P01 GQRA LONGHURST ROAD | Pell Frischmann            | May 2023 |
| Ground Investigation Factual Report. Longhurst Road, Blackley ground investigation report. ( <i>Document no. 077873-CUR-00-XX-RP-GE-005</i> )                          | Soiltechnics Ltd           | Mar-2023 |
| Longhurst Road Phase 1 Preliminary Risk Assessment<br>( <i>Report ref. 077873-CUR-00-XX-RP-GE-005</i> )                                                                | Curtins Consulting Limited | Apr-2021 |
| Phase 1 and Phase 2 Geoenvironmental Report, Longhurst Road, Blackley.<br>( <i>Report ref. 3025-CAU-XX-XX-RP-V-0307.A0-C1</i> )                                        | Caulmert Limited           | Apr-2017 |

## 2 Background

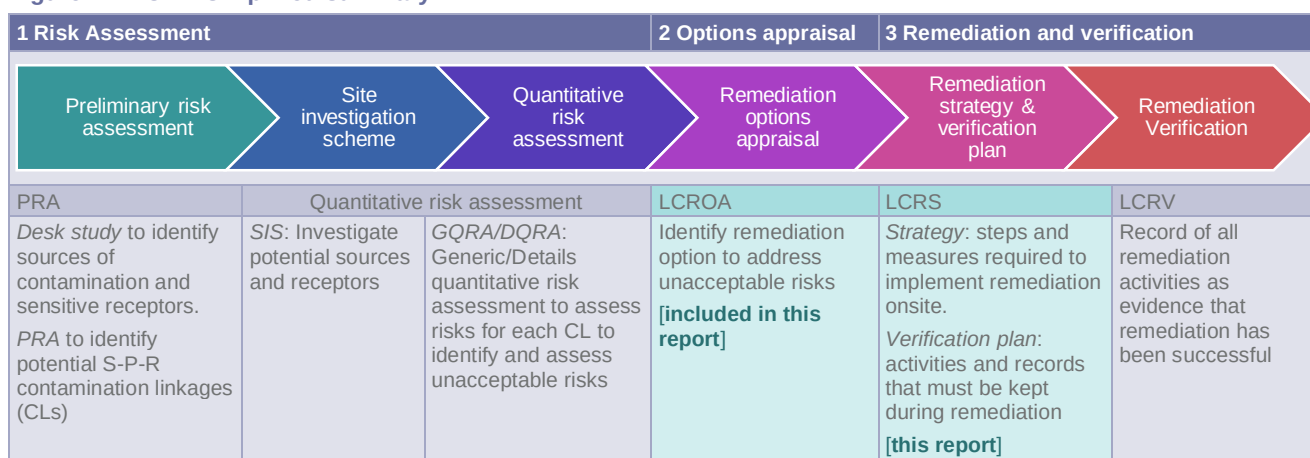
### 2.1 Land contamination risk management

The Environment Agency 'Land Contamination Risk Management' guidance (LCRM, 2021) sets out the process that should be followed for managing the risk from land contamination, including within the planning regime. LCRM should be used to:

- *Identify and assess if there is an unacceptable risk*
- *Assess what remediation options are suitable to manage the risk*
- *Plan and carry out remediation*
- *Verify that remediation has worked*

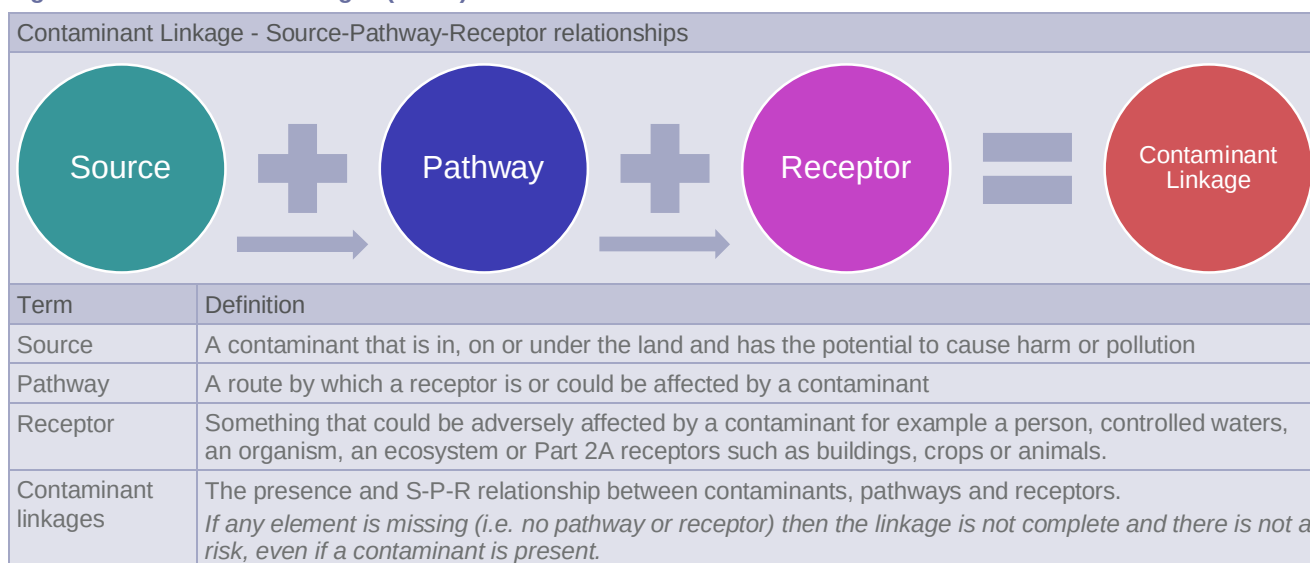
LCRM includes three risk-based stages 'risk assessment', 'remediation options appraisal' and 'remediation and verification'. Figure 2-1 presents Pell Frischmann's simplified summary of the LCRM process.

**Figure 2-1 LCRM simplified summary**



**Conceptual Site Models (CSMs)** are an integral part of land contamination risk management. CSMs collate contamination information for a site or proposed development, including a series of Contaminant Linkages (i.e. relationships between contaminants, pathways and receptors based on the source-pathway-receptor (S-P-R) approach summarised in Figure 2-2), together with interpretation, assumptions, hypotheses and recognition of gaps and uncertainties.

**Figure 2-2 Contaminant linkages (S-P-R)**



CSMs are part of an iterative process and need updating throughout the land contamination risk management process for a development. As stated in the LCRM guidance, the CSM should be used to “*inform the basis of your initial assessment and all future decisions as you progress through Land Contamination Risk Management*” (LCRM, 2021). During the risk assessment stage, the term ‘*potential* contaminant linkage’ is used until the CLs have been confirmed/excluded. The term ‘*relevant* contaminant linkage’ is used to describe linkages where quantitative risk assessment indicates that remediation is required to address unacceptable risks.

## 2.2 Land contamination risk management process to date

**Preliminary risk assessment and site investigation scheme (SIS) and generic quantitative risk assessment (GQRA):** A desk study and an intrusive site investigation was undertaken at the site by Caulmert Limited in 2017, followed by a land contamination generic quantitative risk assessment (GQRA), which is presented in the *Phase I and Phase II Geo-environmental Report (Caulmert Limited, April 2017 ref: 3025-CAU-XX-XX-RP-V-0307.A0-C1)*. The desk study and site investigation covered a larger land parcel (0.82ha), which includes the subject site (0.35ha) in the north, plus additional land to the southeast.

**Preliminary risk assessment (PRA):** PRA and desk study report was undertaken by Curtins Consulting in 2021: *Phase 1 Preliminary Risk Assessment, (Curtins Consulting Ltd, April 2021 ref: 077873-CUR-00-XX-RP-GE-005, April 2021)*. The PRA report covered the same larger land parcel (0.82ha) as the 2017 Caulmert report. Findings from the Caulmert site investigation are included within the report.

**Site investigation scheme (SIS) and generic quantitative risk assessment (GQRA):** Pell Frischmann designed a predominantly geotechnical site investigation for the site in August 2022. The site investigation was undertaken by Soiltechnics Limited between 13 and 14 December 2022. Following the completion of the intrusive works, 5No. return ground gas and groundwater monitoring visits were undertaken between January and March 2023.

**Generic quantitative risk assessment (GQRA):** The Pell Frischmann geoenvironmental team was subsequently commissioned to undertake a generic quantitative risk assessment (GQRA) based on the available information from the site investigation and monitoring. The data from the previous 2017 site investigation undertaken by Caulmert was also included in the assessment. The GQRA is presented in the *Generic Quantitative Risk Assessment (Pell Frischmann, May 2023 ref: 106240-PEF-XX-XX-RP-GG-600001)*.

The 2023 generic quantitative risk assessment (GQRA) identified five contaminants of concern (CoC) in the shallow Made Ground onsite associated with three contaminant linkages for the development that were likely to require remediation in areas of soft landscaping only. The remediation options appraisal process for these contaminant linkages is described in Chapter 3.

## 2.3 Planning condition

The proposed development was granted planning permission in 2023 by Manchester City Council, *planning ref: 136721/FO/2023, 28 April 2023*. Planning conditions relating to land contamination were included within Planning Condition 10 of the decision notice, which is presented (in full) in Table 2-1. The condition has been divided into a series of sub-parts to shows how the Condition aligns with the land contamination risk management process (see Figure 2-1).

**Table 2-1 Planning conditions**

| Condition 10 | Planning condition 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | LCRM Stage                                                                                                            |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 10 (a) i     | Before the development hereby approved commences, a report (the Preliminary Risk Assessment) to identify and evaluate all potential sources and impacts of any ground contamination, groundwater contamination and/ or ground gas relevant to the site shall be submitted to and approved in writing by the City Council as local planning authority. The Preliminary risk Assessment shall conform to City Council's current guidance document (Planning Guidance in Relation to Ground Contamination).                                                                                                                                                                                                  | Preliminary risk assessment (PRA)                                                                                     |
| 10 (a) ii    | In the event of the Preliminary Risk Assessment identifying risks which in the written opinion of the Local Authority require further investigation, the development shall not commence until a scheme for the investigation of the site and the identification of remediation measures (the Site Investigation Proposal) has been submitted to and approved in writing by the City Council as local planning authority. The measures for investigating the site identified in the Site Investigation Proposal shall be carried out before development commences and..                                                                                                                                    | Site investigation scheme and Generic quantitative risk assessment (GQRA)                                             |
| 10 (a) iii   | ..a report prepared outlining what measures if any are required to remediate the land (the Site Investigation Report and/ or Remediation Strategy) which shall be submitted to and approved in writing by the City council as local planning authority.                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Remediation strategy<br><b>[this report]</b>                                                                          |
| 10 (b) i     | When development commences, the development shall be carried out in accordance with the previously agreed Remediation Strategy and prior to occupation a Completion/ Verification Report shall be submitted to and approved in writing by the City Council as local planning authority.                                                                                                                                                                                                                                                                                                                                                                                                                   | Remediation verification report (to be undertaken towards the end of construction)                                    |
| 10 (b) ii    | In the event that ground contamination, groundwater contamination and/ or ground gas, not previously identified, are found to be present on the site at any time before the development in each phase is occupied, then development shall cease and/ or the development shall not be occupied until, a report outlining what measures, if any, are required to remediate the land (the Revised Remediation Strategy) is submitted to and approved in writing by the City Council as local planning authority and the development shall be carried out in accordance with Revised Remediation Strategy, which shall take precedence over any Remediation Strategy or earlier Revised Remediation Strategy. | Previously unidentified contamination (will be included in the verification report if identified during construction) |

## 3 Remediation options appraisal

### 3.1 Introduction

The preliminary risk assessment identified Made Ground as a potential source of contamination onsite. Based on the existing site investigation data, the generic quantitative risk assessment identified five Contaminants of Concern (CoC) within the Made Ground: arsenic, lead, two polycyclic aromatic hydrocarbon (PAH) compounds (benzo(b)fluoranthene and dibenzo(a,h)anthracene) and 'asbestos in soils'.

The end-users (human health receptors) of the development would need to be in direct contact or proximity to the Made Ground for dermal contact, ingestion, or inhalation pathways to exist. With respect to the specific CoCs identified, hardstanding ground cover will effectively cap the Made Ground and break the pathways. Therefore, residual risks will be limited to areas where Made Ground could remain accessible, at or near the final ground surface i.e., areas of proposed soft landscaping. Subsequently, the generic quantitative risk assessment identified three *relevant* contaminant linkages (see Table 3-1), associated with the CoCs within the Made Ground, that will likely require remediation.

**Table 3-1 Relevant contamination linkages that require remediation**

| CL  | Source                                                                                                       | Pathway                                   | Receptor                                                                                                                        |
|-----|--------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 101 | Arsenic, lead, PAH compounds (benzo(b)fluoranthene and dibenzo(a,h)anthracene) within the Made Ground onsite | Ingestion, inhalation and dermal contact  | Human health of end users - private residential gardens (RwHP)                                                                  |
| 102 | Lead within the Made ground onsite                                                                           | Ingestion, inhalation and dermal contact  | Human health of end users - areas of accessible soft landscaping public open space (POS <sub>resi</sub> )                       |
| 201 | Asbestos in soils (AiS) within the Made Ground onsite                                                        | Inhalation of liberated respirable fibres | Human health of end users – accessible soft landscaping (including private gardens and areas of public/shared soft landscaping) |

### 3.2 Remediation areas

The generic quantitative risk assessment determined that *remediation would only be required in areas of proposed soft landscaping onsite* (i.e. across any parts of the site not covered by hardstanding, such as roads, buildings, paved paths etc), due to viable exposure pathways.

The proposed development has been divided into the following zones (see Figure 3-1) to highlight the areas that require remediation:

- **Remediation areas:** areas of proposed private gardens (dark green) and soft landscaping (light green) that will require remediation.
- **Hardstanding areas:** building footprints (blue) and areas of ground level hardstanding (grey) including roads, footways and car parking areas, where remediation will not be required.
- **Inaccessible areas:** comprise land beyond a retaining wall that is not accessible for the future site users.

Figure 3-1 Remediation zones



If the development proposals change – these zones will need to be reviewed and updated where required.

### 3.3 Cut and fill earthworks

#### 3.3.1 Introduction

Reprofiling of the site is required to facilitate the redevelopment of the Longhurst Road site. The proposed houses and apartment buildings will be built on a series of new development platforms that will be cut/benched back into the existing sloped landform with associated retaining walls to the south, as shown in Figure 1-2.

The proposed earthworks will significantly alter the ground condition onsite considering that:

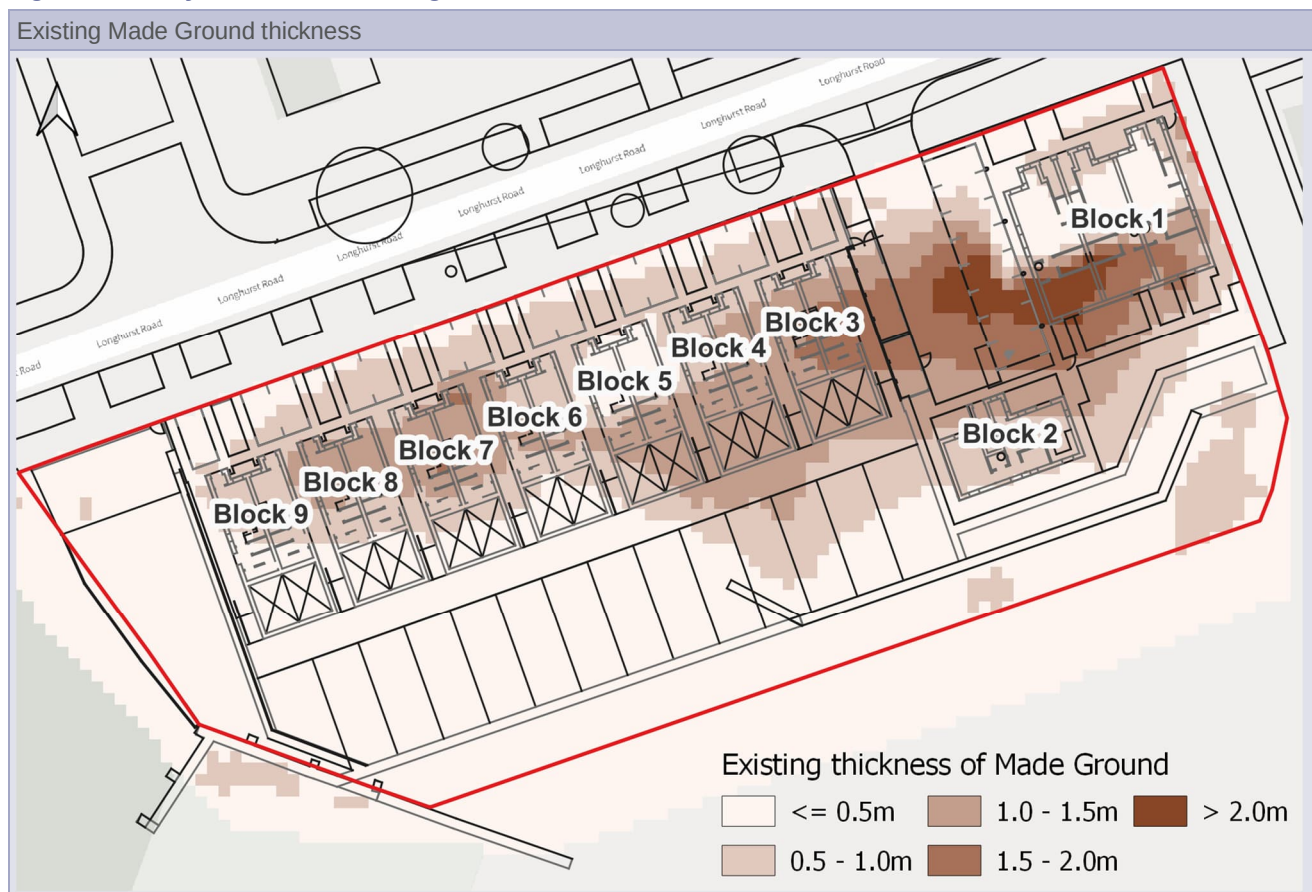
- The proposed cut has the potential to significantly reduce the thickness of the Made Ground across the site and will likely remove the full thickness of Made Ground in some areas.
- The placement of fill also has the potential to relocate Made Ground onsite.

The site investigation data has been used together with the proposed formation levels to estimate how the completed cut and fill earthworks are likely to influence/change the presence and thickness of Made Ground onsite.

#### 3.3.2 Proposed cut and fill

Based on the ground conditions findings of the site investigations, GIS software has been used to calculate the likely thickness/depth and extent of the existing Made Ground onsite (see Figure 3.2). Within this ground model, the proposed ground formation levels have been imported from work completed within CAD to complete the cut and fill drawings.

**Figure 3-2 Likely thickness of existing Made Ground**

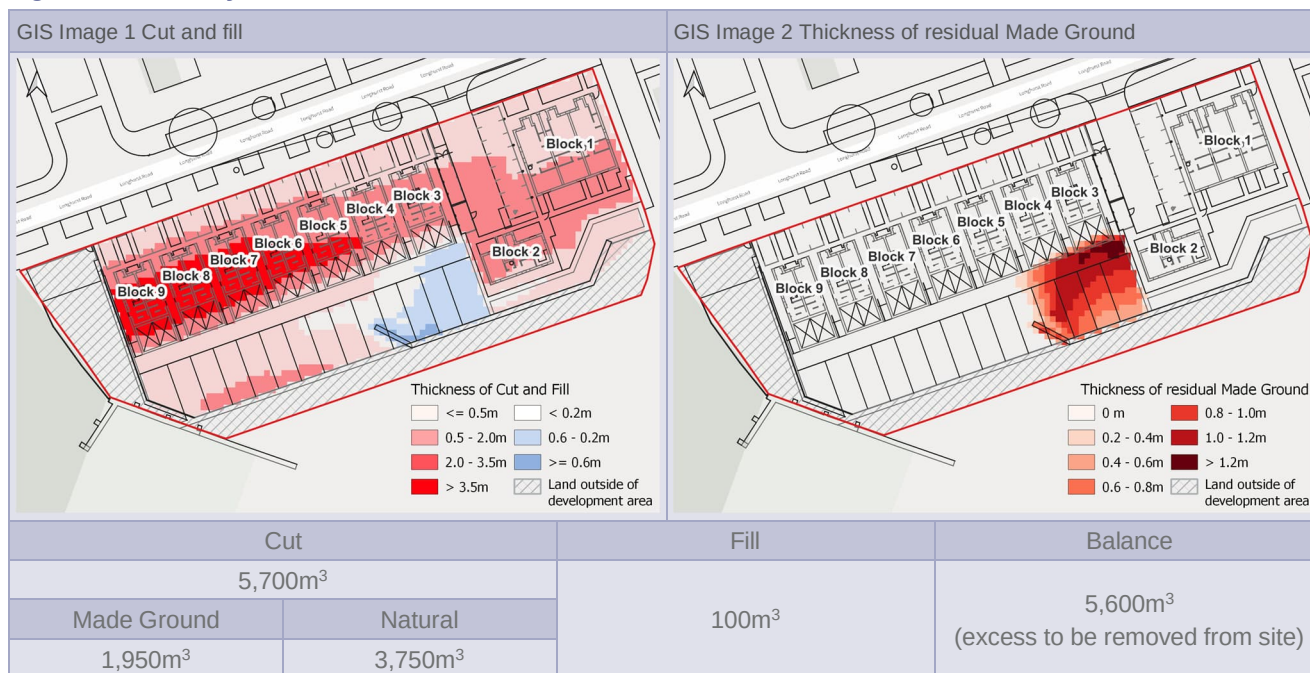


The GIS ground model has been used to run a confirmatory cut and fill exercise for the site for the purpose of informing the remediation options appraisal and strategy. The calculated cut depths and fill thicknesses are shown in Figure 3-3 'GIS Image 1' along with a summary of earthworks balance volumes. The results indicate that parts of the site will be cut by up to 4.8m, which is likely to result in a significant reduction in the thickness of the Made Ground across the site which across much of the site may result in its full removal.

The GIS model was used to estimate the likely extent and thickness of residual Made Ground that remain below formation level following completion of the earthworks. The results from the analysis show that the full thickness of Made Ground is likely to be removed from most areas and that residual Made Ground is only likely to remain in a localised area within the southern part of the site (see Figure 3-3 'GIS Image 2').

The GIS model was also used to estimate the volumes of Made Ground and natural strata that would be involved in the earthworks.

**Figure 3-3 Summary of cut and fill**



### 3.4 Remediation options appraisal

Potential remediation options for ground contamination within shallow Made Ground would typically comprise 'breaking' the contaminant linkage by either 'removing the source' of contamination or 'breaking the pathway/s'. The remediation options process also needs to include identifying the best practicable means to remediate the site without compromising safety while promoting sustainable remediation solutions.

- The cut and fill exercise summarised above indicates that the Made Ground source will be removed from across most of the site, which will break the contaminant linkage for these areas.
- The GIS cut and fill model also indicates that there will be an excess of Made Ground and natural arisings and only a small volume of fill will be required. As part of the remediation options/strategy it is recommended that only natural arisings are used as fill for the earthworks onsite to mitigate/prevent the movement/spreading of any contaminated Made Ground onsite. The rest of this remediation options appraisal and remediation strategy is prepared on this basis.
- Following the cut and fill, remediation will only be required in areas of potential residual Made Ground as indicated in the Figure 3-3 GIS Image 2 which is based on the currently available data. While it is not anticipated that significant residual made ground will be encountered below future soft landscaping elsewhere on site, should it be, the following remediation options would be applicable.

On this basis the following remediation options were considered:

#### **Option 1 – Breaking pathway**

The first remediation option would be to undertake the cut and fill to the formation level in accordance with the development design. Any residual Made Ground remaining after the completion of the earthworks would be left in-situ. A clean cover system comprising suitable thickness of topsoil and/ or subsoil would be installed in the areas where residual Made Ground is present. The cover system would act as a barrier between the Made Ground and the future site users thereby breaking the contaminant pathway.

#### **Option 2 – Source removal**

The second remediation option would be to extend the excavation below the formation level to remove the Made Ground source entirely. The GIS model has been used to estimate the additional volume of Made

Ground arisings that would be generated by this option, the model indicates that the additional volume would be in the order of 250m<sup>3</sup>.

The earthworks balance indicates that a significant volume of excess natural arisings will be generated by the cut and fill. The natural arisings from the cut and fill should be used to backfill the over excavated 'Made Ground' area to restore the ground back up to the formation level thereby avoiding the need to import soils to the site.

### Earthworks balance comparison for Option 1 and 2

Earthworks balance figures for remediation Option 1 and Option 2 are summarised in Table 3-2. The table also includes estimated volumes of Made Ground and natural strata involved in each option. As indicated above – all fill material shall comprise selected arisings of natural strata and not Made Ground. Therefore, it is assumed that all Made Ground arisings will be excess and require off-site disposal, i.e. the 'total fill' volume has been subtracted from the natural strata cut volumes to estimate the likely volume of excess natural soils arisings.

**Table 3-2 Cut and fill volumes**

| Option            | Cut –<br>Made<br>Ground | Cut -<br>Natural<br>Strata | Total cut                 | Total fill<br>required  | Earthworks<br>balance | Excess –<br>Made Ground  | Excess -<br>Natural Strata<br>after fill |
|-------------------|-------------------------|----------------------------|---------------------------|-------------------------|-----------------------|--------------------------|------------------------------------------|
| Option 1          | 1,950m <sup>3</sup>     | 3,750m <sup>3</sup>        | <b>5,700m<sup>3</sup></b> | 100m <sup>3</sup>       | 5,600m <sup>3</sup>   | 1,950m <sup>3</sup>      | 3,650m <sup>3</sup>                      |
| Option 2          | 2,200m <sup>3</sup>     | 3,750m <sup>3</sup>        | <b>5,950m<sup>3</sup></b> | 350m <sup>3</sup>       | 5,600m <sup>3</sup>   | 2,200m <sup>3</sup>      | 3,400m <sup>3</sup>                      |
| <b>Difference</b> | <b>250m<sup>3</sup></b> | <b>-</b>                   | <b>250m<sup>3</sup></b>   | <b>250m<sup>3</sup></b> | <b>-</b>              | <b>+250m<sup>3</sup></b> | <b>-250m<sup>3</sup></b>                 |

Overall, it is considered that Option 2 will offer a cost effective and sustainable remediation option for the site. The contamination source will be removed, there is no need to import additional soils to the site as a clean cover system will no longer be required.

### Contingency

The options appraisal presented above is based on the data obtained from the exploratory holes formed as part of the 2017 and 2023 site investigations undertaken at the site. The information available indicates that the Made Ground is likely to be absent in the western part of the site and that the thickness of this stratum is likely to increase towards the east. The maximum thickness of Made Ground (2.4m), was reported in the north-eastern part of the site (see Figure 3-2). The site investigation data together with the information on the site history has been used to extrapolate the likely shallow ground conditions between and outside the exploratory locations.

It is possible that the earthworks and remediation works uncover a more substantial thickness or extent of Made Ground than indicated by the site investigation data and calculated by the GIS modelling. In order to provide flexibility within the construction phase then the Client has indicated a will to retain the ability to apply Option 1 (breaking pathway through a cover system). Option 1 could be applied in any areas where soft landscaping is proposed and where significant thickness of residual Made Ground is encountered.

## 4 Remediation strategy

### 4.1 Introduction

**Remediation strategy:** full removal of residual Made Ground that remains in the private garden and soft landscaping areas of the development following the cut and fill earthworks. Disposal of surplus arisings from the cut and fill and the remediation works to a suitably licensed facility. Re-use of site-won natural soils to build the site levels back up to formation following the completion of the remedial works.

This remediation strategy chapter:

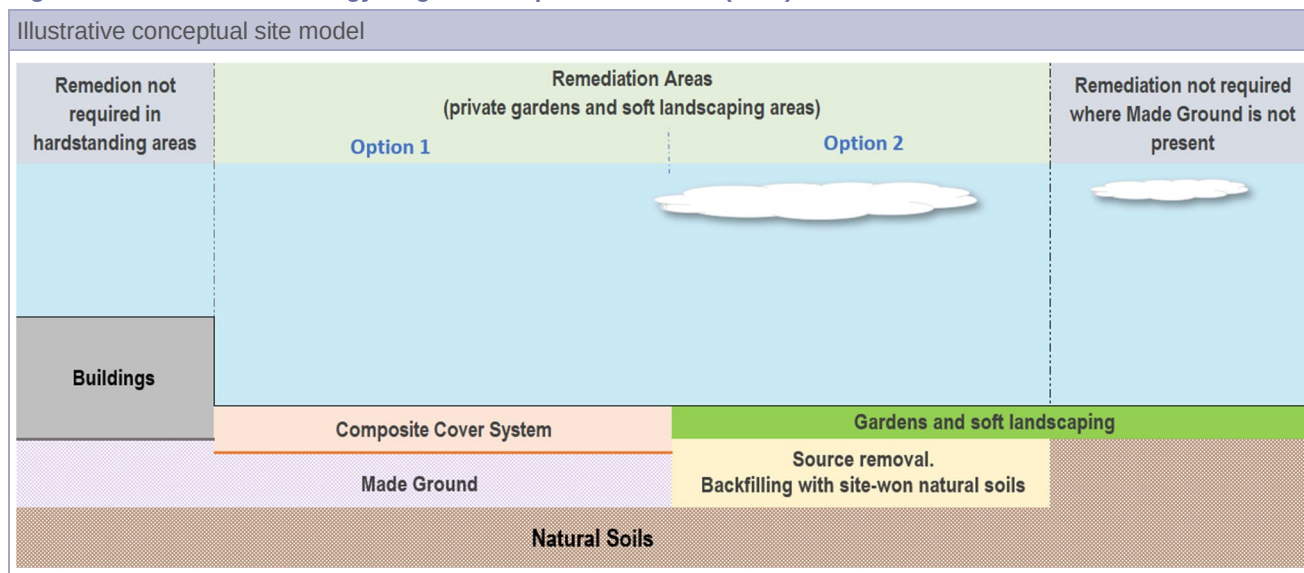
- Describes: source removal of Made Ground down to natural strata, off-site disposal of surplus soils to suitably licensed waste facility, and reuse of site-won natural soils.
- Includes a verification plan setting out compliance criteria and records/ lines of evidence that need to be captured during or after remediation and for subsequent inclusion in the remediation Verification Report.

An alternative remediation of option involving installation of a composite cover system across the private residential garden and soft landscaping areas is also provided should a significant thickness of residual Made Ground be encountered during the earthworks/ remediation works that may render Option 1 unsuitable.

### 4.2 Remediation strategy stage - conceptual site model (CSM)

A simple illustration of the land contamination remediation strategy (LCRS) stage conceptual site model (CSM) is provided in Figure 4-1 to summarise where remediation will and will not be required for the proposed development. Both remediation options are included within the illustration.

**Figure 4-1 Remediation strategy stage - conceptual site model (CSM)**



### 4.3 Source removal

#### 4.3.1 Excavation works

As discussed in Section 3, most of the Made Ground will be removed from the site as part of the cut and fill earthworks. Any residual Made Ground that remains in the private garden/ soft landscaping areas of the development following the completion of the earthworks will need to be excavated and the natural stratum beneath exposed. The likely location(s) and approximate depths of the residual Made Ground are indicated in

Figure 3-3 GIS Image 2. The excavation works involving the removal of the residual Made Ground should be carried out under the supervision of a suitably qualified geoenvironmental engineer.

Upon completion, the geoenvironmental engineer shall inspect the formation level across all the private garden/ soft landscaping areas for remnants of Made Ground, which shall be removed if identified. Samples shall be obtained from the exposed natural soils for laboratory chemical analysis on an approximate 10m by 10m grid. The sides and base of any excavations should also be sampled. The results from the chemical analysis must meet the soil acceptability criteria (SAC) specified in Appendix A. If contaminant concentrations exceeding the specified criteria are reported, further excavation will need to be undertaken and new samples subsequently obtained. This process will need to be repeated until the SAC are met. Excavations shall be backfilled to the formation level using site-won natural soils only (see further details in Section 4.3.3).

The extents of the excavations will need to be surveyed before and after backfilling. The formation level will also need to be surveyed.

#### 4.3.2 Disposal of soils

The excavated soils from the cut and fill and remediation works shall be segregated, with Made Ground and natural soils placed in separate stockpiles pending off-site removal to a suitably licensed facility. The Made Ground soils shall be placed in a lined bund to protect the underlying natural soils from contamination. Classification of the soils should be undertaken in accordance with *Guidance on the Waste Classification and Assessment of Waste, Technical Guidance WM3*. Waste Acceptance Criteria (WAC) testing may also be required prior to disposal. The off-site disposal of the surplus soils must be undertaken in accordance with the Duty of Care and other relevant waste regulations.

#### 4.3.3 Reuse of natural soils

There will be a requirement to make up site levels in some areas of the development including where the excavations have been extended below the formation level to facilitate the complete removal of residual Made Ground. Only site-won natural soils shall be used for making up the site levels. Prior to re-use, samples must be obtained for laboratory chemical analysis to confirm chemical suitability of the material. The laboratory test results must meet the soil acceptability criteria (SAC) specified in Appendix A of this report.

#### 4.3.4 Finished cover soils.

In garden and soft landscaping areas proposed for planting where Made Ground is cut to natural strata, a suitable thickness of clean topsoil meeting the requirements of BS 3882 and the soil acceptability criteria (SAC) specified in Appendix A shall be laid to the requirements set out within the scheme landscaping specification. In areas of proposed turf, this shall include a minimum topsoil thickness of 150mm.

### 4.4 Cover system

If a significant thickness of residual Made Ground is encountered following the cut and fill earthworks and full source removal (Option 1) is not pursued, installation of a composite cover system will be implemented instead.

The composite cover system will comprise the following elements:

- A high visibility geotextile placed over the existing Made Ground soils.
- Placement of a thickness of suitably clean cover soils.

#### 4.4.1 Surface preparation

The surface of the Made Ground will need to be prepared to ensure that the geotextile base layer won't be damaged or punctured for example by sharp objects, metal fragments, angular stones/ masonry including during deployment and as the cover soils are placed above.

#### 4.4.2 Geotextile base layer

Geotextile base layer will need to be placed over the prepared Made Ground surface to create the lower layer of composite cover system. The main purpose of the geotextile is to prevent mixing between Made Ground and the overlying clean cover soils.

The placed geotextile shall:

- comprise a suitable nonwoven geotextile,
- be clearly identifiable to provide a visual deterrent and physical obstruction to future excavation (for example during future landscape maintenance works), and
- inhibit root penetration and prevent soil mixing by burrowing animals.

Table 4-1 provides parameters for the non-woven geotextile which will need to be specified and selected by the contractor, it is anticipated that 'Terram Hi-Vis' or similar will be suitable.

**Table 4-1 Non-woven geotextile parameters**

| Property                             | Value   | Unit               | Test Method  |
|--------------------------------------|---------|--------------------|--------------|
| Mass per unit area                   | >120    | g/m <sup>2</sup>   | BS EN 965    |
| Tensile strength at peak             | >7.5    | kN/m               | EN ISO 10319 |
| Tensile elongation at max. load      | 28      | %                  | EN ISO 10319 |
| Trapezoidal tear resistance          | >275    | N                  | ASTM D4533   |
| Pore Size - Mean AOS O <sub>90</sub> | 130-160 | Mm                 | EN ISO 12956 |
| Permeability @ 5cm head              | 80-110  | l/m <sup>2</sup> s | EN ISO 11058 |

Note: the geotextile will need to be permeable to allow rainfall infiltration. The selected geotextile will need to be laid into the earthworks in accordance with the supplier's installation guidelines appropriate for deployment scenario. The contractor shall keep detailed records including product datasheets, delivery tickets, deployment location details (including plan and elevations) and photos of all geotextile laid.

The presence, location and purpose of the geotextile will need to be communicated to future maintenance and groundwork contractors to reduce the likelihood of accidental damage in the event of future excavation to greater depths.

#### 4.4.3 Cover soils thickness

A suitable thickness of clean cover soils (topsoil and/ or subsoil) will need to be placed above the geotextile base layer as part of the composite cover system. The required thickness depends on key factors including breaking the contaminant pathway/s, the likely depth of future soil mixing and protecting the underlying geotextile. Table 4-2 summarises the specified cover soil thicknesses for the site.

**Table 4-2 Cover soil thicknesses**

| Areas                | Private residential gardens |                                                                                     | Other soft landscaping areas |                                                                                       |
|----------------------|-----------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|
| Cover soil thickness | 600mm minimum               |  | 450mm minimum                |  |

The use of a composite cover system means that 'breaking the pathways' is not solely reliant on the thickness of cover soils. The geotextile base layer will prevent direct contact, mitigate dust generation and prevent natural soil mixing between the underlying Made Ground and the overlying cover soils. Therefore, preventing man-made soil mixing (for example from planned 'digging' or future maintenance) and protecting the underlying geotextile (from weather/ temperature degradation) become the driving factors.

Where the landscape design requires a total soil thickness greater than 600mm (for example tree pits) the landscaping design and site teams will need to ensure that the geotextile is either placed at the deeper Made Ground / Imported soil interface or at 600mm below the final soil surface to maintain a continuous presence of

the composite cover system across the remediation area. Detailed records will need to be maintained to inform the remediation Verification Report.

The elevation of the geotextile installation will be defined by the requirement to accommodate 600mm of total clean soils above it. For example, if the final garden levels will be 400mm above the earthworks formation level, the geotextile will be installed following the removal of an additional 200mm of Made Ground (below formation) in areas where residual Made Ground is identified.

#### 4.4.4 Cover soil suitability

Clean cover soils (including topsoil and subsoil) that are **geochemically 'suitable for use'** will need to be sourced, imported and placed within the private garden and soft landscaping areas as part of the composite cover system. Site-won natural soils can also be used in the construction of the cover system. Re-use of natural soils shall comply with the procedures and standards detailed within Appendix A of this report.

The geochemical suitability requirements for the imported and site-won cover soils are detailed in Appendix A. These criteria represent maximum geochemical threshold concentrations that shall not be exceeded within the cover soils used in the private garden and soft landscaping areas of the development.

The cover soils datasheet also includes a soil import flow chart, which includes key decision gateways relating to the supply, inspection and acceptability of the imported soil. This information has been produced as a separate datasheet/guide for ease of reference during construction.

The imported soils and the process of importing soil will need to comply with all relevant legislation. This remediation strategy has been prepared on the basis that soils will be sourced from onsite (natural soils only) or a recognised topsoil/soil provider as part of a direct purchase arrangement. However, if the soil is sourced by any other means, for example from another development/construction site or soil recycling facilities, then additional procedures will need to be implemented to ensure compliance with 'End of Waste' (EoW) procedures; such as *"The Definition of Waste: Development Industry Code of Practice, (CL:AIRE, 2011)"* and the use of a Materials Management Plan (MMP). (Note MMPs must be in place prior to the movement or transfer of soils).

## 4.5 Health and safety

The contractor responsible for the earthworks and remediation will need to consider health and safety with respect to any contamination present onsite including for example any personal protective equipment (PPE) that may be required. Therefore, the following observations are provided for information only.

Table 4-3 summarises potential contaminant linkages that were identified as part of the GQRA with respect to the health and safety of the construction workers.

**Table 4-3 Contaminant linkages - construction workers**

| CL  | Source                                                                    | Pathway                                   | Receptor                                                             |
|-----|---------------------------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| 401 | Contaminants within the Made Ground onsite (arsenic, lead, PAH compounds) | Ingestion, inhalation and dermal contact  | Health and safety (H&S) of site preparation and construction workers |
| 501 | Asbestos containing soils                                                 | Inhalation of liberated respirable fibres | H&S of site preparation and construction workers                     |

**CL401:** There are no published GACs for construction workers. The ground investigation reported a variable thickness of Made Ground onsite ranging from absent to 2.4m. The Made Ground contained fragments of brick, concrete, ash, clinker, tarmac and slate. The GQRA identified elevated concentrations of arsenic lead, benzo(b)fluoranthene and dibenzo(a,h)anthracene in one or more Made Ground samples. Potential ground contamination risks to construction workers associated with these types of contaminants can typically be mitigated by utilising appropriate personal protective equipment (PPE) and maintaining good hygiene.

**CL501:** Amosite asbestos (loose fibres) was identified in one Made Ground sample tested as part of the 2017 site investigation. The results from the quantification analysis indicated the asbestos concentration in the sample to be <0.001%. The Contractor will need to consider the asbestos in soils results from the site investigation data as part of their risk assessment and method statements (RAMS).

It is recommended that the risk assessment process includes reference to the Control of Asbestos Regulations (CAR, 2012) and the associated asbestos in soils guidance "*Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (shortened name CAR-Soil, 2016)*" and includes consideration of the Joint Industry Working Group (JIWG) Asbestos in Soil and Construction and Demolition "Decision Support Tool" for the "*Categorisation of Work Activities Involving Asbestos in Soil and Construction & Demolition Materials in accordance with the Control of Asbestos Regulations 2012*" (March 2017)". The JIWG tool includes consideration of PPE and Respiratory Protective Equipment (RPE) and dust mitigation requirements.

## 4.6 Unexpected contamination

Should any previously unidentified contamination (by visual or olfactory means) be encountered during development, then appropriate actions will need to be implemented to ensure that additional remediation actions can be taken (if required).

The Contractor will be responsible for ensuring that suitable 'unexpected contamination' procedures are in place. Unexpected contamination – preliminary guide (106240-PEF-XX-XX-RP-GG-600003, November 2023) is included in Appendix B, which includes key considerations and a decision tree (flow chart).

## 5 Verification

The remediation activities described above will need to be verified and reported to demonstrate that the remediation strategy has been fully implemented and to provide a permanent record of the remediation works undertaken on the site.

### 5.1 Record keeping

It is essential that the contractor collates and maintains accurate records of the remediation onsite for inclusion in the verification report. A list of required records is summarised in Sections 5.2 and 5.3.

### 5.2 Verification inspections and sampling

Remediation verification inspections will need to be undertaken by a suitably qualified geoenvironmental specialist. The following verification activities need to be undertaken and recorded:

#### **Source removal:**

- Supervision of the source removal works as described in Section 4.3.1.
- Inspection, sampling, and assessment of the formation level (and excavated areas) to confirm full removal of the Made Ground and geochemical suitability of the exposed natural soils.
- Inspection, sampling, and assessment of the segregated natural soils prior to the re-use onsite against soil acceptability criteria (SAC).

#### **Cover system**

- Inspection and mapping of the high visibility geotextile to confirm presence and correct placement.
- Inspection, sampling, analysis and assessment of imported and/ or site-won natural soils against soil acceptability criteria(SAC) to confirm geochemical suitability of the cover soils.
- Inspection of placed cover soils to confirm depth/ thickness (based on inspection pits, with photographs showing a scaled marker indicating that the necessary thickness has been achieved).

### 5.3 Verification reporting

A remediation verification report will need to be prepared once remediation is complete. The verification report will need to include:

#### **Source removal**

- Copies of the site surveys carried out as part of the remediation works (pre and post backfilling).
- Records and photographs from verification inspection(s).
- Details of the validation sampling (plans, photographs, dates, sample descriptions, depths).
- Copies of laboratory test results (verification sampling, waste classification etc.)
- Screening of the laboratory test results against the specified criteria.
- Records of any deviations/ soil quality failures and corrective actions taken.
- Copies of waste transfer notes for all the excavated arisings sent offsite.
- Site records relating to the placement of re-used of soils (location, volume etc.)

#### **Cover system - geotextile:**

- Manufacturer's supply records for geotextile including product information datasheets, technical specification details and available manufacturers testing records.
- Delivery notes for the geotextile (dates and quantities)
- Plans and photographs showing the location and installation of the geotextile.
- Records of any deviations/defects and the actions/measures undertaken to rectify these issues.
- Where applicable, copies of waste transfer notes for all excavated arisings sent offsite.

### **Imported soils:**

- Pre-import geochemical analyses data for all imported topsoil/ subsoil materials.
- Copies of laboratory test data for the site-won soils tested prior to reuse.
- Supplier details for the imported soils (company name and address and source site name and address).
- Delivery notes for all imported soils (dates and quantities)
- Copy of Material Management Plan (MMP) if used.
- Site records showing the location where imported/ site-won soils have been deployed over time (if multiple suppliers are used, the destination of the soil will need to be recorded for each supplier).
- Verification sampling and inspection plans, photos, and records including
  - o Cover soil thickness confirmation (at each location)
  - o Soil sample dates, locations, and depths
  - o Geochemical laboratory analysis results:
- Assessment of the soil sample geochemical results against the remediation assessment criteria.
- Records of any deviations/soil quality failures and the corrective actions taken.

### **Additional records**

- Summary of remedial works undertaken including any variations to the remediation strategy.
- Copies of all appropriate correspondence including regulatory agreements.
- Details of unexpected contamination encountered including plans showing locations and depths and records of actions taken.
- Any additional records to demonstrate/ verify that the remedial works have been undertaken in accordance with remediation strategy.

## 6 Limitations and Liabilities

This report has been prepared by Pell Frischmann with reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the Client in accordance to the agreed scope of services.

This report has been prepared to provide pre-development geoenvironmental and land contamination information for the redevelopment of the Longhurst Road site. The report contents should only be used in that context and Pell Frischmann disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

The report details the findings of work carried out by Pell Frischmann during a study period from October to November 2023. The report has been prepared based on available information obtained during that study period. Information provided by the referenced third parties has been used in good faith and is taken at face value; however, Pell Frischmann cannot guarantee its accuracy or completeness.

Although every reasonable effort has been made to gather all relevant information within the context of the agreed scope of work, all potential environmental constraints or liabilities associated with the site may not have been revealed. Should additional information become available (including new legislation and changed practices), after the date of the report submission, Pell Frischmann reserves the right to reconsider the recommendations and alter the report accordingly.

Notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds such as Japanese knotweed, this report does not constitute a formal or specific survey of these potential development hazards. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance.



| Introduction                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                            |
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| Title                                         | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |
| Project                                       | Longhurst Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |                            |
| Report Title                                  | Remediation strategy: imported soil and natural strata acceptability and procedure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |
| Prepared by                                   | Pell Frischmann                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Prepared for | Great Places Housing Group |
| Document ref.                                 | 106240-PEF-XX-XX-RP-GG-600002_P02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Date         | 24 January 2024            |
| Introduction                                  | <p>Pell Frischmann have been commissioned by Great Places Housing Group ('the client') to provide land contamination risk management support for the proposed redevelopment at Longhurst Road. The Generic Quantitative Risk Assessment (GQRA) report (ref. <a href="#">106240-PEF-XX-XX-RP-GG-600001</a>), prepared by Pell Frischmann, concluded that remediation was required in the private garden and soft landscaping areas of the proposed development.</p> <p>Topsoil/ subsoil may need to be imported onsite as part of the remediation works if composite cover system is to be installed in the private garden and soft landscaping areas. These soils will need to be 'suitable for use' to prevent "new contamination" risks from being introduced to the site during construction. Therefore, soil acceptability criteria (SAC) and appropriate soil import procedures will need to be in place, as outlined in this document.</p> <p><i>Note: this document relates to soils that are potentially imported to the site. However, site-won natural soils, if re-used in the private garden and soft landscaping areas of the proposed development, will also need to be assessed for their chemical suitability to ensure that they meet the SAC (specified in this document) prior the final placement.</i></p> |              |                            |
| Aims and limitations                          | <p>This document summarises the soil import acceptability process for assessing topsoil and subsoil suitability with respect to land contamination risk management (LCRM) and also for re-use of site-won clean natural strata, including:</p> <ul style="list-style-type: none"> <li>➤ Soil import procedure flow chart,</li> <li>➤ Soil Acceptability Criteria (SAC) limit values,</li> <li>➤ Soil sampling frequencies.</li> </ul> <p>The contractor will be responsible for identifying appropriate soil sources and ensuring that the imported soils meet the requirements set out in this document and that these principles are also applied to the re-use of natural strata where applicable. For imported soils, this document is based on soils being imported from a supplier under delivery tickets, therefore End of Waste processes (for example DoWCoP Material Management Plans) are not included.</p>                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |
| Background                                    | <p>This document forms part of the Pell Frischmann <a href="#">Remediation Strategy (ref. 106240-PEF-XX-XX-RP-GG-600002_P02, January 2024)</a>. The remediation option involving installation of a 'composite clean cover system' includes the need to source, import, place and verify suitable/ clean topsoil/ subsoil onsite. Remediation details including objectives, locations and depth of soil are provided in the Remediation Strategy and are not repeated here.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |                            |
| Soil import acceptability procedure key steps | <p>Figure 1 summarises the soil import acceptability sequence.</p> <p><b>Figure 1 Soil import acceptability sequence</b></p> <pre> graph LR     A[Identify soil sources] --&gt; B[assess suitability]     B --&gt; C[import &amp; inspect]     C --&gt; D[place soils &amp; record]     D --&gt; E[verify &amp; report] </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |                            |

### Introduction

| Title                  | Details                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soil import flow chart | <p>A flow chart summarising the process that should be followed when importing soils (from offsite sources) is shown in the Figure 3 flow chart on Page 7.</p> <p>The chart includes key decision gateways relating to the supplier, inspection and acceptability of the imported soil.</p>  |

### Soil types

| Title                              | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soil sources                       | <p>Potential soil sources typically include (in order of likelihood):</p> <ol style="list-style-type: none"> <li>Topsoil/subsoil supplier (including manufactured soil),</li> <li>Natural uncontaminated soil (in-situ/unexcavated, at another construction site),</li> <li>Natural uncontaminated soils (excavated and stockpiled on another construction site),</li> <li>Soil from soil treatment/waste transfer station (stockpiled).</li> </ol> <p>The contractor should aim to identify soil that originates from sites with no history of potentially contaminative land-uses (e.g. greenfield sites not subject to past contaminative use), that is free from asbestos and where satisfactory information is available to confirm the provenance of the soil. If soils are being sourced from brownfield sites, only the natural soils can be considered and only when the natural soils have been extensively characterised and proven to be clean.</p> <p>The soil import screening process will need to consider soil source type when determining pre-import acceptability and post import verification sample frequency. The geochemical composition of manufactured soils (a, above) is likely to be more variable than natural soils (b) and (c). Natural soils from brownfield sites (including b and c above) require detailed sampling and analysis (to ensure that natural soils have been segregated from Made Ground/potential contamination). Manufactured soils from a soil treatment/waste transfer stations (d) can be highly variable and require more detailed sampling and analysis.</p> |
| Assess suitability prior to import | <p>Soil from potential sources will need to undergo suitable sampling, analysis and assessment to characterise the soils and to assess whether the imported soils are 'suitable for use' (Figure 2). Soils must not be imported to site without an upfront assessment of suitability.</p> <p><b>Figure 2 Sampling, analysis and assessment</b></p>  <p>* limit values are included in this report.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### Introduction

| Title                                                       | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                                 |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
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| Landscaping criteria for plant growth (topsoil and subsoil) | <p>The landscape team's topsoil specification will likely include reference to the British Standards BS3882:2015 Specification for Topsoil. BS3882:2015 includes geochemical thresholds for the potentially phytotoxic elements zinc (Zn), copper (Cu) and Nickel (Ni) only, and pH, summarised in Table 1.</p> <p>BS3882:2015 does not include geochemical thresholds that are protective of human health in the context of land contamination risk assessment or remediation. This document provides additional geochemical thresholds (see Table 4 Soil Acceptability Criteria, SAC) that should be referenced when determining the suitability of imported soils with respect to land contamination and human health.</p> <p><b>Table 1 BS3882:2015 Table 1 (extract) Potentially phytotoxic elements (by soil pH)</b></p> <table><tr><th rowspan="2">Substance</th><th colspan="3">Threshold concentration (mg/kg)</th></tr><tr><th>Soil pH &lt;6.0</th><th>Soil pH 6.0 – 7.0</th><th>Soil pH &gt;7-8.0</th></tr><tr><td>Copper, Cu (Nitric acid extractable)</td><td>&lt;100</td><td>&lt;135</td><td>&lt;200</td></tr><tr><td>Nickel, Ni (Nitric acid extractable)</td><td>&lt;60</td><td>&lt;75</td><td>&lt;110</td></tr><tr><td>Zinc, Zn (Nitric acid extractable)</td><td>&lt;200</td><td>&lt;200</td><td>&lt;300</td></tr><tr><td>pH</td><td colspan="3">5.5 – 8.5 pH</td></tr></table> <p>This land contamination soil acceptability guidance will need to be incorporated into the landscape soil specification to ensure that the soils will be 'suitable for use'.</p> | Substance         | Threshold concentration (mg/kg) |  |  | Soil pH <6.0 | Soil pH 6.0 – 7.0 | Soil pH >7-8.0 | Copper, Cu (Nitric acid extractable) | <100 | <135 | <200 | Nickel, Ni (Nitric acid extractable) | <60 | <75 | <110 | Zinc, Zn (Nitric acid extractable) | <200 | <200 | <300 | pH | 5.5 – 8.5 pH |  |  |
| Substance                                                   | Threshold concentration (mg/kg)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |                                 |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
|                                                             | Soil pH <6.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Soil pH 6.0 – 7.0 | Soil pH >7-8.0                  |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
| Copper, Cu (Nitric acid extractable)                        | <100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <135              | <200                            |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
| Nickel, Ni (Nitric acid extractable)                        | <60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <75               | <110                            |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
| Zinc, Zn (Nitric acid extractable)                          | <200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <200              | <300                            |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |
| pH                                                          | 5.5 – 8.5 pH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                                 |  |  |              |                   |                |                                      |      |      |      |                                      |     |     |      |                                    |      |      |      |    |              |  |  |

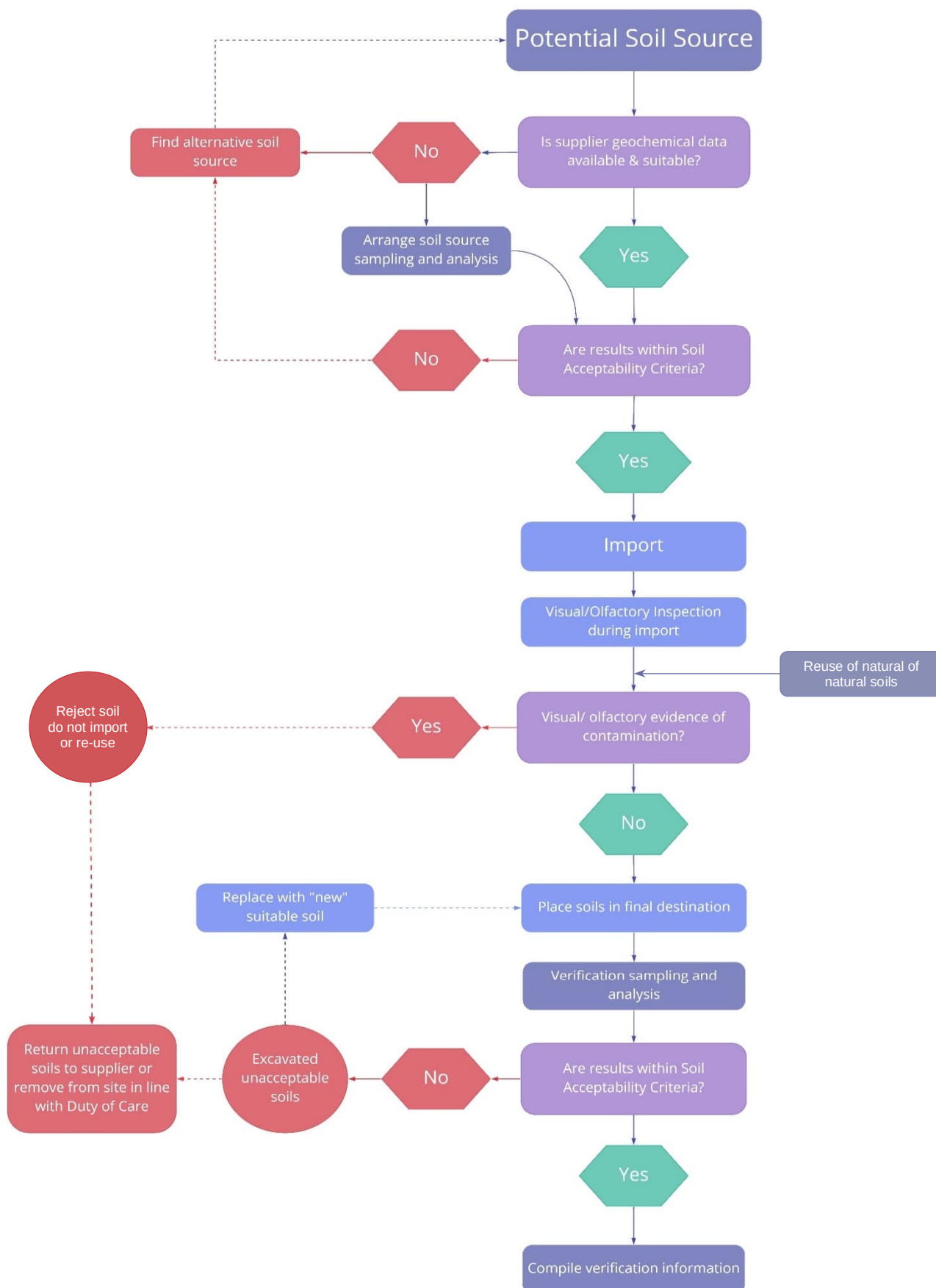
| Soil acceptability                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Title                                                             | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Introduction                                                      | <p><b>Geochemical suitability:</b> There are multiple factors that need to be considered when determining if soils will be suitable for their intended use. The SAC in this guide should be used to assess the geochemical suitability of soils.</p> <p>Other factors such as geotechnical suitability and certainty of use are not covered by this guide.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Background                                                        | <p>Published land contamination Generic Assessment Criteria (GAC) have predominantly been used to determine SAC for the scheme.</p> <p>Published GACs refer to Category 4 Screening Levels (C4SLs) and Suitable 4 Use Levels (S4ULs) published by Defra and Land Quality Management (LQM)/ Chartered Institute of Environmental Health (CIEH) respectively.</p> <p>GACs have been published for several land use scenarios. The proposed soil placement will predominantly be in areas of the private gardens. Therefore, the GACs for residential with home grown produce (RwHP) land use scenario have been referenced in the first instance as the basis of Soil Acceptability Criteria (SAC) for imported/ reused soils.</p> <p>As the imported soil is intended for landscaping/planting, the hydrocarbon thresholds were selected assuming a Soil Organic Matter of 6%, to reflect the inherently organic nature of typical topsoil.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Soil acceptability criteria (SAC) and Soil Screening Values (SSV) | <p><b>Soil Acceptability Criteria (SAC)</b> for the imported soils are summarised in Table 4.</p> <p>Table 4 also includes Soil Screening Values (SSV) for some contaminants or groups of contaminants. The SSV are typically lower than the GAC based human health thresholds and consider additional factors linked to the movement/import/reuse of soil and the waste/material regime within which these activities take place (such as: only clean naturally occurring soils can be imported under a Material Management Plan; potential future Waste Classification/disposal costs of any out of spec soils and reducing risks to the overall scheme) and soil saturation limits.</p> <p><b>Soil Screening Values (SSV):</b> can enable less expensive geochemical analysis to be undertaken to initially screen soil samples. If the results are within the SACs (for contaminants without SSVs) and the SSV (for specified contaminant groups), then the soils would be considered geochemically suitable for reuse. If the geochemical analysis results pass the SAC but fail the SSV the soils can either:</p> <ol style="list-style-type: none"> <li>Be considered unsuitable for reuse, or</li> <li>Additional speciated analysis can be undertaken (for the contaminant groups that fail the SSV) to enable comparison with speciated SAC. If the more detailed results pass all SAC, then the sample can be considered suitable for use (even if the respective SSV are exceeded).</li> </ol> <p>SSVs have been included for organic/hydrocarbon contaminants including total polyaromatic hydrocarbons (PAHs) and 'sum of BTEX' (Benzene, Toluene, Ethylbenzene and Xylene).</p> <p>Where there is any doubt about the suitability of a soil source or individual soil samples, specialist advice should be sought from a suitably experienced land contamination consultant.</p> |
| Pre-import soil sampling and analysis                             | <p>Geochemical data for each and any potential topsoil and subsoil source should be assessed prior to import. It is anticipated that the sample data will be provided by the soil supplier. <i>Results from one soil sample, including from composite samples, is not considered satisfactory. Composite soil sampling should not be undertaken/accepted.</i></p> <p>If the supplier is unable to provide suitable data, then the contractor will need to arrange for appropriate soil samples to be collected (at source where possible) and analysed. The minimum number of soil samples required is summarised in Table 2.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Soil acceptability                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
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| Title                                                                                                                                                                                                                                                                     | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Pre-import soil sampling and analysis (cont)                                                                                                                                                                                                                              | Table 2 Pre-import sampling and analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | Pre-import sampling (per soil source)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Samples collected (minimum) | Samples analysed (minimum) |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | 1. Import quantity up to 150m³                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5 (min)                     | 3 (min)                    |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | 2. Import quantity over 150m³ (1 above) <b>plus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | + 1 per 50m³                | + 1 per 50m³               |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | Minimum number of samples based on source type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | Topsoil/subsoil supplier (a) (not waste treatment centre)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5 (min)                     | 3 (min)                    |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | Natural uncontaminated soil (b) and (c)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7 (min)                     | 5 (min)                    |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | Soils from soil treatment/waste transfer station (d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 9 (min)                     | 7 (min)                    |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | <i>We recommend collecting more samples than you plan to analyse. If the initial results show geochemical variability, then the ‘spare’ samples can be scheduled for analysis.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
|                                                                                                                                                                                                                                                                           | <i>Waste Acceptance Criteria (WAC) analysis results are <b>unsuitable</b> and shall <b>not</b> be used for assessing the suitability and acceptability of soils to be imported or reused onsite.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Once a preferred soil source (or sources) has been identified, additional verification sampling and analysis needs to be undertaken to ensure compliance with the soil acceptability criteria (SAC) and soil screening values (SSVs) of the actual soil imported to site. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Site won natural soils                                                                                                                                                                                                                                                    | <p>Reuse of clean naturally occurring soils will be acceptable where there is a defined need for these materials as part of construction and where they meet the requirements laid out within the following sections and are subject to the same inspection and testing regime as imported soils. Natural soils to be re-used must meet the SAC detailed within Table 4. Procedures for natural soils subject to re-use are also included within the flow chart detailed within Figure 3.</p> <p>Where site-won natural soils do not meet the requirements for re-use, these shall be removed from site under the appropriate waste legislation duty of care.</p> <p>Reuse of natural soils shall be subject to the same requirements of records detailed below such that these records will be available for inclusion within the remediation Verification Report.</p>                                                                                                                                                                                                                                                                                             |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Verification sampling and analysis                                                                                                                                                                                                                                        | <p>Verification sampling and analysis will need to be undertaken to ensure that the soil imported to site comply with the soil acceptability criteria (SAC) and soil screening values (SSV). Verification samples can be collected from stockpiles of imported soil prior to placement or from the final destination i.e. after soils have been placed.</p> <p>The minimum number of soil verification samples that should be collected and scheduled for geochemical analysis are summarised in Table 3.</p> <p>Table 3 Verification sampling and analysis</p> <table><tr><td>Verification sampling</td><td>Samples collected (minimum)</td><td>Samples analysed (minimum)</td></tr><tr><td>Quantity &lt;150m³</td><td>5 (min)</td><td>3 (min)</td></tr><tr><td>Quantity &gt;150m³</td><td>5 (min) plus 1 per 50m³</td><td>3 (min) plus 1 per 50m³</td></tr></table> <p><i>We recommend collecting more samples than you plan to analyse. If the initial results show geochemical variability, then the ‘spare’ samples can be scheduled for analysis. The Contractor will need to allow sufficient time for sampling, analysis, reporting and assessment.</i></p> |                             |                            | Verification sampling | Samples collected (minimum) | Samples analysed (minimum) | Quantity <150m³ | 5 (min) | 3 (min) | Quantity >150m³ | 5 (min) plus 1 per 50m³ | 3 (min) plus 1 per 50m³ |
| Verification sampling                                                                                                                                                                                                                                                     | Samples collected (minimum)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Samples analysed (minimum)  |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Quantity <150m³                                                                                                                                                                                                                                                           | 5 (min)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3 (min)                     |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Quantity >150m³                                                                                                                                                                                                                                                           | 5 (min) plus 1 per 50m³                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3 (min) plus 1 per 50m³     |                            |                       |                             |                            |                 |         |         |                 |                         |                         |
| Inspection                                                                                                                                                                                                                                                                | <p>Visual/olfactory inspection shall be undertaken to screen for the presence of any of the following as imported soil is delivered/unloaded onto site:</p> <ol style="list-style-type: none"><li>1. Black staining</li><li>2. Hydrocarbon (fuel/oil type) staining/odours</li><li>3. Man-made objects (greater than 10mm diameter)</li><li>4. Fibrous materials and/or cement bonded materials</li><li>5. Other deleterious materials including refuse, plastic, metal, fabric, tarmacadam etc .</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |                            |                       |                             |                            |                 |         |         |                 |                         |                         |

| Soil acceptability                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Title</i>                          | <i>Details</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                       | Soils containing any of the above should be considered unsuitable and should not be accepted or used onsite. Suitable arrangements will need to be made to reject and return unacceptable soils.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Out of specification materials</i> | <p>Any 'out of specification' material (either by visual inspection or laboratory analysis) must be segregated and removed from site.</p> <p>Stockpile management must be implemented to ensure that all soils excavated on-site are kept separate from imported soils.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Records</i>                        | <p>The following records shall be collected and summarised in the remediation Verification Report':</p> <ol style="list-style-type: none"><li>1. Soil source – site name and location and supplier details (name and address),</li><li>2. Pre-import geochemical data,</li><li>3. Import – delivery tickets including date and volume,</li><li>4. Post import:<ol style="list-style-type: none"><li>a. Photographic records and sample location plans</li><li>b. Geochemical laboratory analysis data</li><li>c. Soil acceptability screening outcomes</li><li>d. Records of any out of specification materials and actions taken to demonstrate that unsuitable soils were removed from site and replaced with suitable soils</li></ol></li></ol> |

## Soil import flow chart

Figure 3 Soil import and natural soil reuse flow chart



## Soil Acceptability Criteria (SAC)

**Table 4 Soil Acceptability Criteria (SAC)**

| Determinant                        | Soil Screening Values (SSV) | Residential with homegrown produce (RwHP) |
|------------------------------------|-----------------------------|-------------------------------------------|
| Metals and metalloids              |                             |                                           |
| Arsenic                            |                             | 37                                        |
| Boron (w/s)                        |                             | 290                                       |
| Cadmium                            |                             | 26                                        |
| Chromium III                       |                             | 910                                       |
| Chromium VI                        |                             | 21                                        |
| Copper                             | 100, 135, 200 (see Note 1)  | 2,400                                     |
| Lead                               |                             | 200                                       |
| Mercury                            |                             | 40                                        |
| Nickel                             | 60, 75, 110 (see note 1)    | 180                                       |
| Selenium                           |                             | 250                                       |
| Vanadium                           |                             | 410                                       |
| Zinc                               | 200 or 300 (see Note 1)     | 3,700                                     |
| Other                              |                             |                                           |
| Asbestos                           |                             | No asbestos in soils (not detected)       |
| pH value                           |                             | 5.5 to 8.5 pH                             |
| Polyaromatic Hydrocarbons (PAHs)   |                             |                                           |
| Total PAHs (USEPA 16)              | ≤100                        |                                           |
| Benzo(a)anthracene                 |                             | 13                                        |
| Benzo(a)pyrene                     |                             | 5                                         |
| Benzo(b)fluoranthene               |                             | 3.7                                       |
| Chrysene                           |                             | 27                                        |
| Dibenz(ah)anthracene               |                             | 0.3                                       |
| Indeno (1,2,3-cd)pyrene            |                             | 41                                        |
| Napthalene                         |                             | 13                                        |
| Phenanthrene                       |                             | ≤100                                      |
| Total Petroleum Hydrocarbons (TPH) |                             |                                           |
| Total TPH screening value          | <1,000                      |                                           |
| Aliphatic >C5-C6                   |                             | 160                                       |
| Aliphatic >C6-C8                   |                             | 530                                       |
| Aliphatic >C8-C10                  |                             | 150                                       |
| Aliphatic >C10-12                  |                             | 760                                       |
| Aromatic >C5-7 (benzene)           |                             | 300                                       |
| Aromatic >C7-8 (toulene)           |                             | 660                                       |
| Aromatic >C8-10                    |                             | 190                                       |
| Aromatic >C10-12                   |                             | 380                                       |
| Aromatic >C12-16                   |                             | 660                                       |
| Aromatic >C16-21                   |                             | 930                                       |

|                              |                                                                                                                                                      |      |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| BTEX                         |                                                                                                                                                      |      |
| BTEX soil screen value (SSV) | <6                                                                                                                                                   |      |
| Benzene                      |                                                                                                                                                      | 0.87 |
| Notes                        |                                                                                                                                                      |      |
| Note 1                       | The SACs listed for copper, nickel and zinc consider BS3882:2015 (see Table 1) which typically specifies lower thresholds (compared to POSpark GAC). |      |
| Note 2                       |                                                                                                                                                      |      |
|                              | All concentrations mg/kg unless otherwise stated                                                                                                     |      |

This report is to be regarded as confidential to our Client and is intended for their use only and may not be assigned except in accordance with the contract. Consequently, and in accordance with current practice, any liability to any third party in respect of the whole or any part of its contents is hereby expressly excluded, except to the extent that the report has been assigned in accordance with the contract. Before the report or any part of it is reproduced or referred to in any document, circular or statement and before its contents or the contents of any part of it are disclosed orally to any third party, our written approval as to the form and context of such a publication or disclosure must be obtained.

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|-------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|-----------|-----------|
| <b>Report Ref.</b>                              |      | App A_106240-PEF-XX-XX-RP-GG-600002_P02 Imported Soil Acceptability Criteria_Longhurst Rd.docx                                                                                                                                                                                                                                                                                                                                                                                                                  |             |            |           |           |
| <b>File Path</b>                                |      | <a href="https://pellf.sharepoint.com/sites/ICNFramework2020/Shared Documents/Longhurst Road/01 - WIP/Documents/GG Geoenvironment/01 Reports/Appendices RS/App A_106240-PEF-XX-XX-RP-GG-600002_P02 Imported Soil Acceptability Criteria_Longhurst Rd.docx">https://pellf.sharepoint.com/sites/ICNFramework2020/Shared Documents/Longhurst Road/01 - WIP/Documents/GG Geoenvironment/01 Reports/Appendices RS/App A_106240-PEF-XX-XX-RP-GG-600002_P02 Imported Soil Acceptability Criteria_Longhurst Rd.docx</a> |             |            |           |           |
| Rev                                             | Suit | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Date        | Originator | Checker   | Approver  |
| P01                                             | S2   | Initial issue.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 07-Nov-2023 | A Tadayon  | J Barritt | J Barritt |
| P02                                             | S2   | Issue 2 following EHO comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 24-Jan-2024 | J Barritt  | A Boucher | A Boucher |
| Ref. reference. Rev revision. Suit suitability. |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |            |           |           |



| Title                             | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| Project                           | Longhurst Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Report Title                      | Unexpected Contamination, Preliminary Guide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Prepared by/for                   | Pell Frischmann for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Date                              | 09 November 2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Introduction                      | <p>If previously unidentified contamination or 'materials suspected of being contaminated' (by visual or olfactory means) are encountered during the development of the site suitable procedures will need to be in place to inform and guide actions and decisions. The Contractor will be responsible for ensuring that suitable procedures are in place for 'unexpected contamination'. Therefore, this document has been provided as a preliminary guide only.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Unexpected or 'new' contamination | <p>Residual or isolated pockets (hotspots) of unforeseen ground contamination may be encountered during site clearance/preparation, excavation and construction, which were not encountered during the site investigation.</p> <p><b>Waste arisings:</b> If unexpected contamination is encountered during excavation of Made Ground/'soil and stones' destined for offsite disposal, these arisings will need to be segregated and placed in dedicated stockpiles with suitable protection measures to prevent cross contamination of the underlying ground and prevent mixing or confusion with other materials/waste stockpiles (see below for additional considerations). Provided the contaminated soils are removed from site then this material will not need to be considered as part of the 'unexpected contamination procedure'. Note: waste management and waste classification/acceptance procedures are not provided in this report.</p> <p><b>Unexpected contamination (non-waste):</b> If unexpected contamination is encountered in any other areas of the site, contamination specialists should be consulted and suitable steps will need to be undertaken to determine whether additional remediation actions are required.</p> <p><b>These steps are outlined in the flow chart on page 2.</b></p>                                                                                               |
| Additional considerations         | <p>If contamination is encountered, the Contractor will also need to assess if additional or specialist H&amp;S measures are required, for example PPE. If contaminated materials are to be excavated the contractor will need to ensure segregation of excavated contaminated material, including:</p> <ul style="list-style-type: none"> <li>➤ Stockpile in a bunded, quarantined area,</li> <li>➤ Use protection measures under stockpiles to prevent cross contamination of underlying ground (where required),</li> <li>➤ Consider and where appropriate wrap stockpiles to prevent run-off. Contaminated run-off must not be allowed to enter drains or watercourses, or to discharge to and cross contaminate surrounding ground,</li> <li>➤ Label stockpiles to prevent mixing with all other waste arisings or stockpiled materials,</li> <li>➤ Any plant used to handle contaminated soils and stones will need to be washed/cleaned (drainage sealed) prior to handling any other materials or waste streams,</li> <li>➤ Tracking of vehicles through contaminated soils should be avoided and wheel-washing should be in place if tracking is unavoidable,</li> <li>➤ Waste soils and stones arisings will need to be sampled for laboratory analysis and the results will need to be assessed to classify the waste arisings in line with Duty of Care and technical guidance (e.g. TG WM3).</li> </ul> |
| Records                           | <p>Suitable records of remedial works must be kept for inclusion in the [remediation] verification report. These records will need to detail the works carried out, including but not limited to:</p> <ul style="list-style-type: none"> <li>➤ Plans showing the location (and depth) of the unexpected contamination encountered,</li> <li>➤ Photographic records,</li> <li>➤ Copies of laboratory data, sample location plans and waste classification results,</li> <li>➤ Site records of the remedial works,</li> <li>➤ Verification inspection records,</li> <li>➤ Waste transfer or consignment notes for contaminated material sent offsite.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

### Unexpected contamination flow chart



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|--------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|-----------|-----------|
| <b>Report Ref.</b>                                                             |      | 106240-PEF-XX-XX-RP-GG-600002 - Longhurst Road <b>Unexpected Contamination</b>                                                                                                                                                                                                                                                                                                                                                |             |            |           |           |
| <b>File Path</b>                                                               |      | <a href="https://pellf.sharepoint.com/sites/ICNFramework2020/Shared Documents/Longhurst Road/01 - WIP/Documents/GG Geoenvironment/01 Reports/Appendices RS/App B Unexpected contamination_Preliminary Guide.docx">https://pellf.sharepoint.com/sites/ICNFramework2020/Shared Documents/Longhurst Road/01 - WIP/Documents/GG Geoenvironment/01 Reports/Appendices RS/App B Unexpected contamination_Preliminary Guide.docx</a> |             |            |           |           |
| Rev                                                                            | Suit | Description                                                                                                                                                                                                                                                                                                                                                                                                                   | Date        | Originator | Checker   | Approver  |
| P01                                                                            | S2   | Initial issue                                                                                                                                                                                                                                                                                                                                                                                                                 | 09-Nov-2023 | A Tadayon  | J Barritt | J Barritt |
|                                                                                |      |                                                                                                                                                                                                                                                                                                                                                                                                                               |             |            |           |           |
| Ref. reference. Rev revision. Suit suitability (S2 – suitable for information) |      |                                                                                                                                                                                                                                                                                                                                                                                                                               |             |            |           |           |