
Remediation Method Statement

at
Land off Elmgrove Road,
Littlehampton,
BN17 6AH

for
BoKlok Housing Ltd

Report Reference: LP2466/RMS

Report Date: 12th March 2021

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EXECUTIVE SUMMARY

LEAP has been appointed by BoKlok Housing Ltd. to provide a remediation strategy at a site referred to as Land off Elmgrove Road, Littlehampton. The site comprises an approximately rectangular area extending to 2.56Ha. The site is located to the west of Elmgrove Road and to the south of the Littlehampton Academy. The site was previously used as a primary and secondary school, which was demolished around 2013. The site is now disused and partially occupied by two large stockpiles along the southern and western margins.

It is proposed to redevelop the site with 80No. residential dwellings with private gardens, an apartment block with 32No. additional residential dwellings, access roads, and two areas of public open space.

A Phase II Intrusive investigation of the site was completed in 2020. The investigation recorded the presence of elevated PAHs (specifically benzo(a)pyrene) within the made ground soils across the majority of the site, as well as one sample from the southern stockpile. No other contamination was identified anywhere else on site.

Further intrusive investigations have been undertaken in February 2021, across the site. These have concluded that the made ground soils across the site contain elevated levels of benzo(a)pyrene and naphthalene and that remediation will be required to mitigate risk to end users of the site.

The site has been separated into 3 Zones, with different recommendations given for each zone. A site wide strip of the top 200mm of soils is proposed with stripped soils to be screened for possible re-use in less sensitive parts of the site.

For Zone 1, covering the northern portion of the site, it is considered that the initial 200mm strip will be sufficient for removal of the contaminated soils subject to confirmatory testing at formation.

For Zone 2, the western portion of the site, further investigations are recommended following the removal of the stockpile in this area.

For Zone 3, covering the central and eastern parts of the site, a deeper strip is recommended to at least 500mm below original ground level and again subject to confirmatory testing of the formation.

Where unacceptably contaminated soils remain at depth below the stripped areas allowance should be made for further excavation to a maximum depth of 600mm below finished ground level and for the provision of a membrane topped with commensurate thickness of clean cover in the gardens.



It is recommended that all stripped formations are inspected and tested and imported material verified as clean and of suitable depth. A verification report outlining the remediation undertaken, will be required.

Further gas monitoring was also recommended and is underway at the time of writing. The results of the gas monitoring, gas risk assessment and any requirements for gas protection measures if required, will be presented separately once the monitoring has been completed.

Signed :	 Kleri Tantele BSc MSc FGS
Countersigned :	 Richard Brinkworth BEng CEng MICE
Date :	12 March 2021
Revision:	Issue 1

A INTRODUCTION

1 Authority

Leap Environmental Ltd (hereafter referred to as LEAP) has been appointed by Boklok Housing Ltd. to undertake an additional intrusive ground Investigation and provide a remediation strategy of a site referred to as Land off Elmgrove Road, Littlehampton, BN17 6AH. The instruction was given in an email dated 25th January 2021 and signed by Katherine Child of Boklok Housing Ltd.

2 Objective

LEAP understands that Boklok have recently purchased the site and it is proposed to redevelop the site with 80No. residential dwellings and an apartment block with 32No. additional residential dwellings. The development will include access roads, two areas of public open space, and private gardens.

The objective of this report is to provide a remediation strategy for the site.

3 Environmental Setting

3.1 Site Location and Description

The site comprises an approximately rectangular shaped plot of land covering roughly 2.56Ha and located to the west of Elmgrove Road and to the south of the Littlehampton Academy as shown in Figure 1.

The approximate National Grid Reference of the site is TQ 033 026. The site lies at an estimated elevation of 7.50 m Above Ordnance Datum (m AOD).

3.1.1 General Description and Boundaries

A concrete surfaced access road is present along the full length of southern boundary.

A large stockpile ~100 m long by ~25 m wide and ~2.0 m high, is present north of, and parallel to, the access road. The stockpile is covered by scrub vegetation and high grass. Six trial pits were undertaken into the northern side of this stockpile during LEAP's first investigation in 2020, revealing the composition in the excavated areas to be made ground comprising slightly sandy clayey gravel. The gravel included flint, chalk, brick, and concrete, with rare tile and plastic fragments.

The western quadrant of the site is predominantly occupied by a large stockpile that is also covered by grass and scrub vegetation. The approximate dimensions of the western stockpile are ~83 m long by ~55 m wide and ~3.50 m high in places. Two trial pits were undertaken



into this stockpile during LEAP's previous investigation. Ground conditions in the excavated areas comprised varying mixtures of clay, sand, and gravel. The gravel comprised flint, brick, and concrete, with rare asphalt, wood, tile, rubber seals, and plastic fragments. Organic odours were noted occasionally.

There is an area of open land ~20 m wide west of the stockpile, which is only accessible by walking over the stockpile. Along the western fence line there was an area of low lying ground ~350m² in area, possibly a soakaway for Fitzalan Road to the west, but it was dry at the time of the walkover and the base and sides were covered with semi-mature trees, grass and scrub vegetation. An asphalt covered track was observed adjacent to the east of the western stockpile, aligned north to south and connects the southern access road to a small area of asphalt covered hardstanding in the northwest.

The remainder of the site is a largely level scrub covered open field. There is a slight downwards incline from west to east and south to north (excluding the stockpiles). Locally there are smaller mounds of grass covered brick and concrete rubble in the central section of the site, and low-level demolition waste (brick, concrete, asphalt gravel) is visible at surface in many areas.

The site is bounded by the Littlehampton Academy to the north, a children's nursery to the east, with terraced residential properties beyond, an area of public open space (Rosemead Park) is located to the south of the site, additional residential properties are located to the southeast of the site. Fitzalan Road bounds the site to the west beyond which are residential properties.

4 Summary of Previous Investigations

The site has been the subject of previous works undertaken by LEAP and the reader is referred to these earlier reports which should be read in conjunction with this report.

In addition, two boreholes were drilled on site between the 8th January and 1st February 2021 by Wilson Bailey Geotechnical and Environmental for the installation of groundwater monitoring wells. Winter groundwater level monitoring is ongoing at the time of writing.

4.1.1 'Phase I Desk Study Site Reconnaissance & Phase II Site Investigation Report' at Land West of Elmgrove Road, Littlehampton, for BoKlok Housing Ltd. dated July 2020 (ref: LP2265) by LEAP.

The report outlines the findings of a desk study, site walkover, and intrusive investigation completed in June and July 2020. The intrusive investigation included 12 No. trial pits, and 7 No. windowless sampler boreholes. The investigation was followed by geotechnical and geoenvironmental laboratory testing of selected soil samples, as well as 2 No. gas monitoring visits.

Excluding the stockpiles, Made ground, was encountered across the site to between 0.25 and 0.5mBGL. Contamination testing identified that the shallow made ground soils across the site



were impacted by the polycyclic aromatic hydrocarbons (PAH) in particular benzo(a)pyrene. The deepest exceedance was encountered at 0.3m. It was thought likely that removal of old asphaltic cement (tarmacadam) during the demolition works of the school had caused mixing of PAHs contaminated fines into near surface soils. Concentrations above generic assessment criteria for a residential development with gardens were recorded in 7 No. locations across most of the site, and 1 No. location within the southern stockpile. It was recommended that the made ground in garden and soft landscaped areas be removed to 600mm or to natural ground, and that allowance should be made for further excavation of localised areas of deeper contaminated soils. It was also recommended that further investigations take place beneath the stockpiles once they are removed.

Slightly elevated carbon dioxide was recorded during the 2 No. gas monitoring visits. Further gas monitoring was recommended due to the high sensitivity of the proposed end use.

4.1.2 'Additional Investigation and Testing' at Elmgrove Road, for BoKlok Housing Ltd. by LEAP issued March 2021 ref. KT/21/LP2466

The report summarises the findings of a Phase III Site investigation undertaken by LEAP in February 2021. The investigation comprised 35No. trial pits to depths of up to 2.7mBGL.

Soil samples from several depths were tested for the presence of PAHs. 19No. exceedances were found (making the total between the two investigations 24).

Out of the 24No. exceedances, 16No. were within the top 0.2m of soil, and 8No. were between 0.2 and 0.5m. 2No. samples tested within 0.2m of GL were found to have exceedances of Naphthalene. 8No. samples of soil below 0.5m were tested, and no PAH exceedances were recorded in any of these. The exceedances were found across the majority of the site, excluding only the western portion. However, it should be noted that much of this is covered by a large stockpile, and investigations have yet to be conducted beneath this.

It was requested by the client that consideration be given to reusing site-won material for construction purposes. It is intended by the client to excavate the shallow soils, separate and dispose of the fines offsite, and stockpile the remaining aggregate (brick, concrete, blacktop and flint) for re-use during the construction. It was stated in LEAP's report that the separated fines would need to be tested in order to ascertain suitability for re-use for a different purpose, or for waste classification.

The Benzo(a)Pyrene contamination is considered to be related to coal tar containing blacktop which was incorporated into the underlying natural soils during demolition. Based on the elevated Benzo(a)Pyrene concentrations it is considered that any material segregation would need to separate the blacktop from the other aggregate or limit its re-use in accordance with EA guidance on use of treated asphalt waste. If segregated the blacktop would require disposal offsite (potentially as hazardous waste). Further testing of the blacktop material may be required to ascertain its classification for waste disposal. The inert aggregate, following blacktop removal may be suitable for onsite re-use subject to geotechnical and chemical testing and appropriate permitting or use under a regulatory position statement.



LEAP recommended that, in addition to the 200mm strip that will be taking place across the site, deeper stripping (to 500mm minimum) should be undertaken in the central and eastern portions of the site to remove contaminated soils (with allowance for deeper excavation of localised hotspots). Following this, clean cover should be used in areas of soft landscaping. It was also recommended that any material that is to be disposed of should be classified with WAC testing.

Investigations have yet to be undertaken beneath the footprint of the stockpiles on site, and so it was recommended that further investigations take place in these areas once the stockpiles are removed.

B REMEDIATION STRATEGY

5 Revised Conceptual Model

The revised risk assessment has identified benzo(a)pyrene contamination across the site within the top 0.5m of made ground soil and naphthalene contamination in two locations within the top 0.2m of made ground soil. Risks to groundwater are considered to be negligible. Ground gas monitoring is currently underway and a gas risk assessment will be undertaken under a separate cover once monitoring is completed. During the monitoring visits completed thus far, no elevated concentrations of either Methane or Carbon Dioxide have been measured and it is possible that no protection measures will be required. However, this will need to be confirmed following completion of the monitoring program.

Currently the benzo(a)pyrene and naphthalene contamination poses a risk to human health, where present in critical areas such as gardens or areas of soft landscaping. Contamination may impact human health through the direct ingestion, inhalation, skin contact and/or plant uptake pathways that would be present in a residential setting. The contaminated ground is considered to pose an unacceptable risk if it is to be retained in the near surface of garden/outdoor soft covered areas where direct human contact is feasible.

The contamination may pose a risk to incoming water via permeation into supply lines. The use of barrier pipes may be required by the water supplier.

Some remediation to mitigate risk to human health from benzo(a)pyrene and naphthalene impacted made ground soils will be required.

5.1 Remedial Measures

The above identified contaminants will pose a risk to human receptors where they are present in private garden and areas of soft landscaping. For ease of identification and remediation works the site has been zoned. The zones are outlined in Figure 3. The following protective measures are proposed. A site wide strip of the top 200mm of soils is proposed with a view retaining suitable soils for re-use in low sensitivity areas (e.g. beneath roads and hardstandings) following screening and testing.

Zone 1: Across the northern third of the site, all of the exceedances which were recorded fell within the top 200mm of soil. The proposed site-wide 200mm is considered sufficient for removal of the contaminated soils in Zone 1. However, it is proposed that confirmatory inspections be undertaken in proposed garden areas post-strip in order to identify any locally deeper potentially contaminated soils and to verify that the removal has been successful. If the exposed soils are proven to be free of contamination, no further remedial measures are considered necessary other than the provision of clean topsoil and subsoil as appropriate in the gardens.

Zone 2: Much of the western portion of the site is currently occupied by a large stockpile. Thus far, only two soil samples from the non-stockpile part of the western area have been tested. Both were found to be free of contamination. Once the stockpile is removed, and site wide strip is carried out further verification inspection and testing is proposed in garden and soft landscaped areas in order to ascertain whether the initial strip is sufficient (as for Zone 1) or whether deepened excavation is required (as for Zone 3).

Zone 3: Zone 3 encompasses the central and eastern portions (excluding the southern stockpile). Exceedances of B(a)P and naphthalene were found down to 0.5m, and all exceedances were within made ground soils. It is therefore recommended that a deeper strip be undertaken across this part of site, to 500mm below existing ground level.

In many areas of Zone 3 made ground was found to extend below 600mmBGL. As for Zones 1 and 2, once the 500mm strip is completed, verification inspection and testing of the formation is proposed in order to confirm that the deeper strip has been successful.

If more exceedances are found at this level, allowance should be made for provision of a membrane, and a minimum of 600mm of verified clean cover above this including at least 150mm topsoil. That is to say that the maximum excavation depth required in proposed garden areas is 600mm below finished ground level.

Stockpiles: As per the recommendations of the Phase II report, and in the absence of any information to the contrary, the soil stockpiles are considered to be waste arising from construction of the neighbouring site and as such cannot be re-used on site without appropriate permitting. They are to be removed from site, possibly following screening and testing to ensure they can be sent to the most appropriate and efficient waste streams.

8 No. trial pits to date have been undertaken into the stockpiles. Testing of soil samples returned a single exceedance of B(a)P in the southern stockpile. In addition, once these are removed, and as detailed in the Zone 2 recommendations above, further investigations should take place beneath their footprints in order to identify whether any contamination is present in the underlying soils.

5.2 Verification

All stripped formations irrespective of whether made ground soils or natural soils are exposed must be inspected to confirm the remediation required and for verification reporting.

It is envisaged that topsoil and subsoil will be required to be imported to the proposed garden and soft landscaped areas.

In general terms, all imported soils will be approved by LEAP prior to importation. The proposed sources will be assessed on the basis of either a detailed site investigation or laboratory test results in the case of a manufactured topsoil. It is recommended that 3No. tests per source be undertaken. In the absence of this data then LEAP will then advise what further testing, if any, is required prior to importation.



The test frequency will be as follows (to be advised by LEAP on a source by source basis depending on the quality of data provided prior to importation).

Subsoil – 1 sample per 150-300m³

Topsoil – 1 sample per 100-150m³

All imported soils will be subject to the test parameters attached in Appendix C irrespective of the depth at which they are to be placed.

All remediation works will be verified by a validation engineer by a process of regular site inspections and as appropriate soil sampling and laboratory analysis. The Validation Engineer will thereby maintain a watching brief, although the ultimate responsibility for delivery of the remediation strategy remains with the developer.

On completion a verification report will be provided, documenting the results of the site inspections and laboratory testing.

6 Discovery Strategy

It is considered possible that as yet unidentified contamination may be encountered during construction works particularly beneath the southern and western stockpiles and existing hard surfacing, such as the access road. Where additional contamination is identified during works this will be subject to further assessment and documented accordingly. It may be necessary to recommend the removal of additional soils or to propose alternative remedial solutions.

Verification Engineers are to be informed if any material suspected to be contaminated is encountered during the course of the development, so that appropriate revisions to this remediation method statement be implemented as required.

7 Protection of Incoming Services

The use of protective barrier pipes is considered unlikely, particularly once the site has been stripped. However, ultimately the local water supply company will have their own specification and they should be consulted to confirm whether they will require protection measures to be adopted and what the measures should comprise.

8 Waste Disposal

It is anticipated that the proposed development will generate waste soils and that materials will need to be removed from site as part of the construction process.

Where soils are to be disposed off-site, it is the duty of the waste producer, in this case BoKlok Housing Ltd, to ensure that all waste is disposed of appropriately and that any that is sent to landfill is sent to an appropriately licensed one.

In line with current European Commission Regulations including the Waste Framework Directive 2014 and The Waste (England and Wales) (Amendment) Regulations 2012, and Environment Agency Guidance (WM3 2015), waste holders and their advisors (producer, carrier or disposal facility) are required to make an assessment of waste materials and classify them as hazardous, non-hazardous waste or inert.

Once the waste has been classified as either hazardous or non-hazardous and prior to disposal, further analysis may be needed to confirm whether soils to be exported meet the proposed receiver landfill site's Waste Acceptance Criteria. Where a waste is classified as non-hazardous a Waste Acceptance Classification test (WAC) is required to determine whether the material can be accepted at either an inert or non-hazardous landfill. Where the WAC test results exceed hazardous waste WAC limits that waste cannot be accepted at a hazardous landfill site without prior treatment.

In accordance with WM3, wastes containing visible asbestos contamination or asbestos concentrations greater than 0.1% by volume are classified as Hazardous.

All waste sent to landfill must be classified and must be pre-treated.

Any form of pre-treatment should be documented in the Site Waste Management Plan. There are various forms of pre-treatment that are acceptable, but specialist advice should be sought in advance of instructing a groundworker.

It is strongly advised that detailed discussions be held with remediation/groundworks contractors and that receiving landfill sites are identified in advance of commencing any waste removal.

9 CLAIRE Development Industry Waste Code of Practice

It is anticipated that there may be some screened made ground soils and clean natural soils which may be suitable for re-use on site. Given the various waste streams and material movements that are expected on the site, it is strongly advised that a Materials Management Plan is developed for the site and kept up to date during enabling and construction. Where soils are to be re-used on site it is recommended that this is done in accordance with the Development Industry Waste Code of Practice.

The Development Industry Waste Code of Practice (DoWCoP) applies to reuse of natural soils and made ground on site of origin and reuse of natural soils arising from other sites. Reuse of made ground between sites cannot currently be undertaken using the DoWCoP.



The Guidance presents key principals for demonstrating compliance with DoWCoP to reuse of soils as non-waste. Lines of evidence must be set out in the Material Management Plan. Key principals to be met when reusing soils as non-waste are as follows:

- Reuse of material will not create unacceptable risk to human health or other identified receptors – i.e. risk assessment confirming suitability for reuse
- Suitability for reuse without further treatment – suitable chemically and geotechnically – must meet relevant specification – e.g. use as backfill beneath cover systems buildings or hardstanding or for site regrading
- Certainty of Use – must demonstrate that material will actually be used and is not just a probability – i.e. there is planning for the scheme and that backfill is required to make up levels or clean soils required for cover systems
- Quantities – materials used should only be in the quantities required

Should surplus soils from this site be proposed for reuse on another development a Material Management Plan will need to be submitted to a 'Qualified Person' (QP) for review and if appropriate the QP will sign a declaration that proposals within the MMP are in accordance with CoP. The QP will be independent from and have had no prior involvement with the project.

On completion a verification plan will be produced documenting whether proposals set out in MMP were implemented on site – confirming volumes of material reused, reuse locations, and compliance with specifications.

APPENDIX A - LIMITATIONS

Limitations

LIMITATIONS

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any such party relies upon the report at their own risk. Unless explicitly agreed otherwise in writing, this report has been prepared under LEAP's standard terms and conditions, as included in the quotation for this works.

This report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed. LEAP cannot be held responsible for any disclosures or changes in regulation that are provided post production of this report, and will not automatically update the report.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted, and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

The extent of the exploratory holes, laboratory testing and monitoring undertaken may have been restricted due to a number of factors including accessibility, the presence of buried or overhead services, current development and site usage, timescales or clients specification. The exploratory holes only assess a small proportion of the site area with respect to the site as a whole, and as such may only provide an overall assessment of ground conditions on site. The presence of hotspots of undisclosed contamination or exceptional and unforeseen ground conditions cannot be discounted.

Eurocode 7 gives guidance on the type of sampling, sample quality, number and spacing of intrusive investigations, and number of laboratory tests required. It is intended that the Geotechnical Information section of this report will fulfil the general requirements of the Ground Investigation Report as set out in section 6 of Eurocode⁷² although this is subject to the restrictions imposed on the investigation as listed above. For geotechnical design,

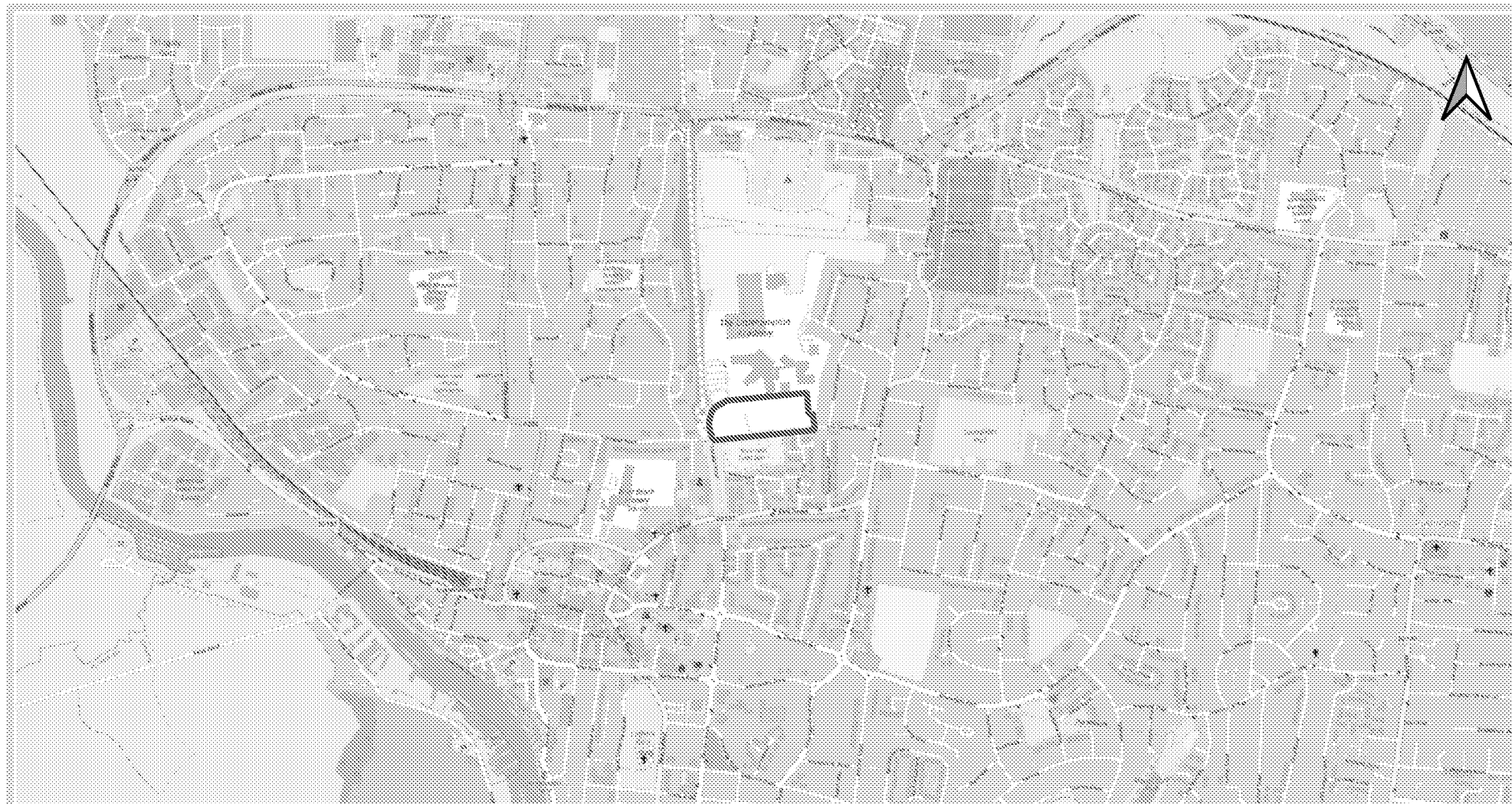
² BS EN 1997 Eurocode 7- Geotechnical Design - Part 1: General Rules (2004) and Part 2: Ground Investigation and Testing (2007)

Eurocode 7 requires the Geotechnical Design Report to address both the geotechnical and structural aspects of the geotechnical design for both the limit and serviceability states. The Geotechnical Appraisal section of this report will not meet the requirements of a Geotechnical Design Report (GDR), and should therefore be used for preliminary guidance only.

The presence of asbestos may be noted during the site walkover survey, intrusive investigations and/or from the results of contamination testing. However, this report does not constitute an asbestos survey. On this basis, the presence of asbestos on site cannot be discounted and a full asbestos survey should be undertaken.

APPENDIX B - FIGURES

Figures



Basemap: © OpenStreetMapcontributors

 Site boundary



Client: BoKlok Housing Ltd

Title: Site Location Plan

Project ID:

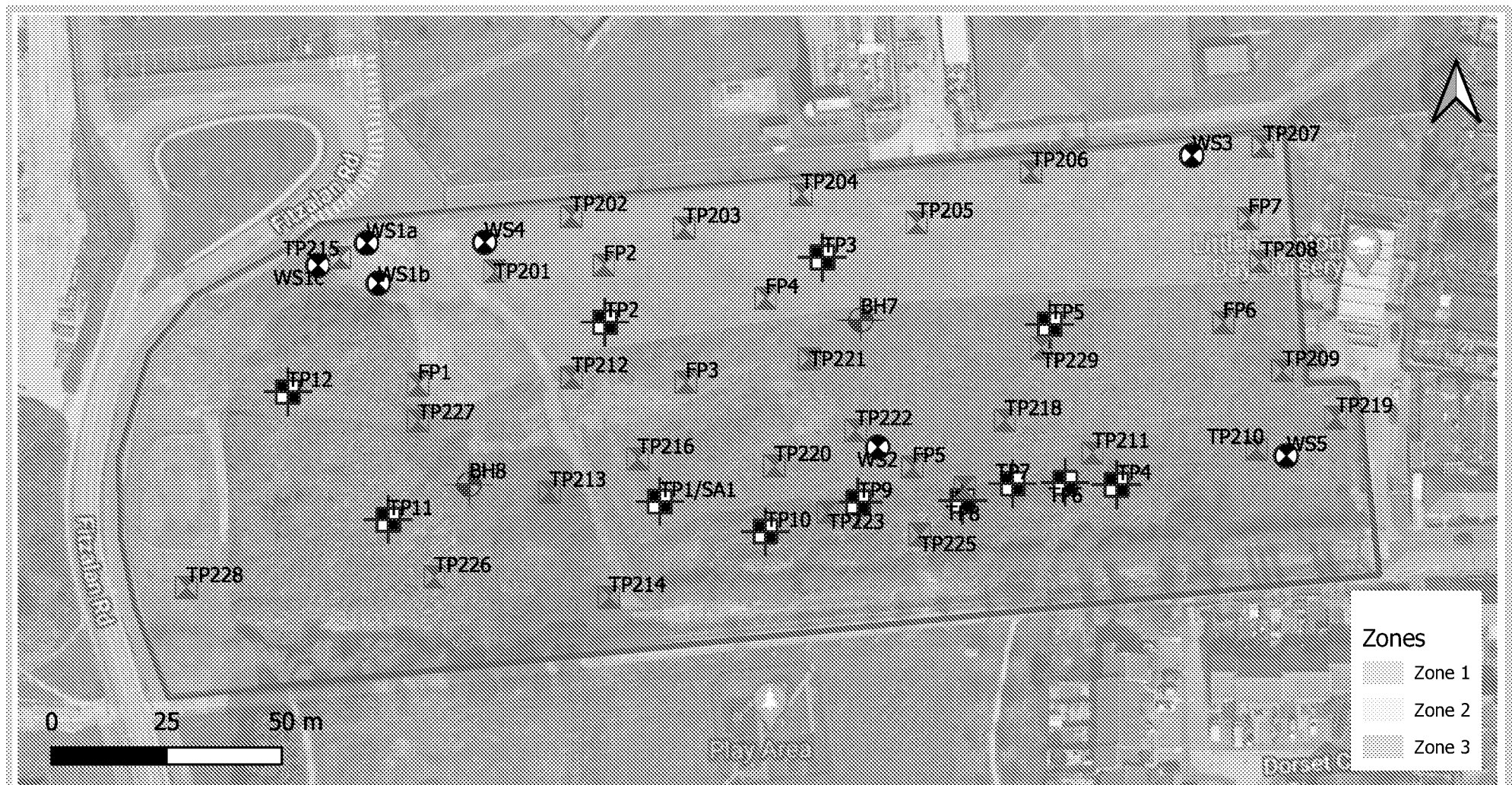
LP2466

Project: Land off Elm Grove Road, Littlehampton

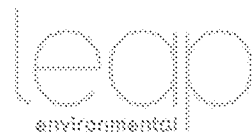
Date: 03/02/21

Figure No.

1



Note 1: Exploratory holes have been positioned by handheld GPS survey and should therefore only be taken as approximate
 Note 2: Exploratory holes shown are not to scale
 Note 3: Elevations not shown



Client:	BoKlok Housing Ltd	Title:	Site Zones	Project ID:	LP2466
Project:	Land off Elmgrove Road, Littlehampton	Date:	01/03/21	Figure No.	2

APPENDIX C – IMPORTED MATERIAL SPECIFICATION

Imported material
specification

LEAP SPECIFICATION FOR PLACEMENT OF IMPORTED FILLS AND PROCUREMENT OF IMPORTED TOPSOIL AND SUBSOIL

1 Fills

1.1 General

Filling shall be carried out in accordance with the recommendations of BS 6031:2009¹ and the CL:AIRE Definition of Waste Code of Practice (DoWCoP)².

Fill shall be maintained and protected in a satisfactory condition at all times until final completion.

Any material rendered unsuitable or unsatisfactory after being placed in the works shall be repaired or replaced as appropriate so that all the completed filling is in accordance with the specification.

1.2 Dimensions

Fills shall be constructed to achieve the finished levels of the development with an allowance for shrinkage and consolidation of the material subsequent to completion, and in order that the minimum clean cover as specified in the remediation method statement is achieved.

The excavated levels shall be recorded before the commencement of filling. The level of the filled areas shall be taken and recorded after filling.

2 Types of Fill

There are potentially two types of fill to be used. These are as follows:

- Topsoil
- Subsoil

The capping of landscaped areas will comprise a minimum of 150 mm of topsoil and a maximum of 300 mm to finished garden or landscaped area level. Underlying subsoil thicknesses will be as required to achieve the overall finished levels and to provide the required cover layer thicknesses as detailed in the main body of this report.

¹ BS6031:2009 Code of practice for earthworks

² CL:AIRE The Definition of Waste: Development Industry Code of Practice Version 2, March 2011

2.1 Topsoil

It is recommended that imported topsoil complies with the requirements of BS 3882:2015³ for a Multipurpose Purpose Grade material.

The topsoil shall be free from fragments of glass, bricks, concrete, wire or other potentially hazardous matter.

Manufactured topsoil shall not be made from waste materials.

The topsoil shall be subject to the additional limitations set out below.

2.2 Subsoil

Imported manufactured or modified subsoil shall comprise certified clean material which satisfies the conditions set out in BS8601:2013⁴. Subsoil arising from site or from a certified direct transfer (e.g. under DoWCoP) shall comprise clean natural arisings from construction activities which have been confirmed acceptable by the Engineer.

2.3 Sources of Materials

Imported materials may be obtained from any source unless otherwise stated in the Drawings or in the Specification.

It shall remain the responsibility of the Contractor to obtain only fill material complying with the Specification and Method Statement, notwithstanding any tests which may be accepted by the Engineer.

The Contractor shall demonstrate to the Validation Engineer's satisfaction that the fill materials from each source are uncontaminated by submitting to the Validation Engineer a chemical analysis of material or evidence of such other tests as the Validation Engineer may require for all proposed sources of fill, and if necessary sampling and analysing materials as they are delivered to stockpiles or the fill location on site.

Sampling rates shall be a typical of one sample per 150 cubic metres of imported soil – as per the frequencies stated in the main body of the report - with a minimum of three samples per source of material, unless otherwise agreed with the Engineer. Such tests for chemical composition as may be agreed by the Engineer shall be carried out on each sample and the results of tests shall be forwarded to the Engineer. Testing for contamination on samples taken shall be carried out at a testing laboratory approved by the Engineer and shall be to appropriate MCERTS standards. The Contractor shall maintain records of the location in the Works of fill from each source and the date of delivery to the site, and shall submit these records to the Engineer as requested. Chemical analysis on the imported fill material shall include testing for the contaminants listed in Table I as a minimum. Contaminant

³ BS3882:2015 Specification for topsoil

⁴ BS8601:2013 Specification for subsoil and requirements for use

concentrations shall be below those listed in Table I (attached) unless agreed otherwise by the Engineer. Additional analyses may be requested depending on the source and nature of the material. The concentrations in Table I are derived from available assessment criteria which are considered to represent uncontaminated concentrations of soil - Suitable for Use Levels (S4ULs)⁵ for a residential land use with private gardens where produce may be grown and, in the case of the phytotoxic metals copper, nickel and zinc, the topsoil specification in BS3883:2015. The concentrations in Table I assume that no significant contaminant linkage to controlled waters exists that could pose an unacceptable risk.

The S4ULs represent near-minimal risk to human health. In the case of cadmium, hexavalent chromium and benzo(a)pyrene, Category 4 Screening Levels (C4SLs)⁶ also exist which are higher than minimal risk but are still strongly precautionary. In instances of persistent failures of the S4ULs for these chemicals, regulators may allow the C4SL to be used instead. This approach shall require regulatory agreement before being implemented. In addition, the following shall be deemed as unacceptable for replacement fills:

- Peat, materials from swamps, marshes and bogs.
- Logs, stumps and perishable material.
- Materials in a frozen condition.
- Clay having a liquid limit determined in accordance with BS17892-12:2018⁷, exceeding 90% or plasticity index determined in accordance with BS17892-12:2018, exceeding 65%.
- Material susceptible to spontaneous combustion.

2.4 Practical Considerations

2.4.1 Formation Level / Subgrade Testing

Where made ground from previous site usage remains present at formation level then subgrade / formation level testing will be required to confirm the necessary thickness of subsoil and / or topsoil to be placed, as per the agreed remediation method statement. Sufficient time should be allowed in the programme for this testing to be completed prior to the requirement for clean cover to be laid. The standard turnaround for laboratory testing is 5 working days from the date of receipt at the laboratory.

2.4.2 Preparation of Subgrade

All pile mat, scaffold base and/or waste materials must be removed in their entirety from the surface of areas to become gardens or public open space / soft landscaping prior to the application of clean cover soils. This aspect of the works will be inspected and validated by the Engineer.

⁵ The LQM/CIEH S4ULs for Human Health Risk Assessment, Nathaniel P et al, 2015. Copyright Land Quality Management Ltd, reproduced with permission: Publication Number S4UL3509

⁶ Defra 'SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document' December 2014.

⁷ BS EN ISO 17892 Geotechnical investigation and testing. Laboratory testing of soil. Determination of liquid and plastic limits

2.4.3 Out of Specification Materials

Notwithstanding the specification for maximum allowable contaminant concentrations provided in Table I, no materials will be accepted that are odorous, stained or contain visible product as is required by DoWCoP.

Should the Contractor proceed with stockpiling or spreading of fill prior to receiving approval from the Engineer of results for the above tests, and the results of such tests show that the fill is contaminated above acceptable levels, the Contractor shall remove all contaminated material and replace it with acceptable material at his own cost as part of the main contract.

2.4.4 Suitability of Materials in Gardens

Materials laid as clean cover in private gardens must not only meet the requirements to be protective against land contamination but they must also be suitable for gardening. Hence, topsoil should not contain more than the British Standard-specified percentage of clay as exceeding this value may result in poor drainage and the failure of turf to establish. Subsoil should contain sufficient nutrition and be of sufficient depth to allow for the establishment of larger shrubs and trees and hence, a subsoil exceeding the British Standard-specified percentage of sand (i.e. an as-dug sand) would be unsuitable.

**TABLE 1: CHEMICAL CONTAMINANT
SPECIFICATION FOR IMPORTED MATERIALS**

Determinant	Assessment Criteria mg/kg
Arsenic	37
Cadmium	11 ¹
Trivalent Chromium	910
Hexavalent Chromium	6 ¹
Copper	100
Lead	200
Mercury (inorganic)	40
Nickel	60
Selenium	250
Zinc	200
Benzo(a)pyrene ²	0.79 ³
Naphthalene ²	2.3 ³
Asbestos	No asbestos detected

Notes to table

1. C4SL also available.
2. Surrogate markers for all PAHs.
3. Higher assessment criteria are possible and may be agreed with the regulator on a case by case basis, for example, depending on the Soil Organic Matter content of the imported material.