



Remediation Strategy and Verification Plan

Project Name: Kerswell Close

Location: Tottenham, London, N15 5HT

Client: Selsdon Building Contractors Limited

Project ID: V0965

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SUMMARY

The site, which extends to approximately 1,800m² comprises an area of soft landscaping, car parking and pedestrian access associated with residential properties on the southern side of Kerswell Close. It is proposed to redevelop the site with a part-3 and part-6 storey building, comprising 44 no. one bedroom affordable residential units, with amenity space and soft landscaping including new publicly accessible pedestrian routes and tree planting.

Geological records indicate the site to be underlain by London Clay.

A Phase 1 Environmental Study has previously been undertaken for the site by RSK, and indicates that the site has a history of residential use.

Two phases of intrusive investigation were carried out, one by Pell Frischmann in 2021 and one by Southern Testing in 2023.

Relevant pollutant linkages were identified in respect of lead, polyaromatic hydrocarbons (PAH) and asbestos in the Made Ground.

A Remediation Strategy comprising either the removal or capping of the Made Ground is proposed (dependant on finished levels) subject to approval by regulatory authorities.

A Verification Plan and Discovery Strategy are also included.

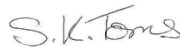
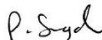
The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

The recommendations contained in this report are made in respect of the particular development proposals as described in the report and may not be appropriate to alternative development schemes.

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The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

This report should be considered in its entirety and Southern Testing Laboratories Ltd accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

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For and on behalf of Southern Testing Laboratories Limited

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A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in Site Directive #SD-7 issued by Khamil Bello on the 5th February 2024, on behalf of Selsdon Building Contractors Limited.

2 Location

The site is located to the north of the A305 Seven Sisters Road, approximately 450m to the southwest of Seven Sisters Railway Station, in north London. The approximate National Grid Reference of the site is TQ 33096 88526. The site location is indicated on Figure 1 within Appendix A.

3 Proposed Construction

It is proposed to construct a part-3 and part-6 storey building, comprising 44 no. one bedroom affordable residential units, with amenity space and site landscaping including new publicly accessible pedestrian routes and tree planting.

For the purposes of the contamination risk assessment, the proposed development land use is classified as Public Open Space (residential) CLEA Model Ref [1] / C4SL Report Ref [2].

4 Scope

This report presents our Remediation Options Appraisal, Remediation Strategy, and Verification Plan for the proposed remedial works at the site.

As with any site there may be differences in soil conditions between exploratory hole positions.

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B BACKGROUND INFORMATION

5 Site Investigation Works

The site has been the subject of a series of site investigation reports, as listed below.

Ref	Date	Author	Ref No	Title / Subject
1	Aug. 2017	RSK	29435 R01(00)	Phase 1 Environmental Study
2	Dec. 2021	Pell Frischmann	105079-PEF-xx-xx-RP-GT- 10001 P02	Geotechnical Design Report

Ref	Date	Author	Ref No	Title / Subject
3	Nov. 2023	Southern Testing	J15567	Supplementary Site Investigation & Risk Assessment Report
4	Jan. 2024	Southern Testing	SKT/PJS/J15567 (letter)	Ground Gas Risk Assessment Report

These reports provide good coverage and characterisation of the site and information derived from these reports is discussed below. The reader is referred to the original reports for supporting detail if needed. These reports are referred to below by the number given in the left hand column of the above table.

6 Site History

The Desk Study, detailed in report ref. 1 above, indicates that the site comprised undeveloped land to circa 1896, by which time it was largely covered by houses, with Russell Road crossing the south-western corner. In the late 1970's/early 1980's the site was extensively redeveloped, as per the present day layout, with the exception of what are possibly lock-up garages located in the existing car park between 1982-2014.

The surrounding area has a similar history to the site itself, comprising farmland up until circa 1896, when extensive development with high-density housing took place. The area then remained significantly unchanged, until the late 1970's when the area underwent significant redevelopment, including the construction of Kerswell Close.

7 Summary of the Findings of the Intrusive Site Investigation Works

7.1 Pell Frischmann – Geotechnical Design Report

Pell Frischmann's Geotechnical Design Report was based on the findings of a Factual Ground Investigation Report by Land Science (ref. LS5646) dated October 2021.

The specification for the site works was given by Pell Frischmann, and comprised 1No. 30m and 2No. 25m cable percussive boreholes, 4No. 2m deep machine dug trial pits and 4No. foundation inspection pits. One of the cable percussive boreholes was installed with gas and groundwater monitoring wells, and one of the machine dug trial pits was used for undertaking soakage testing.

The soils found in the trial holes comprised Made Ground to depths of between 0.5m and 1.8m bgl, over River Terrace Deposits to depths of between 0.55m and 0.6m (within the car park on the north of the site only), with the London Clay below both the Made Ground and River Terrace Deposits, to a depth of 30m+. The Made Ground comprised dark brown sandy, gravelly clay with flit, brick, tile, plastic and metal. The River Terrace Deposits comprised dark grey to orange fine to medium sand and fine to coarse flint gravel.

With the exception of the Made Ground, no visual or olfactory evidence of potential contamination was observed within the Made Ground.

Groundwater was not encountered in any of the exploratory hole locations.

Laboratory analysis for a range of potential common contaminants identified concentrations of lead above the screening value for a residential without home-grown produce land use in three samples of Made Ground. Loose fibres of chrysotile (white) asbestos were also identified in one sample of the Made Ground, with a quantification of <0.001%, which is below the laboratory limit of detection.

Combined groundwater and ground gas monitoring wells were installed in BH02 (on the southwest of the site) with response zones at depths of 1-2m bgl in the Made Ground, and 3-10m bgl in the London Clay. Six return monitoring visits were made. Significantly elevated concentrations of both methane and carbon dioxide were recorded throughout the monitoring period, within both of the installations.

The report recommend that as only limited geoenvironmental assessment had been undertaken, further investigation was required. With respect to the elevated concentrations of ground gases, it was recommended that consultation be had with the gas utilities providers, and that additional ground gas monitoring be undertaken. It was also recommend that further risk assessment, and potentially verification sampling be undertaken, following the removal of the bund of Made Ground.

7.2 Southern Testing – Supplementary Site Investigation & Risk Assessment Report & Ground Gas Risk Assessment Letter Report

The supplementary intrusive investigation works (report ref. 3) comprised the drilling of 4No. windowless sampler boreholes to a maximum of 3.0m deep, installed with ground gas monitoring wells, and 2No. hand dug pits to a depth of 1.0m.

In general the soils found comprised Made Ground to depths of between 0.6 – 1.5m over silty CLAY (London Clay). Evidence of possible contamination in the form of Made Ground was recorded in all of the exploratory hole locations. Groundwater was not observed in any of the exploratory holes during excavation/drilling.

Laboratory analysis found that the Made Ground on site contains elevated concentrations of lead and PAH. Loose fibres of asbestos, and in one location asbestos containing material (ACM) in the form of fragments of asbestos cement, were identified in the Made Ground within the landscaped mounds on the south of the site.

Given the footprint of the new proposed building, it was assumed that the majority of the Made Ground within the landscaped bunds would be removed from site in order to facilitate its redevelopment. Where Made Ground remains within proposed soft landscaped areas, it was recommended that either this material is removed, or alternatively capped with clean soils in order to protect future site residents.

It was also recommended that during the removal of the Made Ground, and during groundworks phases of the redevelopment, a careful watch for pockets of ACM should be kept. The risk to wider human receptors should also be considered, particularly as the site is bounded on two sides by housing. Dust should be kept to a minimum.

Where Made Ground remains and new services are to be laid, clean corridors should be constructed.

The findings of a program of six return ground gas monitoring visits are given in report ref. 4.

The Desk Study did not identify any potential gas sources, either on or in the vicinity of the site. However, ground gas monitoring undertaken by Land Science recorded elevated concentrations of both methane and carbon dioxide throughout the monitoring period, in an installation within the borehole on the southwest of the site.

Following consultation by the client with the gas supplier, a leaking gas main was identified within the vicinity of this installation. It was therefore considered likely that this was the source of the elevated concentrations of ground gases recorded. However, to confirm this, additional ground gas monitoring wells were constructed across the site, with a program of six fortnightly monitoring visits undertaken.

After the gas main was repaired no measurable concentrations of methane, or concentrations of carbon dioxide above 5% (at which consideration of the potential need for ground gas protection measures) were recorded during the subsequent monitoring.

Given the lack of any potential on-site or off-site sources of ground gas generation, the repair of a leaking gas main, and the most recent ground gas monitoring results (with no elevated concentrations of methane and carbon dioxide recorded) ground gas protection measures were not considered to be required on the site.

8 Relevant Pollutant Linkages

The various site investigations and risk assessments carried out identified the following Relevant Pollutant Linkages for the site:

Contaminant / Source	Pathways	Receptor
Lead and PAH's in Made Ground	Soil/dust dermal exposure	Site/construction workers Future residents
	Soil/dust ingestion/inhalation	Site/construction workers Human receptors adjacent to the site Future residents
	Plant uptake	Flora & fauna

Contaminant / Source	Pathways	Receptor
Asbestos in Made Ground	Dust inhalation	Site/construction workers Human receptors adjacent to the site Future residents

C REMEDIAL OBJECTIVES AND OPTIONS

9 Remedial Objectives

The site is to be redeveloped for residential use, comprising a block of 44No. residential units, with amenity space and site landscaping including new publicly accessible pedestrian routes and tree planting. In the absence of significant off-site risk, the principal objective of the remediation is to remove or reduce to an acceptable level the identified potential risks to construction and future maintenance workers, future residents and end-users of the site. Additional objectives are to achieve the remediation goal in a cost effective and timely manner, whilst minimising impact from associated traffic movements, landfill and resource consumption.

10 Options Appraisal

10.1 Lead in the Made Ground

The risks to human health receptors from lead in the Made Ground could be dealt with by several methods.

In respect of construction and maintenance workers, the use of PPE and safe working practices (minimising disturbance of the soil, creation of dust and the extent and duration of contact with soils) can reduce risk by helping to break the exposure pathways. However, while use of these measures should be considered as part of good practice in construction and maintenance, they typically are looked upon as a measure of last resort and need to be used in combination with other measures. Neither are such measures appropriate for future site users (residents).

Breaking the exposure pathway prior to construction by emplacement of imported clean material and/or impermeable cover over the Made Ground could reduce risks to human health receptors including future site users. Buildings, access roads and car parking spaces constitute impermeable cover and therefore imported soils would only be needed for areas of the site proposed as gardens or soft landscaping.

Removing the source by careful selective excavation of affected soils and subsequent off-site disposal to an appropriately licensed facility is also capable of reducing/eliminating the risk to human health receptors. As with emplacement of a barrier of clean material, this would only be required for gardens & soft landscaping areas, as buildings, access roads and car parking spaces will break the pathway.

Off-site disposal of contaminated soils and importation of clean materials place additional demands on aggregate resources and waste disposal capacity, and both require significant road haulage. Use of these remediation methods therefore requires that the quantities involved be minimised to ensure the approach remains sustainable in respect of resources, energy and traffic impacts.

An approach combining source removal and replacement with clean material to limited areas of the site, with carefully considered safe working methods for construction is considered most likely to be effective and sustainable in respect of lead in the Made Ground.

10.2 Polyaromatic Hydrocarbons in the Made Ground

The risks to human health receptors from PAH in the Made Ground could be dealt with by the methods outlined for lead as described above.

Additional options include removing the source by in-situ or ex-situ soil treatment. However, such soil treatments are limited to organic contaminants and will not reduce or remove lead from the soil. Furthermore, such soil treatment methods have knock-on impacts of their own in terms of energy use, traffic movements, dust/vapour, etc. Ex-situ methods such as bio-remediation by aeration of stockpiled soils require too much time and space to make them effective for this site. In-situ methods such as stabilisation/solidification or ozone treatment are considered 'over engineered' given the size of the site and the volumes of material concerned.

An approach combining source removal and replacement with clean material to limited areas of the site, with carefully considered safe working methods for construction is considered most likely to be effective and sustainable in respect of PAH in the Made Ground.

10.3 Asbestos in the Made Ground

There is a potential risk to construction workers, residents in the surrounding properties and future site residents from the presence of Asbestos Containing Materials (ACM) within the Made Ground.

In respect of ground workers, construction and maintenance workers, the use of PPE/RPE and good working practices such as damping down soils, stockpiles and haul roads; avoiding exposing large areas of Made Ground and/or stockpiling Made Ground were possible; sheeting stockpiles; and keeping site offices and welfare facilities free of mud and dust can reduce risk by helping to break the exposure pathways. However, while use of these measures should be considered as part of good practice, such measures are not appropriate for human receptors in the surrounding area or future site users, including residents.

With respect to the generally low concentrations of loose asbestos fibres found across the site, the removal or capping of the Made Ground in all soft landscaped areas, will remove the risk to future site users.

D REMEDIATION STRATEGY

11 Remediation Methods

The Remediation Strategy will comprise the following:

Please see Fig. 2 Topsoil GA TM-517-LA-104 Rev. A & Fig. 3 Site Remediation Plan (to which the colours below refer) in Appendix A for details.

Location	Details
Soft landscaping	Either: - Excavation and removal of a minimum of 300mm of Made Ground, and replacement with a minimum depth of 300mm of certified clean, imported topsoil. Or - Capping of the existing Made Ground with a minimum depth of 300mm of certified clean, imported topsoil. (dependent on current and finished site levels) Where the Made Ground is thinner, only the Made Ground will be removed. Placement of a geotextile membrane above the residual Made Ground soils. Tree root protection zones: - Placement of a 200mm capping layer of certified clean, imported topsoil.

12 Assessment Criteria

The following assessment criteria values will be used in the verification process:

Imported soils shall be free from deleterious materials, weeds and contamination. The material to be used will be tested in accordance with the appropriate BS Specifications for Topsoil (BS 3882:2015) and Subsoil (BS 8601:2013) and the analysis shall also comply with the values given for Public Open Space (residential) in the table in Appendix B. These values are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

Certificates for imported soils must include details of the source, description of the material, and dates of sampling and analysis, as well as the test results for potential contaminants. The date of sampling and analysis must relate to the material imported. Associated consignment notes must clearly identify the source material, and must correspond to the certified material.

E VERIFICATION PLAN

13 Data Collection

Location	Data	Responsible Party
Soft landscaping	Verification of the depth of the reduced level dig & placement of a deter-to-dig membrane (lawn area)	Southern Testing
	Post placement check of topsoil thickness within the tree root protection areas (lawn area)	Southern Testing
	Consignment Notes for the imported soils, along with suppliers laboratory test certificates (all soft landscaped areas)	Groundworker

14 Reporting

At the end of the remediation, a verification report will be produced by Southern Testing Laboratories Limited.

15 Discovery Strategy

As with any site, areas of contamination not identified during site investigation works may come to light in the course of redevelopment. Accordingly, a discovery strategy will be adopted to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner, as follows:

- A close watch will be maintained during all demolition and excavation works.
- In the event that unexpected or malodorous soils or liquids are encountered, excavation work shall cease in the affected area.
- The affected area shall be made safe and fenced off to prevent unauthorised access.
- The Site Manager shall notify *Southern Testing Laboratories Limited* of the discovery, who will attend site to inspect the suspect materials, provide advice and take samples as necessary. Within Southern Testing Laboratories Limited, Sarah Toms shall be the first point of contact.
- The Site Manager shall notify Haringey Council of the discovery. Within Haringey Council, the Contaminated Land Officer shall be the first point of contact.

Any suspect excavated soil will be stockpiled separately on polythene sheeting, covered, and tested before being removed.

16 General Guidance

In general terms, the workforce and general public should be protected from contact with contaminated material. There is a range of relevant documents published by the Health and Safety Executive, and organisations such as CIRIA, and the BRE.

Some soils will require removal from site and disposal to suitably licensed landfills. Different guidelines and charges will apply to different waste classifications. As waste producers, the Developer holds responsibilities under the various governing regulations, including:-

- Ensuring that waste is characterised in accordance with current Technical Guidance.
- Ensuring that waste is disposed of at a facility appropriately licensed to receive the waste as classified.

- Keeping accurate records of all waste classification, transfer and a disposal log including information such as:
 - Date, Waste Classification, Carrier's Registration Number, Transfer Note Number, Ultimate Destination.
- Submitting full copies of those records for inclusion in validation/closure reports.

Maintaining those records for potential future regulatory inspection.

REFERENCES

- [1] Environment Agency, "Updated technical background to the CLEA model," 2009.
- [2] Contaminated Land: Applications in Real Environments (CL:AIRE), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination," 2014.
- [3] CIRIA, "C665 Assessing risks posed by hazardous ground gases to buildings," 2007.

APPENDIX A
Site Plans





Site:	Kerswell Close, Tottenham, London, N15 5HT	Project ID	V0965
Figure 1	Site Location Plan	Date:	08/02/2024



Site:	Kerswell Close, Tottenham, London, N15 5HT	Project ID	V0965
Figure 2	Fig. 2 Topsoil GA TM-517-LA-104 Rev. A	Date:	08/02/2024



Location	Details
Soft landscaping	Either: - Excavation and removal of a minimum of 300mm of Made Ground, and replacement with a minimum depth of 300mm of certified clean, imported topsoil. Or - Capping of the existing Made Ground with a minimum depth of 300mm of certified clean, imported topsoil. (dependent on current and finished site levels) Where the Made Ground is thinner, only the Made Ground will be removed. Placement of a geotextile membrane above the residual Made Ground soils. Tree root protection zones: - Placement of a 200mm capping layer of certified clean, imported topsoil.

Site:	Kerswell Close, Tottenham, London, N15 5HT	Project ID	V0965
Figure 3	Site Remediation Plan	Date:	08/02/2024

APPENDIX B

Verification Criteria

B

Contaminant Screening Values for Imported Soils

Contaminant	Units	Proposed Land Use					
		Residential with home grown produce consumption	Residential without home grown produce consumption	Open Space * (Residential)	Open Space * (Park)	Allotments	Commercial / Industrial
Arsenic (As) [2]	mg/kg	37	40	79	170	43	640
Cadmium (Cd) [2]	mg/kg	11	85	120	555	1.9	190
Trivalent Chromium (CrIII) [2]	mg/kg	910	910	1,500	33,000	18,000	8600
Hexavalent Chromium (CrVI) [2]	mg/kg	6	6	7.7	220	1.8	33
Lead (Pb) [3]	mg/kg	200	310	630	1300	80	2330
Mercury (Hg) [1,2,7]	mg/kg	7.6-11	9.2-15	40	68-71	6.0	29-320
Selenium (Se) [2]	mg/kg	250	430	1,100	1,800	88	12,000
Nickel (Ni) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	60 75 110		
Copper (Cu) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	100 135 200		
Zinc (Zn) [2,4]	mg/kg			pH <6.0 pH 6.0 – 7.0 pH >7.0	200 200 300		
Phenol [1,2]	mg/kg	120-380	440-1200	440-1300	440-1300	23-83	440-1300
Benzo[a]pyrene [1,5]	mg/kg	1.7-2.4	2.6	4.9	10	0.67-2.7	36
Naphthalene [1,2]	mg/kg	2.3-13	2.3-13	77-430*	77-430*	4.1-24	77-430*
Total Cyanide (CN) [6]	mg/kg	/	/	/	/	/	/
Free Cyanide [6]	mg/kg	/	/	/	/	/	/
Complex Cyanides [6]	mg/kg	/	/	/	/	/	/
Thiocyanate [6]	mg/kg	/	/	/	/	/	/

Notes:

* Open Space levels calculated on the basis of the exposure modelling developed in the C4SL research.

+ Screening values constrained to saturation limit. Higher values may be acceptable on a site specific basis.

[1] Where ranges of values are given for organic contaminants the screening value is dependent on the Soil +Organic Matter.

[2] LQM/CIEH S4UL (2014). Copyright Land Quality Management Ltd. reproduced with permission; Publication Number S4UL 3116. All rights reserved.

[3] C4SL (DEFRA 2014).

[4] Copper, Zinc and Nickel may have phototoxic effects at the given concentrations. Alternative criteria should be adopted for importation of Topsoil or other soils for cultivation. BS3882:2015 and BS8601:2013 suggest values of 200 to 300mg/kg for Zn, 100 to 200mg/kg for Cu, and 60 to 110mg/kg for Ni, for topsoil and subsoil, depending on pH.

[5] Based on the Surrogate Marker approach and modelled using the modified exposure parameters of C4SL but retaining 'minimal risk' HCV.

[6] Screening criteria derived on a site specific basis if test results indicate.

[7] S4UL for Methyl Mercury, higher concentrations may be tolerable if inorganic mercury is the only species present. Lower concentrations apply for elemental Mercury.



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