A2 Site Investigation

13 Belsize Crescent

Interpretive Report

March 2023

24022-A2SI-XX-XX-RP-Y-0003-00

Project Name	13 Belsize Crescent
Project Number	24022
Client	Edmund Lehmann and Jennifer Nguyen
Document Name	Interpretive Report

A2 Site Investigation Limited
One Westminster Bridge Rd
London, SE1 7XW

020 7021 0396
contact@a2-si.com
www.a2-si.com

Prepared by	Checked by	Approved by
Shengbin. Cui BEng(Hons), MSc, DIC	Alex Wright MEng(Hons) CEng MICE	Alex Nikolic BEng(Hons), MSc, DIC, CEng, MICE, MSt(Cantab)
Graduate Engineer	Senior Engineer	Director

Document Reference	Status	Notes	Revision	Issued by	Date
24022-A2SI-XX-XX-RP-Y-0003-00	First Issue	First issue	00	AW	31/03/2023

Contents

Appendices

1. Introduction

A2 Site Investigation Limited (A2SI) were engaged by Edmund Lehmann and Jennifer Nguyen to prepare an Interpretive Report (IR) for the proposed development at 13 Belsize Crescent, London, NW3 5QU.

1.1. Study Aims and Objectives

The scope of this report comprises the following elements:

- Technical assessment and interpretation of ground investigation data carried out for geotechnical design parameters.
- Outline assessment of shallow foundations (ULS and SLS performance, and groundwater considerations, including uplift and heave mitigation).
- Earth retention system topology assessment.
- General buildability and earthworks considerations.
- Geo-environmental assessment (generic quantitative risk assessment – GQRA) based on the ground investigation results, proposed development plans presented herein and A2SI, *Phase I Desk Study Report* (ref 24022-A2SI-XX-XX-RP-Y-0001-01), dated January 2023.

The GQRA has been undertaken in general accordance with *Land Contamination Risk Management* (LCRM) guidance, published by the Environmental Agency of the UK Government website, and in the context of *National Planning Policy Framework* (NPPF) requirements and *The Building Regulations 2010, Approved Document C - Site preparation and resistance to contaminants and moisture (2004 Edition incorporating 2010 and 2013 amendments)*. The assessments have been undertaken specifically for the proposed development to assess whether there are any unacceptable risks which require either further assessment or remediation.

The recent ground investigation and reporting have been undertaken in general accordance with *BS10175:2011 Investigation of Potentially Contaminated Sites – Code of Practice*.

1.2. Information Sources

- *Phase I Desk Study Report* prepared by A2SI, dated January 2023 (ref: 24022-A2SI-XX-XX-RP-Y-0001-01).
- *Factual Report* prepared by A2SI, dated January 2023 (ref: 24022-A2SI-XX-XX-RP-X-0001-01).
- *DRAFT Structural Engineers Report* prepared by Baker Chatterton Structural Design Ltd, dated October 2022 (ref. J207-S-RP-001 rev. 00).
- Architectural drawings prepared Undercover Architecture, dated August 2022.
- Proposed and existing structural drawings prepared by Baker Chatterton Structural Design Ltd, dated October 2022.

2. The Site and Proposed Development

2.1. Development Location and Current Site Use

The development site is located at 13 Belsize Crescent, London, NW3 5QY, as shown in Figure 2.1. The approximate National Grid reference for the site is 526790, 184970 and the site footprint covers approximately 0.02 hectares. The approximate ground surface elevation at the site is 69.0m above Ordnance Datum (mOD) and ground surface levels in the surrounding area fall towards the south. The development site falls within the administrative boundaries of the London Borough of Camden and currently includes a four-storey residential property including a lower ground floor and associated private front and rear gardens.

The existing structure is anticipated to be of traditional masonry construction supported by masonry strip foundations.

Figure 2.1 Location of the proposed development (red line reflects the site boundary used for this assessment)

2.2. Proposed Scheme

The scheme for the proposed development comprises partial demolition of internal superstructure elements. The lower ground floor will be extended and a single-storey basement will be constructed, extending beyond the footprint of the existing building to include a swimming pool, gym and bathrooms. The house will be accessible with an external platform lift to the lower ground floor and a small internal lift to all floors will be installed.

It is anticipated that the existing structure will be supported on shallow underpin foundations during construction, and by a cast-in-situ reinforced concrete raft in the permanent case.

An indicative section through the proposed development is shown in Figure 2.2.

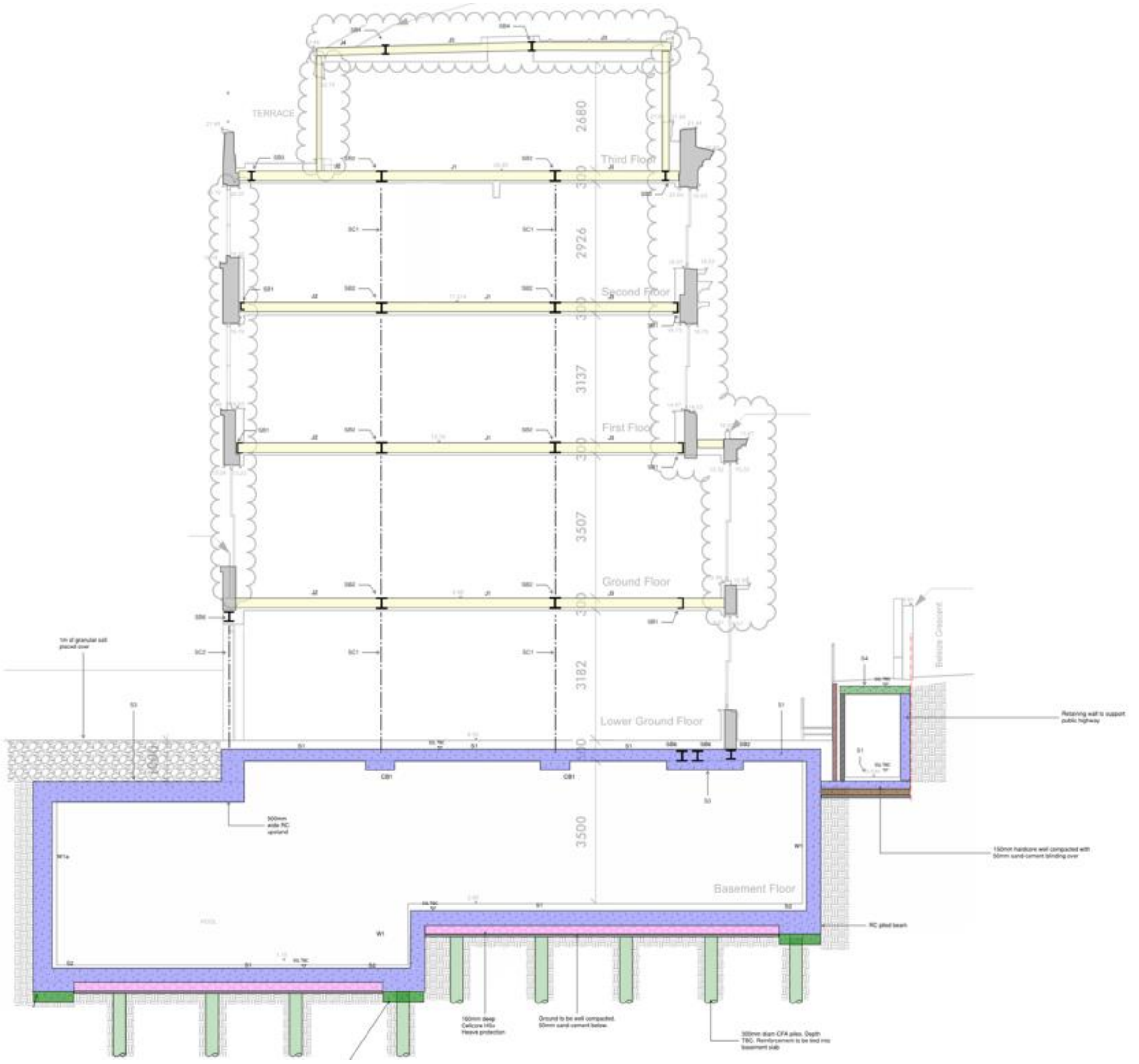


Figure 2.2 Section view of the proposed development

2.3. Potential Land Contamination

A preliminary risk assessment (PRA) has already been undertaken for the proposed development (see *Phase I Desk Study* ref: 24022-A2SI-XX-XX-RP-Y-0001-01). The PRA identifies unacceptable risks to human health and building structure receptors. These receptors have been further assessed herein via GQRA.

3. Geological Setting

3.1. Regional Geological Overview

The development site is located within the London Basin, which refers to an approximately triangular synclinal structure in which the sedimentary units underlying London and much of southeast England were deposited. The London Basin is comprised of the following formations, in order of decreasing depth:

- A deep (~200m thick) layer of Chalk, deposited throughout the Upper Cretaceous period, forms the base of the basin and is the principal aquifer of the region.
- The Thanet Formation, which comprise fine, silty glauconitic sands originating in shallow seas.
- The Lambeth Group, a depositionally and geographically complex unit which comprises layers of sands and gravels, shelly and mottled clays, minor limestones and lignites, and occasional sandstone and conglomerate.
- The London Clay Formation, a fine-grained deposit of silty locally sandy clay which is the dominant Thames Group Deposit. Contains layers of weakly to strongly cemented claystones.
- Superficial (drift) deposits: River Terrace Deposits (comprising mainly gravels and sands) and Alluvium (fine, often organic soils) aggraded/deposited by the River Thames and its tributaries on top of the London Clay.

3.2. Site Geology and Anticipated Ground Conditions

Figure 3.1 illustrates the location of the development within the context of a regional geological map. The map illustrates the spatial distribution of superficial (drift) deposits and bedrock outcrops at the ground surface. Made Ground is generally not shown but is assumed to be present on site due to historical demolition and construction works.

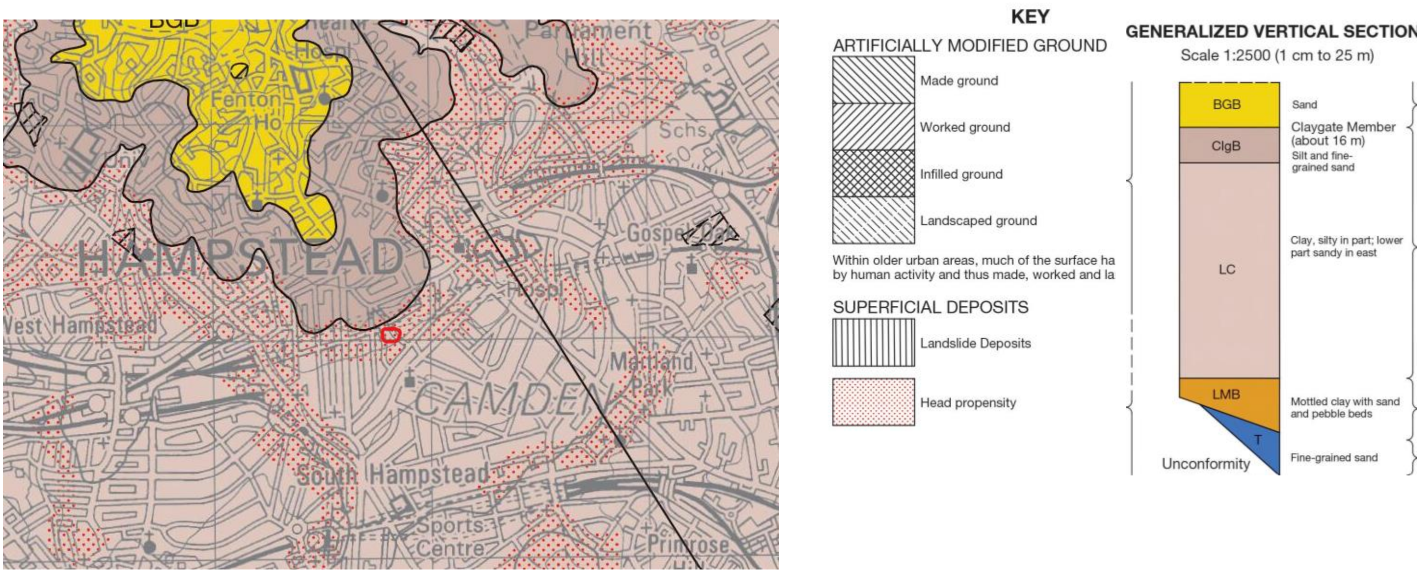


Figure 3.1 Geological context of the site

4. Geotechnical and Geo-environmental Ground Investigation

4.1. Overview

A site-specific ground investigation was undertaken by A2SI in two phases between September and December 2022. Details of the ground investigation findings are presented in the *Factual Report* (as referenced in Section 1), which is included as Appendix A.

The primary purpose of the ground investigation works was to inform the management and mitigation of geo-environmental and geotechnical risk associated with the proposed redevelopment of the site, and to achieve the objectives outlined in Section 1.1. The aims of the ground investigation were thus to:

- To obtain a geotechnical profile of the site and identify any contamination and hydrology characteristics to assist in the design of proposed development.
- To collect geo-environmental data to inform GQRA.
- To enable the assessments of the ground conditions for preliminary and detailed foundation design of the proposed development.

The scope of the on-site investigation is summarised as follows:

- 1 no. modular cable percussion borehole to a depth of 20.0m.
- 4 no. modular dynamic sampler boreholes to depths of up to 6.0m.
- Installation of 3 no. monitoring wells (WS1, WS2, HP1).
- 1 no. hand pit in the front garden to determine material beneath the proposed storage structure.
- 2 no. structural trial pits on the party walls to determine existing foundation details.
- 3 no. shallow sample environmental pit locations in the rear garden for additional contamination testing.
- In-situ and laboratory geotechnical and geo-environmental laboratory testing.
- 6 no. post-fieldwork groundwater and gas/vapour monitoring rounds.

An exploratory hole plan is presented in Figure 4.1. Standpipes were installed for groundwater and ground gas monitoring purposes, as summarised in .

Table 4.1 Monitoring standpipes summary

Location	Installation Diameter (mm)	Type of Installation	Depth to Bottom of Response Zone (m)	Depth to Top of Response Zone (m)	Strata
WS1	50	SP/G	1	0.5	Made Ground
WS2	50	SP/G	1	0.5	Made Ground
HP1	50	SP/G	1	0.5	Made Ground

SP/G – Standpipe with gas monitoring valve.

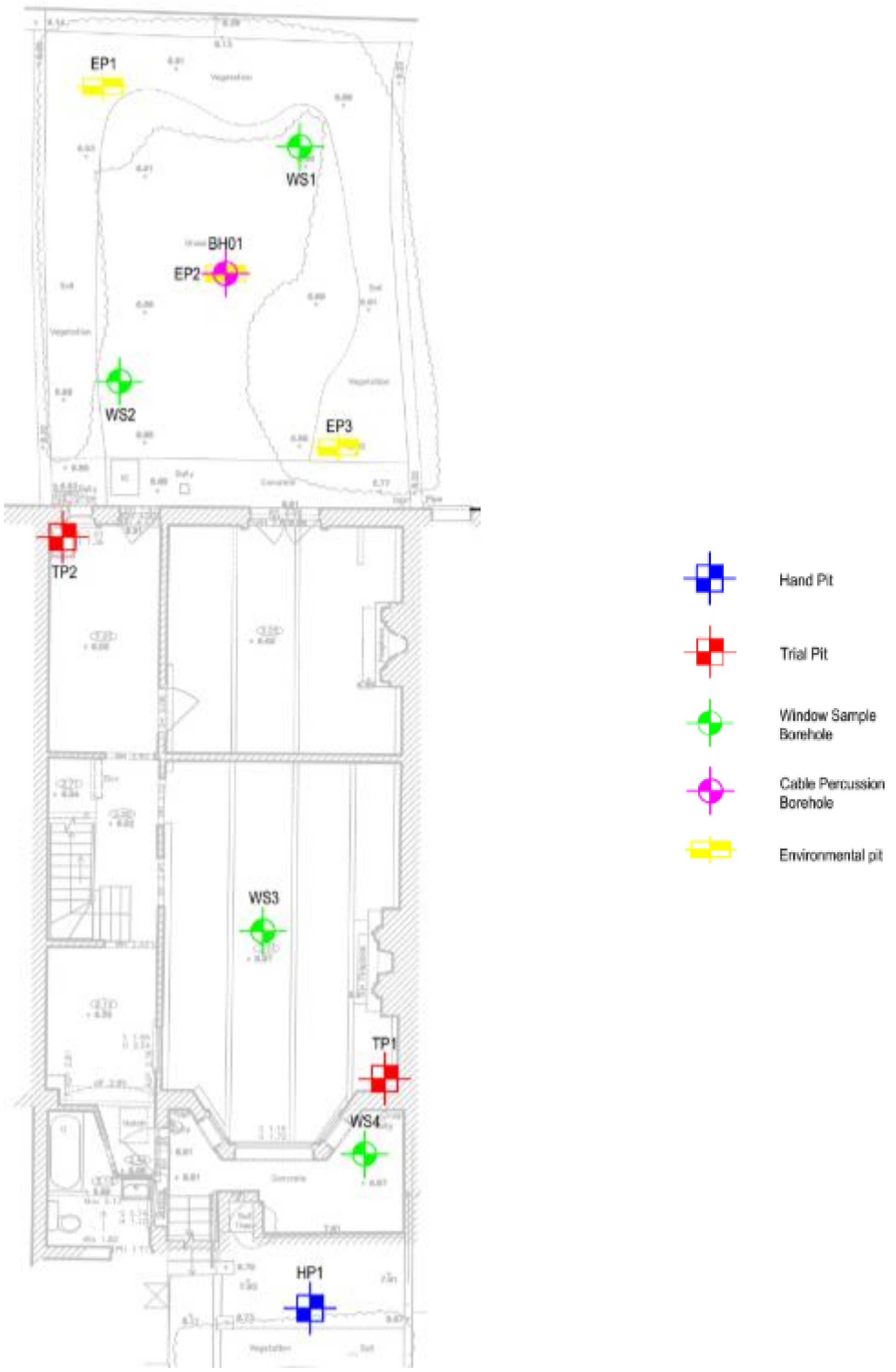


Figure 4.1 Exploratory hole location plan

4.2. Monitoring

Return monitoring visits were undertaken on 13th, 20th, 24th October and 3rd and 17th November 2022 and consisted of the following:

- Groundwater level gauging.
- Ground gas recordings which included oxygen (O_2), carbon dioxide (CO_2), methane (CH_4), hydrogen sulphide (H_2S), carbon monoxide (CO), VOC concentrations, flow rates and atmospheric pressure.

The return visits included ground gas and soil vapour monitoring at installed boreholes WS1, WS2 and HP1 using a calibrated Gas Data GFM436 hand-held gas analyser and a calibrated MiniRae Lite ATEX photoionisation detector (PID). The data collected included soil vapour / ground gas concentrations and flow rates. Each return visit also included groundwater level gauging of each of the installed monitoring wells using an oil-water interface probe

4.3. Testing

4.3.1. In-Situ Testing

- 27no. standard penetration tests (SPT).
- VOC head-space testing using a PID.

4.3.2. Geotechnical Laboratory Testing

- 8no. moisture content tests.
- 8no. classification/index tests(4 Point Liquid & Plastic Limit).
- 6no. BRE Suite D tests.

4.3.3. Geo-environmental Laboratory Testing

- 10no. Soil Organic Matter (SOM).
- 10no. Total Organic Carbon (TOC).
- 10no. Fraction Organic Carbon (FOC).
- 10no. pH.
- 10no. Water soluble sulphate.
- 10no. TPHCWG including BTEX and MTBE.
- 10no. Speciated Polyaromatic Hydrocarbons (PAHs) (EPA16).
- 10no. Asbestos ID (with quantification if asbestos identified).
- 10no. Heavy metals and metalloids suite.

5. Ground Conditions

5.1. Ground Model

A summary of the ground conditions encountered during the intrusive investigation is presented in Table 5.1 below.

Table 5.1 Summary of the encountered geological profile

Unit	Maximum Level (m)[1] [2]	Minimum Level (m)[1] [2]	Maximum Thickness (m)	Description
Made Ground	7.0	5.5	1.5	Soft, brown, slightly gravelly, slightly sandy, silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub-angular brick, with occasional concrete, flint and mortar.
London Clay	5.5	0	>18.8	Firm, orangish brown mottled light grey CLAY. Occasional pockets of silt and coarse selenite crystals.

1) Refers to top of stratum.
2) Levels refer to a local datum, not mOD.

A water strike was recorded in BH01 at -11.04m (17.9 m depth) in the London Clay.

5.2. Geotechnical Parameters

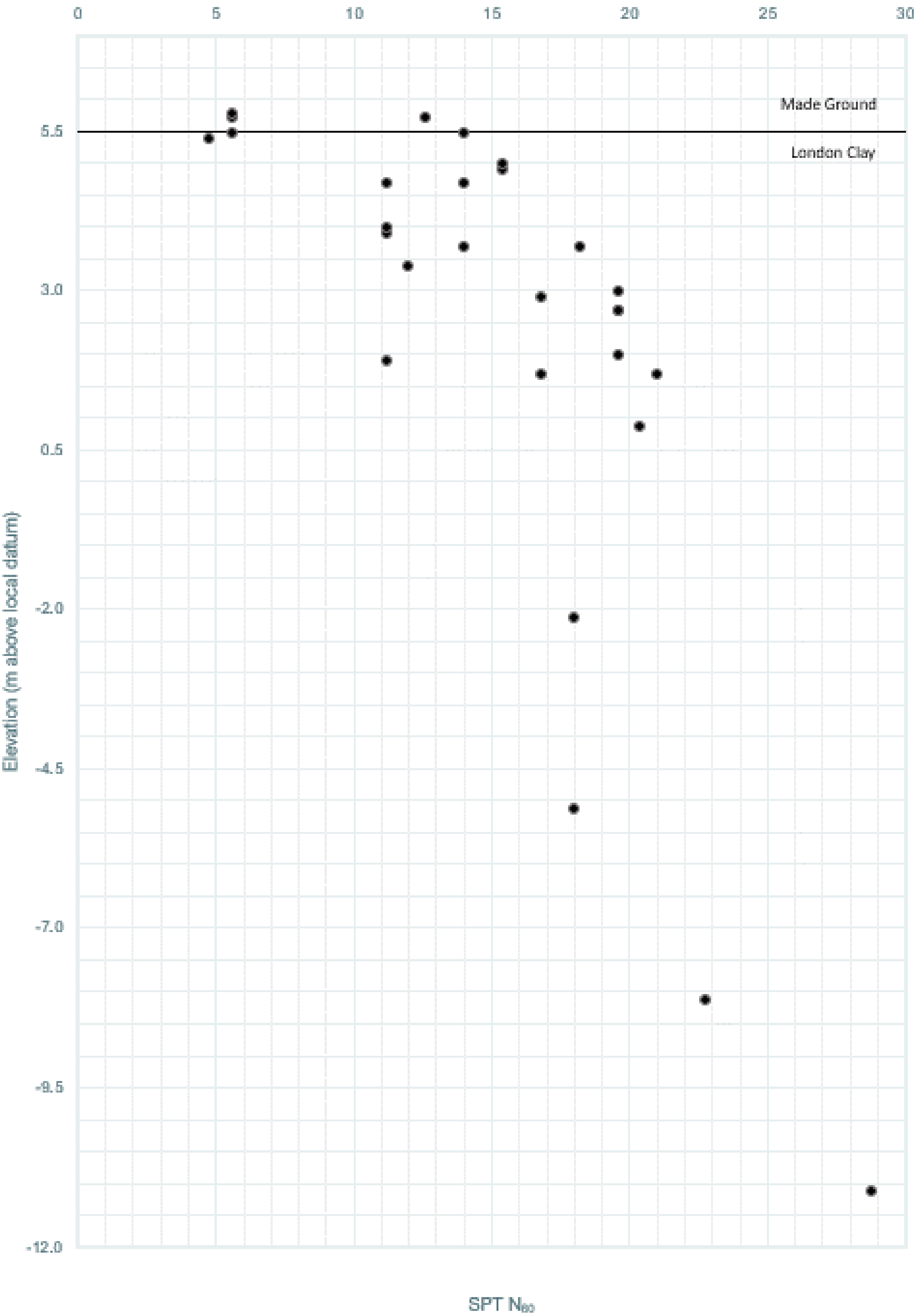
The characteristic geotechnical parameters determined for the main geological units are shown in Table 5.2.

Table 5.2 Characteristic geotechnical parameters adopted for design

Stratum	Top of strata (m[1])	γ_b (kN/m^3)[2]	ϕ'_{cv} (°)	c' (kPa)	c_u (kPa)	E' (MPa)	E_u (MPa)	ν	K_0[9]
Made Ground[3]	7.0	18	25	0	-	10.0	-	ν' = 0.2	0.5
London Clay	5.5	20	23[6]	0[6]	5.5 – 2.0m[1]: 60[5] 2.0 – -11.0m[1]: 85[5]	5.5 – 2.0m[1]: 24.0[7] 2.0 – -11.0m[1]: 34.0[7]	5.5 – 2.0m[1]: 30.0[6] 2.0 – -11.0m[1] : 42.5[6]	ν' = 0.2 ν_u = 0.5[8]	1.2

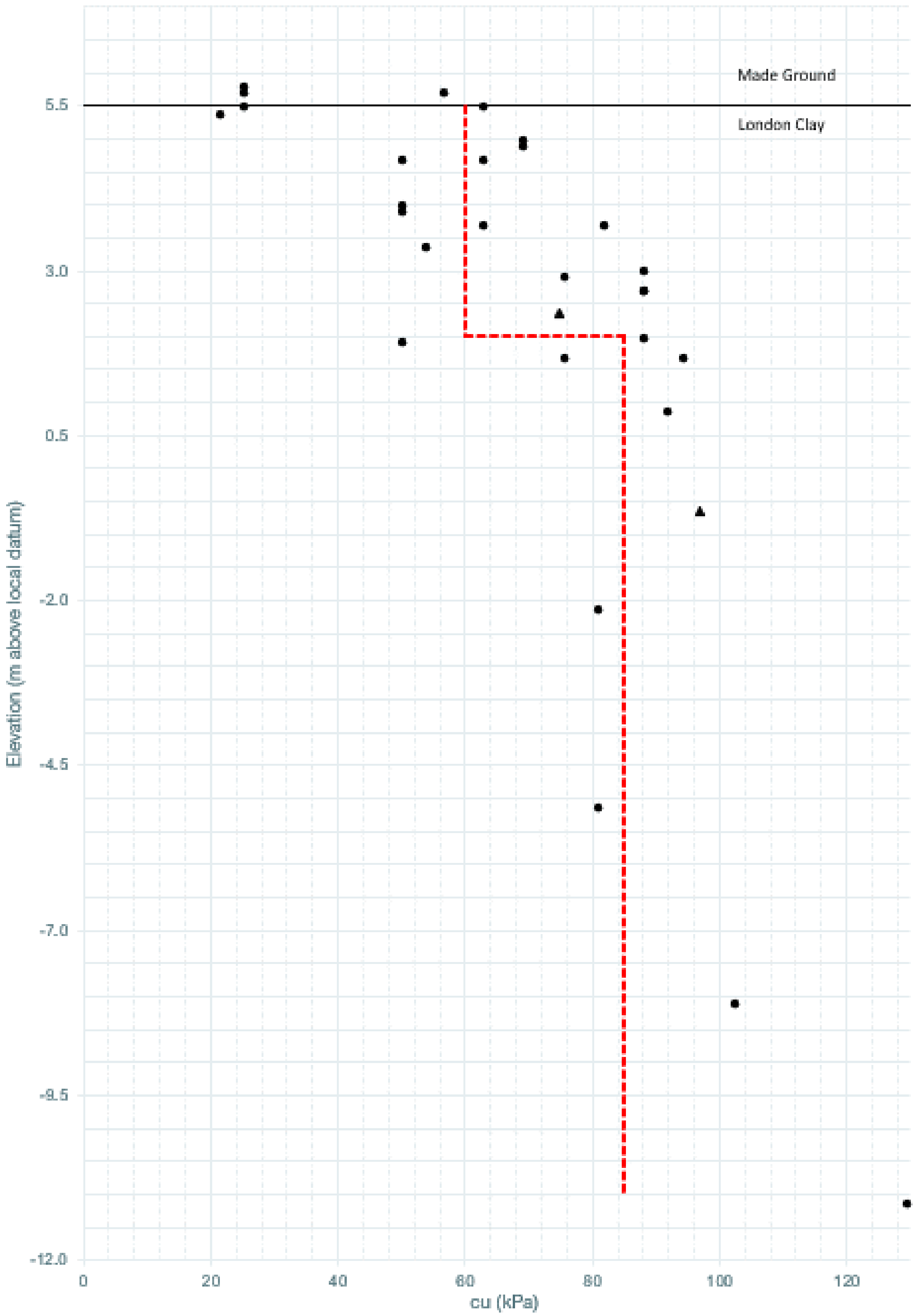
γ_b: bulk unit weight φ'_{cv}: effective critical state angle of shearing resistance c': effective cohesion c_u: undrained shear strength E': drained Young's Modulus
E_u: undrained Young's Modulus ν: Poisson's Ratio K_0: in-situ lateral earth pressure coefficient

1. Refers to local datum.
2. Bulk unit weights are based on material descriptions.
3. Moderately conservative geotechnical parameters representative of the variable nature of the Made Ground have been provided based on the material description.
4. The effective critical state angle of shearing resistance for the London Clay stratum has been calculated from an average plasticity index of 23% using Equation 7 from BS 8002:2015 Code of practice for earth retaining structures. Per BS 8002:2015 §4.3.1.4.9 c'_{cv} is taken as 0kPa.
5. The undrained shear strength, c_u, of the London Clay has been estimated from SPT N_{60} values and unconsolidated undrained (UU) triaxial tests. SPT N_{60} and c_u have been correlated using the ratio $c_u/N_{60} = f_1 = 4.5$, per CIRIA C143. The SPT N_{60} plot and the c_u plot with the adopted design line for the London Clay are presented in Figure 5.1 and Figure 5.2, respectively.
6. The undrained stiffness of the London Clay has been estimated using the relationship $E_u/c_u = 500$.
7. The drained stiffness of the London Clay has been estimated using the relationship $E'/E_u = 0.8$.
8. ν_u is the undrained Poisson's Ratio (no volume change undrained condition).
9. K_o calculated from 1 – sinφ′ for normally consolidated and lightly overconsolidated materials. K_0 for the London Clay based on overconsolidated nature of the material.



Interpreted strata boundaries marked by solid line.

Figure 5.1 SPT N_{60} results



Interpreted strata boundaries marked by dashed lines. London Clay design line shown in black.

Figure 5.2 Undrained shear strength, c_u (kPa)

5.3. Groundwater

Standpipes in all window samples were recorded as dry during all six visits between October 13th and November 17th 2022. It is recommended that design water tables of -0.8m from the local datum (0.5m below basement formation level) in the short-term construction condition and 5.8m (1.0m below rear garden level) in the long-term condition are adopted for structural design. A more representative design water table of the current site conditions may be adopted for any civil/drainage design works.

5.4. Visual / Olfactory Evidence of Contamination

Visual / olfactory evidence of contamination was recorded in soil during the ground investigation as summarised in Table 5.3.

Table 5.3 Visual / olfactory evidence of contamination summary (soil)

Exploratory Hole	Depth (mbgl)	Stratum	Evidence	Soil Sample Head-space (ppm)	Laboratory testing ? (y/n)
TP1	0.07 – 0.60	Made Ground	Clinker	0.6	Y

Soil sample head-space readings using a PID were undertaken during the site investigation. All soil head-space results were recorded below 2 ppm (i.e. very low readings).

No visual / olfactory evidence of contamination was recorded during the return monitoring visits such as evidence of groundwater contamination.

6. Geotechnical Engineering Design

The following sections provide an overview of potential earth retention and foundation options for the development taking into account the current proposals, site constraints and geological conditions.

6.1. Excavation Works and Retention

6.1.1. Excavated Material

Based on the proposed scheme information provided, Made Ground and London Clay will be excavated to form the new basement space. It is not anticipated that these strata will provide materials suitable for reuse on-site. Waste Acceptance Criteria testing may be required to aid in classifying the waste category of the removed materials.

6.1.2. Groundwater Control

Significant dewatering works are not anticipated to be required as part of the excavation process. However, it is recommended that a provision for local sumping or pumping is provided in the instance that finite volumes of groundwater isolated within/above cohesive strata are encountered.

The design of the basement walls should consider long-term waterproofing requirements to ensure water resistance in line with BS 8102:2009 and stability/global equilibrium of the substructure elements. It is assumed that the basement will require Grade 3 waterproofing protection, where no water penetration should be allowed. Consideration should be given to combined protection, as defined in BS 8102:2009.

6.1.3. Earth Retention

Soil structure interaction (SSI) effects should be considered to obtain an accurate estimate of earth pressures for retaining wall design, or to confirm the applicability of empirical correlations contained within Eurocode 7. SSI effects include considerations of wall type and geometry, hydraulic conditions, overall stiffness of the earth retaining system and anticipated lateral movements.

Where underpins are to be installed, especially beneath party walls, the local excavations should be spaced appropriately to avoid undermining large sections of the structures to be underpinned. The horizontal in-situ earth pressures should be supported by temporary props in the short-term condition to avoid excessive ground movements and reduce the risk of bearing capacity failure due to load eccentricity.

Appropriate care would be required during construction to ensure that installation effects do not introduce excessive ground movements and potential impact on surrounding structures and assets.

It is noted that site constraints and logistics may impact the type of plant and equipment which may be adopted for the installation operations and broader earth retention construction works.

6.2. Heave and Consolidation

The demolition of internal superstructure elements will introduce an equivalent unloading pressure of approximately 3-5kPa/storey and the proposed excavation will remove approximately 5.3m of overburden below the building and 6.5m below the rear garden. This will cause the soil underneath the existing shallow foundations to heave, resulting in upwards ground/façade movements. Negative excess pore pressures will be generated in the London Clay as it responds to the unloading. The excess pore water pressures will dissipate with time, resulting in long-term heave.

The time dependent long-term heave pressure on the underside of the proposed basement slab may correspond to approximately 50% of the effective overburden pressure removed (taking into consideration a degree of partial consolidation during construction and soil-structure interaction effects). A design value of 30kPa below the building and 35kPa below the rear garden is recommended for long-term heave. Note that this value should only be used for structural (STR) and geotechnical (GEO) design, and not for uplift/buoyancy (UPL) checks. It is noted that any change in excavation depth will have an inherent impact on the excess pore water pressure generation and magnitude of heave pressure.

The heave pressure can be mitigated in part with the use of a proprietary heave mitigation layer, such as a Cordek Cellcore product or equivalent. The product is designed to resist the wet concrete pressure with an appropriate safety margin, beyond which it will crush under increase in heave pressure in the long-term condition. This would limit the pressure applied to any suspended slabs which span between pile foundations or discrete footings, should such options be adopted. This option would not be applicable for a ground-bearing slab.

Generation of consolidation settlements is anticipated within the London Clay stratum as a result of the increase in loading associated with the proposed structure. These long-term settlements should be considered for the substructure design.

6.3. Uplift

The long-term hydrostatic uplift anticipated to act on the underside of the basement equates to an unfactored pressure of 45kPa below the main building and 60kPa below the deeper rear garden section of the basement.

The global stabilising action acting across the building footprint will need to be in excess of the uplift force from the water table with appropriate partial factors applied in accordance with Eurocode 7. Further checks of the substructure should be carried out as design develops, incorporating more refined load takedowns to assess both global and local uplift conditions.

6.4. Shallow Foundations

6.4.1. Underpins

The proposed scheme comprises the use of underpins founded in the London Clay to support the superstructure above. Assuming an embedded depth of 0.5m and an underpin width of 1m, an indicative safe bearing pressure of 250-300kPa is recommended for design development. This may result in settlements in the order of 5-10mm. A more detailed serviceability check should be undertaken as part of the detailed design, considering structural loading applied to the underpins and associated differential settlements. It should be noted that changes to the geometry and embedment of shallow foundations will result in a different safe bearing pressure.

6.4.2. Ground-Bearing Raft Foundation

Based on the anticipated net change in loading across the site, a raft foundation is satisfactory from a global safe bearing capacity perspective. The serviceability performance of a raft system should be assessed as part of the detailed design, considering soil-structure interaction mechanisms and the distribution of loading through the proposed development superstructure and substructure.

6.5. Concrete Aggressivity

The Design Sulphate Class for the London Clay is DS-4, and the corresponding Aggressive Chemical Environment for Concrete (ACEC) Class is AC-3s for static groundwater.

6.6. Other Risks/Further Considerations

Further ground engineering considerations are summarised below:

- **Below ground obstructions**: No significant obstructions were noted in the ground investigation; however, the project team should consider the presence of potential below ground obstructions across the site (natural and anthropogenic).

- **Site logistics and construction means and methods:** Specialist contractor advice should be sought in relation to plant limitations and constraints.
- **Surrounding buildings and third-party assets**: A ground movement assessment, looking at the impact of the proposed construction of the development on surrounding buildings, will be carried out to support the Planning application. Ground movements may also impact buried services/utilities and surrounding roads and infrastructure, and further ground movement assessments may be required for these assets.
- **Shallow foundations:** The design of shallow foundations is governed by serviceability considerations, such as limiting differential settlements between loading positions, to avoid excessive distortions of the superstructure and damage to surrounding structures. This is of particular relevance where significant overburden is removed as a result of basement excavation, and this facet should be explored as part of detailed design.
- **Monitoring:** It is suggested that monitoring of the surrounding assets, buildings and infrastructure is undertaken during the progression of the works in conjunction with a project specific Action Plan.
- **Uplift:** Global uplift stability and differential settlements from local buoyancy forces between support positions should be in line with the project specific design criteria. It is noted that the impact of local hydrostatic forces acting between column and support positions and the potential associated hogging of the raft should be assessed as part of the detailed raft design.
- **Retaining walls:** Selection of earth pressures should consider lateral movements and SSI effects mentioned in Section 6.1.3. The impact of SSI effects and prediction of anticipated lateral movements should be reviewed as part of the detailed design of the underpins.
- **Durability/aggressivity:** The DS and ACEC design classes presented in Section 6.5 should be adopted for proposed concrete substructure elements. The corresponding Design Sulphate Class may be reduced considering limited expected disturbance or exposure to oxygen of the strata over extended periods of time. The reduction in Design Sulphate class should be confirmed by the geotechnical engineer.

7. Generic Quantitative Risk Assessment (GQRA)

7.1. Targeted Potential Sources of Contamination

GQRA should be based on adequate site investigation which appropriately targets potential sources of contamination and / or exposure pathways. The targeting of potential on-site sources of contamination identified in the Phase I Desk Study is summarised in Table 7.1. All identified potential on-site sources of contamination have been targeted.

Table 7.1 Targeting of Potential On-site Sources of Contamination

Potential Source	Targeted Exploratory Locations
Made Ground	EP1 – EP3 HP1 and WS1 – WS4

A summary of the visual / olfactory evidence of contamination identified and the targeted sampling undertaken in response is presented in Section 5.4.

The installed monitoring well network provides coverage for potential contamination migrating onto the site via the saturated or unsaturated zones. Potential off-site sources of contamination are identified in the Phase I Desk Study.

The results of the GQRA have been considered in view of the risk assessment matrix in Appendix B. Where risk classifications (e.g. low risk, low to moderate risk etc.) are stated this is in accordance with the risk assessment matrix.

Risks to site workers and the environment during the construction phase of the proposed redevelopment can be appropriately managed by successful implementation of construction phase risk assessments and method statements (RAMS). Therefore, the associated construction phase land contamination risks are not considered further in this document but should be appropriately considered and mitigated by the Principal Contractor in their preparation and implementation of construction phase RAMS and Construction Phase Plan (CPP).

7.2. Soil Assessment

The soil sample laboratory analytical results have been compared to human health generic assessment criteria (GAC) appropriate for assessing risks for the specifically proposed development. The selected human health GAC include the LQM/CIEH 'Suitable 4 Use Levels' (S4ULs). The S4ULs are based on Health Criteria Values that represent minimal or tolerable levels of risks to health as described in the Environment Agency's SR2 guidance, ensuring that the resulting assessment criteria are 'suitable for use' under Planning.

For each chemical substance, S4ULs include individual GAC for 6 no. generic land-uses (residential with home grown produce, residential without home grown produce, allotments, commercial and 2 no. public open space land uses) and a range of Soil Organic Matter (SOM) contents. All toxicological and physical-chemical parameters used in the derivation of the S4ULs are presented and discussed in the source publication.

In some instances, selected human health GAC used in this report have been applied from the DEFRA 'Category 4 Screening Levels' (C4SLs), CL:AIRE GAC, Environment Agency (EA) Soil Guideline Values (SGVs) and Atkins AtRisk Soil Screening Values (SSVs). The human health GAC source reference used for each chemical determinant is presented in the GQRA screening tables included as Appendix C. C4SLs have been used preferentially where available.

The proposed development includes residential premises with gardens. Therefore, a human health GAC has been applied to each chemical determinant based on the 'residential with home grown produce' generic land-use scenario. In future, should the site redevelopment plans change from those considered herein then the geo-environmental risk assessments presented in this report will need to be reconsidered.

The human health GAC for mercury assumes the presence of elemental mercury as a conservative worst-case assumption.

There is no published human health GAC with respect to asbestos or asbestos containing materials (ACMs) in soil. Industry best practice document '*Asbestos in soil and made ground: a guide to understanding and managing risks', CIRIA C733, 2014*, indicates that soils containing asbestos concentrations of 0.001 % w/w may be able to liberate airborne fibre concentrations that exceed contemporary occupational exposure limits for nuisance dust. However, as detailed in other research, including publications such as the *CAR-SOIL Industry Guidance (2016)*, in circumstances where very low concentrations of asbestos are identified in soils, the associated risks are considered low. In this study an initial asbestos human health GAC of 'no asbestos detected above laboratory detection limit' is adopted i.e. mitigation or further assessment is required if asbestos in soil is detected at or above <0.001 % w/w.

The identified exceedances of the selected human health GAC are summarised in Table 7.2 and spatially orientated on Figure 7.1.

Table 7.2 Human Health GAC Exceedances Summary

Exploratory Location	Depth (m bgl)	Stratum	Determinant	Detected Concentration (mg/kg)	Human Health GAC (mg/kg)
EP1	0.10	Made Ground	Lead	760	200
EP2	0.20	Made Ground	Lead	1,200	200
EP3	0.10	Made Ground	Lead	1,700	200
WS1	0.30	Made Ground	Lead	830	200
WS2	0.10	Made Ground	Lead	1,700	200
WS4	0.12	Made Ground	Lead	440	200
HP1	0.50	Made Ground	Lead	210	200

The detected exceedance for lead is most likely representative of general Made Ground composition beneath the site in the vicinity of EP1-EP3, WS1, WS2, WS4 and HP1. At PRA stage the same determinants were identified as potential contaminants within Made Ground.

Areas of proposed hardstanding or building footprint will suitably break the contaminant linkage between source and receptor such that no additional mitigation measures are required in these areas. However, the human health GAC exceedances indicate that there is low to moderate risk to proposed on-site human health via direct contact and particulate inhalation and ingestion in proposed garden or soft-landscaping areas. This also reflects unacceptable risk in proposed garden or soft-landscaping areas.

The unacceptable risk can be suitably addressed by removing Made Ground where it aligns with proposed gardens or soft landscaping.

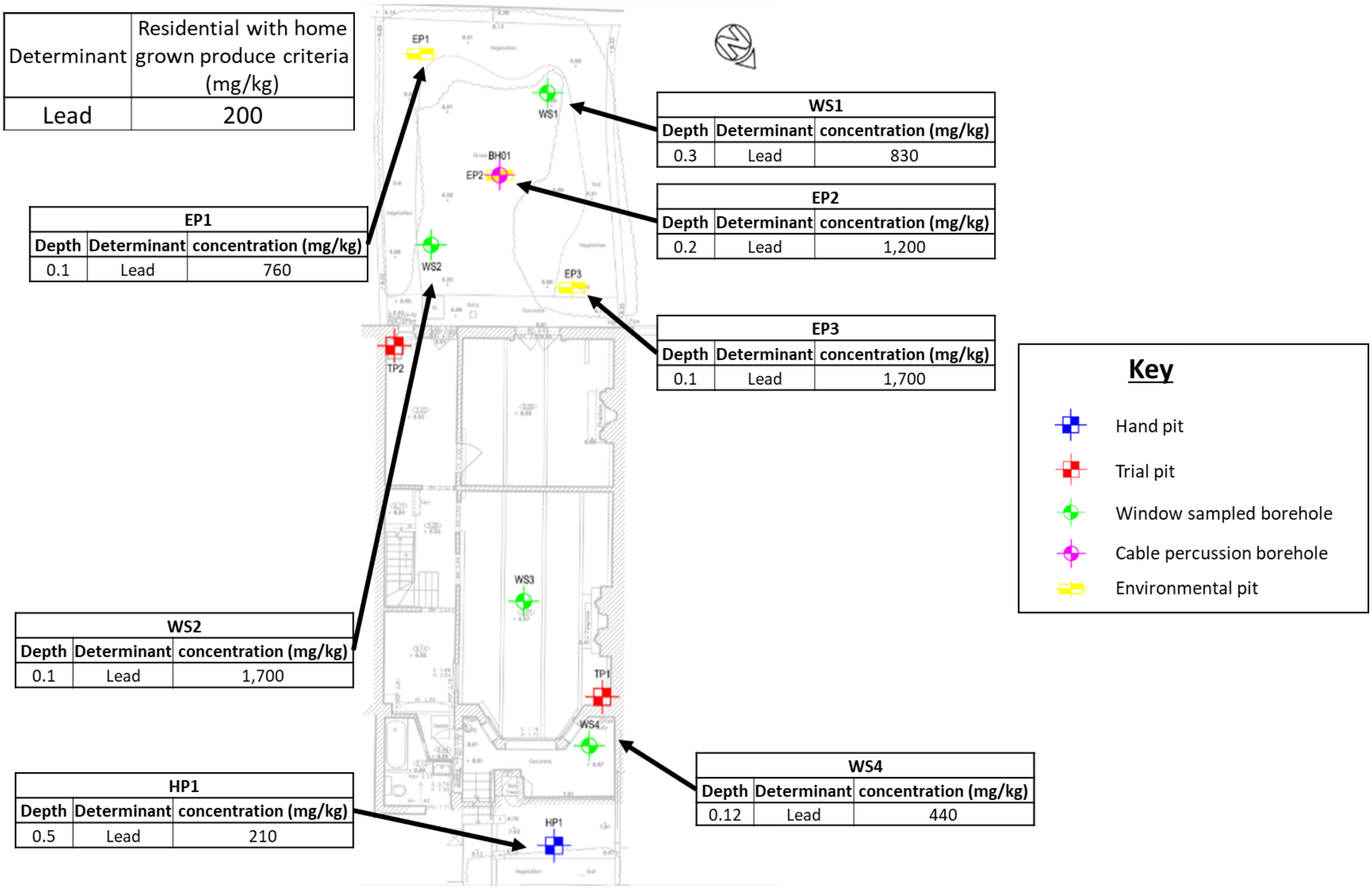


Figure 7.1 Human health GAC exceedances plan

7.3. Ground Gas Assessment

The PRA indicates that the only potential on-site ground gas source is Made Ground. A Made Ground thickness summary plan is provided as Figure 7.2.

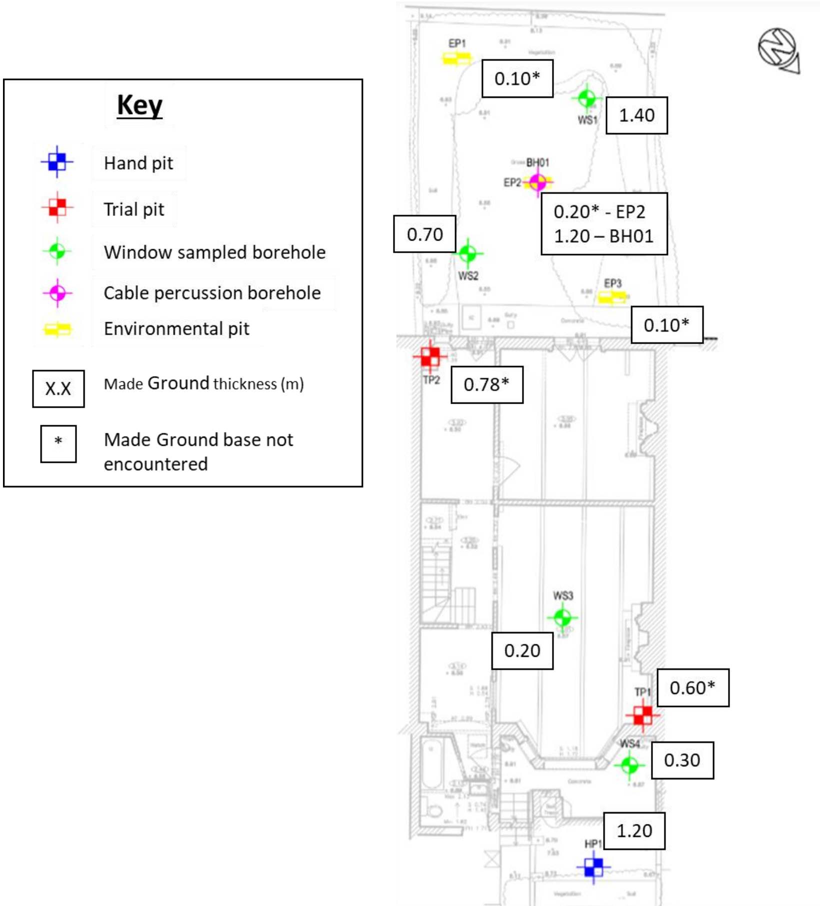


Figure 7.2 Made Ground thickness plan

A total of 3 no. monitoring wells were installed as part of the ground investigation (HP01, WS01 and WS02). Monitoring well construction details are summarised in Table 4.1. The equipment and processes which have been implemented for the ground gas monitoring are summarised in Section 4 and in the Factual Report.

The ground gas assessment has been undertaken in general accordance with guidance contained within *CIRIA 665, 'Assessing risks posed by hazardous ground gases to buildings'* and *BS8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*. The method requires use of both gas concentrations and ground gas well flow rates to calculate a gas screening value (GSV). The GSV is calculated as follows:

$$GSV = \frac{Analyte\ Concentration\ (\%)\ \times Flow\ rate\ (L/hr)}{100}$$

The calculation is carried out for methane (CH_4) and carbon dioxide (CO_2).

6 no. rounds of ground gas monitoring have been undertaken. The results of the ground gas monitoring are presented in the Factual Report. Atmospheric pressures ranged from 976 mb to 1012 mb across all monitoring rounds which includes episodes of high and low pressure. The results are summarised in Table 7.3. The atmospheric pressure trends summarised in Table 7.4 were determined from barometric pressures recorded using the GFM436 analyser at the start and end of each monitoring day. The results show that monitoring was undertaken on three occasions when there were falling atmospheric pressures and two occasion where they rose then fell. Falling atmospheric pressures can be considered to represent worst case conditions for gas monitoring, so the collected dataset is appropriately conservative.

Table 7.3 Ground Gas Monitoring Summary Data

Exploratory Hole Reference	Monitoring Round Date	Minimum O_2 (%)	Maximum CO_2 (%l)	Maximum CH_4 (%)	Maximum H_2S (ppm)	Maximum CO (ppm)	Maximum PID (ppm)	Steady-state Flow Rate (l/hr)	Barometric Pressure (mb)
HP1	13/10/22	20.6	0.4	<0.1	<1	<1	0.2	<0.1	1003
	20/10/22	20.3	0.6	<0.1	<1	<1	0.3	<0.1	998
	24/10/22	20.2	0.6	<0.1	<1	<1	0.2	<0.1	1004
	03/11/22	20.0	0.7	<0.1	<1	<1	0.3	<0.1	993
	10/11/22	20.3	0.5	<0.1	<1	<1	0.2	<0.1	1012
	17/11/22	20.4	0.3	<0.1	<1	<1	0.1	<0.1	976
WS1	13/10/22	20.1	0.6	<0.1	<1	<1	0.1	<0.1	1003
	20/10/22	19.7	0.8	<0.1	<1	<1	0.2	<0.1	998
	24/10/22	20.5	0.5	<0.1	<1	<1	0.1	<0.1	1004
	03/11/22	19.6	0.8	<0.1	<1	<1	0.3	<0.1	993
	10/11/22	19.9	0.6	<0.1	<1	<1	0.1	<0.1	1012
	17/11/22	19.9	0.5	<0.1	<1	<1	0.2	<0.1	976
WS2	13/10/22	19.9	0.9	<0.1	<1	<1	0.3	<0.1	1003
	20/10/22	19.6	1.0	<0.1	<1	<1	0.4	<0.1	998
	24/10/22	19.8	0.8	<0.1	<1	<1	0.4	<0.1	1004
	03/11/22	19.4	1.1	<0.1	<1	<1	0.5	<0.1	993
	10/11/22	19.9	0.7	<0.1	<1	<1	0.3	<0.1	1012
	17/11/22	20.1	0.6	<0.1	<1	<1	0.3	<0.1	976

Table 7.4 Ground Gas Monitoring Summary Atmospheric Pressure Trends

Monitoring Round Date	Barometric Pressure Trend
13/10/22	Stable
20/10/22	Falling
24/10/22	Falling
03/11/22	Falling

Monitoring Round Date	Barometric Pressure Trend
10/11/22	Rising and falling
17/11/22	Rising and falling

BS8485 utilises the GSV and categorises the ground gas risk into 6 no. different hazard potentials, referred to as Characteristic Situations (CS1 – CS6). These are summarised in Figure 7.3.

CS	Hazard potential	Site characteristic GSV [A)] L/h	Additional factors
CS1	Very low	<0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	0.07 to <0.7	Typical measured flow rate <70 L/h (otherwise consider an increase to CS3)
CS3	Moderate	0.7 to <3.5	–
CS4	Moderate to high	3.5 to <15	–
CS5	High	15 to <70	–
CS6	Very high	>70	–

[A)] The figures used in this column are empirical.

NOTE The CS is equivalent to the characteristic GSV in CIRIA C665 [6].

Figure 7.3 CS vs. GSV (ref. *BS8485*)

GSV have been calculated to define the gas regime at the site as per *BS8485*. The measured worst-case parameters across all wells have been adopted for the calculation on a conservative basis. The GSV for carbon dioxide and methane have been calculated using the maximum concentrations of carbon dioxide (1.1%) and methane (<0.1%) detected during the return monitoring visits. The maximum detected steady gas flow rate (<0.1 l/hr) has also been used in the calculation. Where parameter values are recorded below the equipment detection limit then the limit of detection has been assumed for the calculation. The calculated GSV for CO_2 and CH_4 are:

- Carbon dioxide: 0.0011 l/hr
- Methane: 0.00010 l/hr

On the basis of the calculated GSV the site is classified as characteristic situation 1 (CS1) – 'very low risk'.

On the return monitoring visits hydrogen sulphide (H_2S) and carbon monoxide (CO) were not detected above equipment detection limits in each of the wells (<1ppm). Figure 7.4 has been taken from *CIRIA C665* and includes Occupational Exposure Limits (OELs) for long-term and short-term exposure by humans. The monitoring data for H_2S and CO indicates no exceedances of the OELs and therefore it is considered that there is low risk (i.e. no unacceptable risk) with respect to hydrogen sulphide and carbon monoxide and the proposed development. No mitigation for H_2S and CO is required.

Properties	Methane	Carbon dioxide	Carbon monoxide	Hydrogen sulphide	Hydrogen
Chemical symbol	CH_4	CO_2	CO	H_2S	H_2
Density (g/l)	0.71	1.98	1.25	1.53	0.09
Melting point (°C)	−184	−78.5 (subliming point)	−205	−85	−259
Boiling point (°C)	−164		−191	−61	−252.87
Colour	Colourless	Colourless	Colourless	Colourless	Colourless
Odour	Odourless	Odourless (acid taste)	Odourless	Rotten eggs Sense of smell disabled at high (toxic) concentrations	Odourless
Flammability	Explosive in air at 515 % Range decreases if CO_2 present. >25 % CO_2 will render non-flammable	Non-combustible	Explosive in air at concentrations of 12.5–74.2 %	Flammable at concentrations of 4.5–45.5 % in air	Explosive in air at 4–74 %
Solubility in water (at 25°C)	25 mg/l	1450 mg/l pH dependent	21.4 mg/l	4100 mg/l	1.62 mg/l* at 21°C
Formation	Anaerobic degradation of organic material	Oxidation and combustion of organic materials, respiration	Incomplete combustion of organic material. Indicator of underground fires	Anaerobic decomposition of organic matter containing sulphur	Anaerobic degradation of organic material
Reactiveness	Fairly inert except with chlorine or bromine in direct sunlight	-	Low	Moderate – atmospheric half life of 1–30 hours	
Toxicity effects on humans	**Low** But at high concentrations (>33 %) can result in asphyxiation due to displacement of oxygen	**High** Headaches and shortness of breath at 3 % Loss of consciousness at 10 – 11 % Fatality at 22 %. OELs 1.5 % (short-term) and 0.5 % (long-term)	**High** OELs 200 ppm (short-term) and 30 ppm (long-term) EAL 350 μg/m³ (long-term) 10 000 μg/m³ (short-term)	**High** Asphyxiant at 400 – 500 ppm OELs 10 ppm (short-term) and 5 ppm (long-term) EAL 140 μg/m³ (long-term) 150 μg/m³ (short-term)	**Low** But at high concentrations (>30 %) can result in asphyxiation due to displacement of oxygen
Toxicity effects on vegetation	Displacement of oxygen	Cause toxic reactions in root systems. Displacement of oxygen			

Figure 7.4 Physical and chemical properties of common hazardous soil gases (ref. *CIRIA C665*)

7.4. Vapour Assessment

The soil samples with the highest VOC head-space readings (which were all very low anyway) underwent laboratory testing but no VOC concentrations were detected above the selected human health GAC. The chemical laboratory results for soils indicate that volatile contamination is generally not present.

Table 7.3 summarises the vapour concentrations detected in monitoring wells during the return monitoring rounds. All return monitoring visits identified VOC concentrations <1 ppm within the monitoring wells.

Taking into consideration the multiple lines of evidence, there is low risk (i.e. no unacceptable risk) to human health and buildings and structures of the proposed development due to volatile contamination.

8. Preliminary Waste Assessment

The results of the chemical soil analysis have been considered in view of potential soil waste classification. The waste assessment presented below is preliminary and based on the soil chemical laboratory results only. Any excavation and subsequent disposal of soils from the site should be informed by a full waste assessment for the specific excavation and disposal activities being undertaken in accordance with *Technical Guidance WM3 - Waste Classification: Guidance on the classification and assessment of waste (1st Edition v1.2.GB)*.

The available soil sample analytical results generally indicate that on-site Made Ground can be classified as Non-hazardous waste if excavated and sent for off-site disposal. However, elevated heavy metal concentrations (including 1,200 and 1,700 mg/kg lead) have been detected in Made Ground. These concentrations indicate that Made Ground at EP2, EP3 and WS2 may represent Hazardous waste on excavation. A full waste assessment based on *WM3* is recommended which may be able to identify an alternative classification.

WAC testing may enable disposal of Non-hazardous Made Ground from the site at a landfill licenced to accept inert materials. It should be possible for natural soils excavated from the site to be sent to a landfill licenced to accept inert materials.

WAC testing will be required to enable landfill acceptance of any Hazardous soil waste (if present) excavated from the site.

Please be aware that non-landfill solutions are also potentially available for soils excavated from the site. Should a full waste assessment and appraisal of disposal / recycling / re-use options be required for the construction phase then we can assist once specific details of the required excavation and disposal activities are known. The finalised site cut and fill model would be particularly useful for this exercise.

9. Closing Remarks

A2 Site Investigation Limited were engaged by Edmund Lehmann and Jennifer Nguyen to prepare an Interpretive Report report for the proposed development at 13 Belsize Crescent.

The site currently includes a four-storey residential building including a single-level lower ground floor over the majority of the building footprint. The scheme comprises partial demolition of internal superstructure elements. The lower ground floor will be extended and a large single-storey basement will be constructed, extending beyond the footprint of the existing building to include a swimming pool, gym and bathrooms.

This report comprises an interpretation of the findings from the recent ground investigation undertaken at the site and provides an assessment of key geotechnical considerations associated with the proposed development.

The ground conditions at the site Made Ground underlain by the London Clay Formation underlain by the Lambeth Group.

Guidance in relation to the constructability of the development has been provided, alongside key ground engineering risks associated which require project-specific mitigation measures to be developed.

Following GQRA, it is considered that in accordance with *LCRM* guidance there is unacceptable risk to proposed on-site human health in proposed garden / soft-landscaped areas due to the lead concentrations detected in Made Ground. The unacceptable risk can be addressed by removing the exposure pathways. This may be achieved by removing Made Ground where it aligns with proposed gardens or soft landscaping.

Appropriate new water supply pipe construction is required in consultation with the utility provider.

Risks to site workers and the environment during the construction phase of the proposed redevelopment can be appropriately managed by successful implementation of construction phase risk assessments and method statements (RAMS). Therefore, the associated construction phase land contamination risks should be appropriately considered and mitigated by the Principal Contractor in their preparation and implementation of construction phase RAMS and Construction Phase Plan (CPP).

Should any changes be made to the proposed development compared to the details presented herein, or should any new information become available, then the assessments included in this interpretive report must be updated.

Appendix A: Qualitative Risk Assessment Matrix

A2SI qualitative risk assessment for geo-environmental purposes is undertaken in accordance with *CIRIA C552: Contaminated Land Risk Assessment, A Guide to Good Practice (Rudland et al., 2001)*. The CIRIA C552 risk categories and the assessment methodology are summarised below in Table B.1, Table B.2 and Table B.3. Potential magnitude and potential likelihood are both classified to enable a risk rating to be assessed.

Potential magnitude takes into account the potential consequences should a complete source–pathway–receptor linkage be present. Potential magnitude is classified as per Table B.1.

Table B.1 Definition of potential magnitude of consequence

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings / property, major pollution to controlled waters.
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures.
Minor	Damage to non-sensitive ecosystems or species.

Potential likelihood takes into account the presence of the hazard and receptor as well as the integrity of the pathway for exposure, i.e., whether a source-pathway-receptor linkage is present or not. Potential likelihood is classified as per Table B.2.

Table B.2 Definition of potential likelihood of exposure

Category	Definition
High Likelihood	Pollutant linkage may be present and is almost certain to occur in the long-term. Or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that it will occur over the long-term.
Low Likelihood	Pollutant linkage may be present, and there is a possibility that it will occur, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but it is improbable that it will occur.

The potential magnitude of consequence and the potential likelihood of exposure are assessed in accordance with the risk matrix presented in Table B.3.

Table B.3 Geo-environmental risk assessment matrix

		Potential Magnitude of Consequence			
		Severe	Medium	Mild	Minor
Potential Likelihood of Exposure	High Likelihood	Very High	High	Moderate	Low to Moderate
	Likely	High	Moderate	Low to Moderate	Low
	Low Likelihood	Moderate	Low to Moderate	Low	Very Low
	Unlikely	Low to Moderate	Low	Very Low	Very Low

Appendix B: GQRA Screening

Human Health Generic Quantitative Assessment for Soil

Key:	
(yellow)	Exceedance of the GAC
GAC -	Generic Assessment Criteria

Laboratory Report Ref.	Units	Residential Home with Plant uptake		2444415	2444416	2444417	2444418	2444419	2444420	2444421	2444422	2444423	2444424
Exploratory Location Ref.				Garden 1	Garden 2	Garden 3	TP1	TP2	WS1	WS2	WS3	WS4	HP1
Sample Depth (m)				0.10	0.20	0.10	0.10	0.10	0.30	0.10	0.80	0.12	0.50
Sample Date				29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022
Made Ground / Natural ?		1% SOM											
		GAC	GAC Ref.										
Anions and Other													
pH - Automated	pH Units	-		7.5	7.8	7.9	8.7	7.9	7.6	7.9	8.2	11.4	9.4
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	-		44	26	30	340	2300	24	56	930	250	260
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	-		0.022	0.013	0.015	0.17	1.2	0.012	0.028	0.47	0.12	0.13
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	-		22.2	12.8	15.2	171	1170	11.9	27.8	467	123	132
Organic Matter (automated)	%	-		8.4	3.7	4.9	0.2	0.5	4.6	4	0.3	1.1	0.8
Fraction Organic Carbon (FOC) Automated	N/A	-		0.049	0.022	0.029	< 0.0010	0.0028	0.027	0.023	0.0017	0.0066	0.0048
Total Organic Carbon (TOC) - Automated	%	-		4.9	2.2	2.9	< 0.1	0.3	2.7	2.3	0.2	0.7	0.5
Heavy Metals													
Arsenic (aqua regia extractable)	mg/kg	37	DEFRA	24	25	18	14	15	20	24	14	16	14
Barium (aqua regia extractable)	mg/kg	1,300	CL:AIRE GAC	220	410	350	67	92	320	510	88	280	94
Beryllium (aqua regia extractable)	mg/kg	1.7	LQM S4ULs	1.1	1.4	1	0.95	1.4	1.1	1.6	1.6	1	1.2
Boron (water soluble)	mg/kg	290	LQM S4ULs	2.5	0.5	0.3	1.3	2.2	0.9	1.2	0.9	0.4	1.5
Cadmium (aqua regia extractable)	mg/kg	22	DEFRA	< 0.2	1.7	0.9	< 0.2	< 0.2	0.9	1.4	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	21	DEFRA	U/S	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	910	LQM S4ULs	U/S	33	36	46	41	32	38	50	25	48
Chromium (aqua regia extractable)	mg/kg	910	LQM S4ULs	23	34	37	46	41	33	38	50	25	48
Copper (aqua regia extractable)	mg/kg	2,400	LQM S4ULs	75	120	65	15	22	90	130	18	39	24
Lead (aqua regia extractable)	mg/kg	200	DEFRA	760	1200	1700	44	82	830	1700	27	440	210
Manganese (aqua regia extractable)	mg/kg	-		290	370	370	290	230	380	490	220	320	190
Mercury (aqua regia extractable)	mg/kg	11	LQM S4ULs	1.5	1.4	0.6	< 0.3	< 0.3	0.8	1.5	< 0.3	0.8	< 0.3
Molybdenum (aqua regia extractable)	mg/kg	670	CL:AIRE GAC	1.9	1.4	1	0.8	1.1	1.4	1.7	0.49	0.97	0.83
Nickel (aqua regia extractable)	mg/kg	130	LQM S4ULs	28	25	20	19	31	24	28	37	19	31
Selenium (aqua regia extractable)	mg/kg	250	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	410	LQM S4ULs	45	60	51	71	65	54	67	77	53	72
Zinc (aqua regia extractable)	mg/kg	3,700	LQM S4ULs	500	610	590	210	70	480	830	74	550	90
Asbestos													
Asbestos in Soil	Type	Non Detection	A-squared GAC	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	Non Detection	A-squared GAC	MWI	MWI	MWI	MWI	MWI	MWI	MWI	MWI	MWI	MWI
PAHs													
Naphthalene	mg/kg	2.3	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	170	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	210	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	170	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	95	LQM S4ULs	0.69	0.66	0.88	< 0.05	< 0.05	0.67	0.72	< 0.05	0.53	0.3
Anthracene	mg/kg	2,400	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.22	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	280	LQM S4ULs	1.4	1.7	1.8	< 0.05	< 0.05	1.6	2.1	< 0.05	2.2	0.82
Pyrene	mg/kg	620	LQM S4ULs	1.3	1.5	1.6	< 0.05	< 0.05	1.5	1.8	< 0.05	2	0.74
Benzo(a)anthracene	mg/kg	7.2	LQM S4ULs	0.91	1.1	0.87	< 0.05	< 0.05	0.9	1.4	< 0.05	1	0.39
Chrysene	mg/kg	15	LQM S4ULs	1.1	1.1	1.2	< 0.05	< 0.05	1.1	1.5	< 0.05	1.4	0.56
Benzo(b)fluoranthene	mg/kg	2.6	LQM S4ULs	1.4	1.5	1.4	< 0.05	< 0.05	1.5	2.1	< 0.05	1.5	0.55
Benzo(k)fluoranthene	mg/kg	77	LQM S4ULs	0.5	0.74	0.63	< 0.05	< 0.05	0.52	0.68	< 0.05	0.71	0.23
Benzo(a)pyrene	mg/kg	5.0	DEFRA	0.99	1.2	1.1	< 0.05	< 0.05	1.1	1.5	< 0.05	1.4	0.45
Indeno(1,2,3-cd)pyrene	mg/kg	27	LQM S4ULs	0.6	0.67	0.63	< 0.05	< 0.05	0.57	0.85	< 0.05	0.75	0.26
Dibenz(a,h)anthracene	mg/kg	0.24	LQM S4ULs	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.21	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	320	LQM S4ULs	0.71	0.77	0.69	< 0.05	< 0.05	0.71	0.88	< 0.05	1	0.32
Speciated Total EPA-16 PAHs	mg/kg	-		9.7	10.9	10.8	< 0.80	< 0.80	10.3	14	< 0.80	12.5	4.62
TPH													
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	42	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	100	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	27	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	130	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	1100	LQM S4ULs	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	65,000	LQM S4ULs	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg			< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0

Human Health Generic Quantitative Assessment for Soil

Key:	
	Exceedance of the GAC
GAC -	Generic Assessment Criteria

Laboratory Report Ref.	Units	Residential Home with Plant uptake		2444415	2444416	2444417	2444418	2444419	2444420	2444421	2444422	2444423	2444424
Exploratory Location Ref.				Garden 1	Garden 2	Garden 3	TP1	TP2	WS1	WS2	WS3	WS4	HP1
Sample Depth (m)				0.10	0.20	0.10	0.10	0.10	0.30	0.10	0.80	0.12	0.50
Sample Date				29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022
Made Ground / Natural ?		1% SOM											
		GAC	GAC Ref.										
TPH-CWG - Aliphatic >EC35 - EC40	mg/kg	65,000	LQM S4ULs	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	70	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	130	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	34	LQM S4ULs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	74	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7	< 1.0	< 1.0	2.4	1.8
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	140	LQM S4ULs	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	8.6	< 2.0	< 2.0	7.3	6.4
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	260	LQM S4ULs	11	11	< 10	< 10	< 10	14	12	< 10	11	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	1,100	LQM S4ULs	18	25	21	19	13	34	27	< 10	24	12
TPH-CWG - Aromatic >EC35 - EC40	mg/kg	1,100	LQM S4ULs	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg		-	29	36	21	19	13	64	39	< 10	45	21
BTEX and MTBE													
Benzene	µg/kg	200	DEFRA	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	130,000	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	47,000	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	56,000	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	56,000	LQM S4ULs	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	49,000	CL:AIRE GAC	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

A2 Site Investigation

A2 Site Investigation Limited
One Westminster Bridge Rd
London, SE1 7XW

020 7021 0396
contact@a2-si.com
www.a2-si.com