Intelligent Ground Solutions

Preliminary Risk Assessment and Geo-Environmental Assessment

Bradfield Road, South Ruislip
HA4 0NU

For Safestore

21 February 2025
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Executive Summary

Site Location	Bradfield Road, South Ruislip, HA4 0NU grid reference 512480, 185340. The site is currently an active warehouse in the western area of the site with associated car parking in the north and loading bays in the southeast. It is understood the site is proposed for the construction of two extensions on the existing Safestore facility, to the north and east of the current building.
Site History	Earliest available historical mapping shows the site comprised agricultural land with drainage system in the southern area of the site. Aerial imagery shows that by c.1967 the site comprised a warehouse in the western area of the site until present day. The wider area generally comprised a railway line (adjacent to the south), industrial development including various depots, works, factories, warehouses and tanks (within 200 m north and west of the site) and a residential development (within 100 m east of the site).
Environmental Setting	The site is considered to be underlain by the bedrock geology of the London Clay Formation (Unproductive Strata). No superficial strata are recorded on-site. The nearest surface water feature is the Roxbourne Ditch located approximately 615 m north of the site. The site is not located within a Source Protection Zone (SPZ). There are no recorded groundwater and surface water abstractions within 1 km of the site.
Contamination Potential Risk	Significantly elevated concentrations of contaminants have not been identified within shallow soils at the site. However, loose fibres of amosite and chrysotile asbestos was identified at DS103 within the shallow Made Ground in the eastern area of the site. Safe working procedures need to be adopted. The groundworks Contractor should be made aware of the possibility of encountering potential Asbestos Containing Materials (ACM) within the Made Ground and an appropriate protocol to mitigate exposure of the workforce and general public should be in place. Consequently, Geo2 consider there to be a **Low to Moderate** risk to human health from contamination in soil, primarily to construction workers during the development phase. Marginally elevated concentrations of heavy metals were identified within the groundwater across the site. Given the low permeability of the underlying London Clay Formation, absence of potable water abstractions and no SPZ, Geo^2 consider there to be a **Low** risk to controlled waters. Ground gas monitoring indicated the site can be classified as CS1 (Low Risk), where ground gas protection measures will not be required.
Geotechnical Assessment	Based upon the findings of the ground investigation traditional pad foundations are considered suitable within the natural firm clays of the London Clay Formation. The use of traditional foundations should give consideration to the variable ground conditions, groundwater levels and volume change potential of the clays. All foundation excavations should be inspected by a suitably qualified engineer prior to casting to ensure the appropriate depth, founding medium and strength characteristics have been achieved. A lightly loaded ground bearing floor slab is likely suitable for the proposed development following excavation and removal of Made Ground and any soft soils,

	and replacement with engineered granular backfill. Alternatively, floor slabs could be suspended.
Recommendations	The following development considerations may apply: • A hotspot protocol (watching brief) should be in place for groundworkers to act upon should previously unidentified potential contaminants be identified; • Appropriate asbestos safe working practises will be required. Groundworkers should be provided with appropriate risk assessments and PPE and/or RPE and any associated air monitoring as required; • Waste classification testing may be required should soils be destined for off-site management at landfill / treatment facility; and, • Confirmation should be sought from the Local Water Authority as to whether they will require upgraded pipework to be installed for any new service installations, although this is considered to be unlikely.
This table is a summary only, full details and limitations of the assessment are provided within the main body of the report.	

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1.0 Introduction

Geo^2 Limited were commissioned by Safestore to conduct a Preliminary Risk Assessment and Geo-Environmental Assessment for a site at Bradfield Road, South Ruislip, HA4 0NU. The site is approximately 0.41 hectares in area and located at grid reference 512480, 185340.

The study was undertaken prior to proposed construction of two extensions on the existing Safestore facility, to the north and east of the current building.

1.1 Scope of Works

The Preliminary Risk Assessment, consisting of desk study and site walkover, was conducted in order to assess the potential for contaminant sources to be present on site, resulting from the past use of the site and current land use. The desk study was also undertaken to identify possible sensitive environmental receptors that may be at risk from sources, if present on site, within the locality of the site.

The scope of the Preliminary Risk Assessment and investigation have been designed with consideration of guidance on Planning Practice Guidance (Land Affected by Contamination), Land Contamination: Risk Management pages of the GOV.UK web pages and the relevant requirements of the National Planning Policy Framework (NPPF) (as revised 2023) (paragraphs 180 & 189-191). geotechnical scope of investigation was designed in consideration with BS EN 1997-1:2004 Eurocode 7: *Geotechnical Design – Part 1 General Rules* and BS EN 1997-2:2007 Eurocode 7: *Ground Investigation and Testing*. Unless specifically stated, this report does not constitute a Geotech Design Report (GDR) under Eurocode 7.

The intrusive investigation was conducted between 8th and 9th January 2025. The investigation was undertaken in accordance with the agreed proposal dated 17th December 2024 (Ref. Q4383). The findings of the investigation are presented herein.

2.0 Description of the Site and Surroundings

2.1 Site Description

The site is located at 1 Bradfield Road, Ruislip HA4 0NU, approximately 1.35 km east of South Ruislip train station and approximately 1.3 km north of A40 road. Figure 1 in Appendix A shows the location of the site. The area shown within the red site boundary on Plate A below, will be referred to throughout this document as 'the site'.

The site is currently an active warehouse with offices on the northern extent of the warehouse. Associated hardstanding car parking is noted on the north and east of the site with storage units located southeast of the site.

Figure A: Site Location Plan. Red is the site boundary. © Crown Copyright and Database Right 2024

2.2 Site Walkover

A site walkover was undertaken on 8th January 2025, with a photographic survey included in Appendix B. The site walkover findings are detailed below.

The site is occupied by a Safestore warehouse on the west of the site with offices in the northern area and self-storage units in the southern area of the warehouse. Associated car parking was noted in the northwestern area and northeastern area of the site. Several shipping containers were noted in the southeastern and southern area of the site. The majority of the site was covered in hardstanding with soft landscaping noted in the southern and southwestern areas of the site.

A caged gas storage area was noted in the southeastern area of the site and an electrical sub-station was noted adjacent to the northwest of the site.

The southern boundary of the site slopes upwards towards the south. A retaining wall was noted along the eastern boundary of the site.

No visual or olfactory evidence of contamination was noted during the site walkover.

2.3 Site Surroundings

The surrounding land uses of the site are summarised below.

Direction	Land Use
North	Bradfield Road with commercial/industrial development beyond.
East	Field End Road with residential development beyond.
South	Railway line with residential development beyond
West	Commercial/industrial development.

3.0 Desk Study

3.1 Desk Study Data

Information regarding the environmental setting of the site was obtained from the Envirocheck report, which collated information from a variety of sources. A copy of the Envirocheck report is presented in Appendix C.

Where indicated in the table below, the data from the Envirocheck report has been supplemented with additional information obtained from freely available online data.

Site Geology	British Geological Survey (BGS) data indicates that the site is directly underlain by the bedrock geology of the London Clay Formation comprising clay, silt and sand. There are no BGS recorded boreholes on site. One BGS recorded borehole (Ref. TQ18NW13) is located approximately 560 m northwest of the site. The ground conditions encountered comprised the following generalised sequence: • Made Ground comprising tarmac over silty clay to a depth of 1.60 m bgl; • Reworked London Clay comprising slightly sandy clay or gravelly sandy clay to a depth of 4.60 m bgl; and, • London Clay comprising sandy clay or silty clay to end borehole depth of 21.00 m bgl.
Ground Stability	The Envirocheck report shows the site has the following risk ratings associated with these ground stability hazards: • Collapsible ground stability – *very low risk.* • Compressible ground stability – *no hazard.* • Ground dissolution – *no hazard.* • Landslide ground stability hazard – *very low to low risk.* • Running sands stability hazard – *very low risk.* • Shrinking or swelling clay stability hazard – *low risk.*
Mining	There are no BGS Recorded Mineral Sites within 1 km of the site. The site is not within an area which may be affected by underground mining.
Radon	The site is in a low probability radon area (less than 1% of homes are estimated to be at or above the Action Level). As such, no radon protective measures are necessary in the construction of new dwellings or extensions.
Site Hydrogeology	The London Clay Formation is classified as an Unproductive Aquifer. The historic BGS recorded borehole (TQ18NW13) did not encounter groundwater. The site is not located within a designated groundwater Source Protection Zone (SPZ). According to the Envirocheck Report no groundwater abstractions are located within 1 km of the site.
Site Hydrology	The nearest surface water feature is The Roxbourne ditch located approximately 615 m north of the site. According to the Envirocheck report, there are no surface water abstractions within 1 km of the site.

	Three Discharge Consent entries are recorded within 500 m of the site all relating to Thames Water Utilities Ltd. The two closest entries are located approximately 360 m northwest of the site relating to storm sewage overflow into the Yeading Brook East with revoked dates in March 2019 and September 2010. One Substantiated Pollution Incident Register entry is located within 250 m of the site. The entry is located approximately 205 m west of the site associated with firefighting run-off. The incident is dated August 2003 and the impact to water was recorded as significant (category 2). No impact to land or air was recorded from the incident.
Waste and Infilled Land	There are no EA, LA or historical landfills sites within 1 km of the site. Two licensed waste management facilities are located approximately 455 m southwest of the site, operated by Dafcon Haulage Ltd for household, commercial and industrial transfer stations, status surrendered in March 1993 and status transferred. Three areas of potentially infilled land (water) are located within 250 m of the site. The closest of which is located approximately 30 m northeast of the site.
Local Industrial Land Use	The Envirocheck Report records the following pertinent entries on-site: • Five contemporary trade directory entries (active and inactive) including printers, electrical goods sales, garage services, commercial cleaning services and waste disposal services; and, • Three commercial services points of interest relating to recycling services, repair & servicing and transport, storage and delivery. The following pertinent entries are recorded within 250 m of the site: • Twenty-one contemporary trade directory entries (active and inactive) including car dealers and services, kitchen furniture manufacturers, builders' merchants, pharmaceutical manufacturers & distributors, freight forwarders, frozen food processors & distributors and water coolers; • Seven commercial services points of interest relating to repair & servicing and transport, storage and delivery; and, • Six manufacturing and production points of interest relating to a business park & industrial estates and stone quarrying & preparation.
Sensitive Environmental Receptors	It is understood from information provided within the Envirocheck Report, that an adopted green belt is located approximately 475 m south of the site.
Heritage Interest	Historic England Records (historicengland.org.uk) do not list any entries on or within the immediate vicinity of the site.
Unexploded Ordnance (UXO)	A review of Zetica online risk mapping for the area indicates the site is located in a moderate area with respect to UXO. A Preliminary Explosive Ordnance Risk Assessment report is presented as Appendix D. This confirms a low risk to the proposed works. However, there is a potentially elevated likelihood of Explosive Ordnance (EO) being encountered during the proposed development works.

	Therefore, a Stage 2 Detailed EO Risk Assessment is recommended prior to the development phase works commencing.

3.2 Environmental Sensitivity

Given the above, the site is considered to be of a low environmental sensitivity given the underlying Unproductive Strata of the bedrock geology at the site, the absence of an underlying SPZ, the absence of nearby groundwater abstractions, and the distance of the nearest surface watercourse (615 km southeast).

3.3 Historic Planning Applications

A review of Hillingdon London Borough Council planning portal has shown that planning permission has previously been obtained for the site, summarised in the table below.

Planning Ref.	Year	Details
2391/APP/2024/563	March 2024	Erection of a two-storey extension and a three storey extension to existing self-storage unit (Use Class B8) with associated works to the existing building including new roof, amendments to fenestration and external materials. The decision was granted in May 2024 with condition 5 relating to the requirement of a desk top study, site investigation, remediation and verification.
2391/APP/2002/611	March 2002	Erection of a two storey extension to an existing self-storage facility. The decision was granted in May 2002. No further information was provided.
2391/F/98/0682	April 1998	Change in use from Class B8 (warehousing) to use for car bodyshop repairs and respraying. The decision was granted in June 1998. No further information was provided.

3.3.1 Off-Site Planning Applications

A brief review of planning applications has been made for sites within 350m, pertinent applications are summarised in the table below.

Planning Ref.	Year	Details
70454/APP/2015/383	January 2016	Details Pursuant to conditions 8 (Contamination) parts i and ii only of planning permission ref: 70454/APP/2015/383 for 'demolition of the existing building and erection of a three-storey industrial building and pedestrian link to the adjacent building of Unit 4 Bradfield Road (Use Class B2b) together with car parking to the front' dated 12/01/2016. *Approximately 85 m west of the site.* The decision was granted in March 2016. An additional ground investigation report was provided. Further detail of the report is shown in Section 5.0.

25508/APP/2015/3183	August 2015	Details pursuant to conditions 6 (Water Management), 8 (Energy Report) and 9 (Contamination) of planning permission Ref: 25508/APP/2014/3570 dated 02/03/2015 (Demolition of existing buildings and redevelopment to provide a Builders Merchants (sui generis use) with associated access, servicing, parking and outdoor storage) (Resubmission). *Approximately 305 m northwest of the site.* The decision was granted November 2015. A ground investigation report and a waste removal statement were provided. Further detail is provided in Section 5.0.
70454/APP/2015/383	February 2015	Demolition of an existing industrial building and the construction of a storey industrial unit (Use Class B1B). *Approximately 85 m west of the site.* The decision was granted with condition 8 relating to the requirement of a site investigation and remediation & verification. Phase 1 and Phase 2 reports have been provided. Further detail of the reports are shown in Section 5.0
63619/APP/2011/1250	May 2011	Details in compliance with conditions 17 (refuse management plan), 20 (contamination strategy), 21 (energy efficiency), 22 (SUDS) and 24 (electric vehicle charging) of planning permission ref. 63619/APP/2010/381 dated 25/06/2010: New single storey warehouse, incorporating site re-levelling, re-using and improving existing road access point with associated parking, 2 lorry servicing bays and covered cycle facilities, including demolition of existing single storey warehouse with ancillary two storey offices and surrounding outbuildings. *Approximately 295 m west of the site.* The decision was granted in July 2011. A Phase ll Geo-Environmental Report was provided. Further detail of the report is shown in section 5.0.
915/APP/2006/645	March 2006	Erection of workshop unit for the servicing and preparation of motor vehicles (Class B2) and 2 units for B1(c), B2 or B8 use together with parking, landscaping, access arrangements and associated works. *Adjacent to the west of the site.* The decision was granted June 2006. No further information was provided.

3.4 Regulatory Enquiries

The Hillingdon contaminated land public register does not record the site or any sites in the surrounding areas as Part 2A.

4.0 Site History

Details regarding the development of the site, its immediate surroundings and potentially contaminative land uses were obtained from a review of historical maps. Copies of the maps are provided in Appendix C.

From the earliest map edition dated 1868 the site comprised agricultural land with drainage in the southern area of the site. By 1916 the site has been subject to the development of a railway line along the southern boundary of the site.

Plate D: Envirocheck Historical Map Extract dated 1916. Full plan provided in Appendix C. ©Crown copyright and database rights 2024

By circa. 1967 one building was noted on the western area. The site remained unchanged to the present day. Between circa. 1978 and 1993 the southeastern area of the site was labelled depot.

The following potentially contaminative land uses are noted within 250 m of the site;

- Railway line adjacent to the south between circa. 1914 until present;
- Residential development approximately 100 m east of the site from circa. 1935 until present;
- An electrical substation approximately 250m west between circa.1978 and 1999 mapping.
- Industrial development within approximately 200 m north and west of the site including warehouses, motor body works, electronic factory, vehicle repair depot, carpet warehouse, chemical works, engineering works, toilet requisites factory, refrigerator repair depot, photographic depot, and other factories, works and depots between circa. 1948 until present; and,
- Four tanks approximately 150 m west of the site between circa. 1989 and 1999 mapping.

5.0 Existing Reports

The following report has been obtained by Geo^2 from the planning portal for review:

- Delta-Simons, Phase ll Geo-Environmental Assessment, ref. 07-3036.02, September 2010;
- Soiltechnics, Ground Investigation Report, ref. STL2801B-G01, August 2014;
- HP Construction Limited, Waste Removal Statement, no date provided;
- Constructive Evaluation, Phase 1 Desktop Report, ref. 14.8371, January 2015;
- Constructive Evaluation, Phase 2 Site Investigation Report, ref. 14.8371, January 2015; and,
- Constructive Evaluation, Additional Ground Investigation, ref. 14.8371, June 2015.

No reliance is assumed or inferred, and a review of the reports is provided for information purposes only.

5.1 Delta-Simons 2010, Phase ll Assessment

Delta-Simons undertook a Phase ll Geo-Environmental Assessment in July 2010 at a parcel of land at Stonefield Way, Ruislip (approximately 295 m west of the site). The investigation involved the advancement of four window sample boreholes to a maximum depth of 5.00m bgl and one cable percussive borehole to a depth of 16.00m bgl. Three wells were installed for ground gas & groundwater monitoring

No olfactory evidence of soil or groundwater contamination was identified during the intrusive works. Clinker and ash were noted within the Made Ground

Seven soil samples were analysed against Generic Assessment Criteria for a commercial end-use, with regards to human health. Delta-Simons recorded no concentrations of heavy metals or petroleum hydrocarbons above their relevant assessment criteria.

Groundwater assessment was not undertaken as part of these works.

One round of gas monitoring was undertaken on 28th July 2010. It was suggested that the ground gas regime of the site was Characteristic Situation (CS) 1 (Very Low Risk) and it was recommended no gas protection measures were required.

5.2 Soiltechnics 2014, Ground Investigation Report

Soiltechnics undertook a ground investigation in June 2014 at 23 Stonefield Way, Ruislip HA4 0YF (approximately 305 m northwest of the site). The investigation involved the advancement of five trial pits to a maximum 2.0m bgl, ten driven tube sampling boreholes and four dynamic cone penetration boreholes.

Soil samples were analysed against Generic Assessment Criteria for a commercial end-use and included, TPH, metals and metalloids, sulphate, PAHs, asbestos and pH.

An area of hydrocarbon contamination was identified in the central area of the site, however, the measured concentrations were below the guideline values and therefore, posing a low risk to human health. It was known that the hydrocarbon impacted soils were adjacent to the proposed surface water attenuation system. Therefore, it was recommended some removal of the hydrocarbon contaminated soil may be required. Chrysotile asbestos cement was identified within samples TP04 (0.30 m bgl) and TP05 (0.20 m bgl) within the made ground. It was recommended a specialist contractor is consulted to advise in the matter.

It was concluded that the risk to controlled waters was low due to no significant source of contamination identified within the ground investigation.

No ground gas monitoring was undertaken as part of the investigation. However, it was stated that it was not considered necessary to consider possible pathways for migration of ground gases and implementation of further investigation to measure concentrations of ground gases.

5.3 HP Construction Ltd, Waste Removal Statement

With reference to the ground investigation report produced by Soiltechnics, dated August 2014, the following recommendations were made:

- Any soil arisings for off-site disposal should be classified as 'Direction Waste';
- Should any potentially asbestos containing material be encountered in soils during remediation works, the contractor should seek advice of an asbestos specialist; and,
- The contractor should maintain site diaries detailing all contamination issues arising during the development.

5.4 Constructive Evaluation 2015, Phase 1 Desktop Report

Constructive Evaluation (CE) undertook desktop study in January 2015 for at 555 Stonefield Way, Ruislip HA4 0NU (approximately 85 m west of the site).

The following potential sources of contamination were noted during the site walkover:

- On-Site: Asbestos roofing, Waste Storage; and,
- Off-Site: Car dealership including AST and oil drums, railway running lines, surrounding industrial estate.

Historical sources of contamination on-site included an infilled pond (1960-1961), works (1960-1961), engineering works and soft drink depot.

A Low Risk to end users was generally noted from potentially impacted soils both on and off-site, however, a moderate risk was considered appropriate relating to the potential for volatilisation of hydrocarbons.

It was recommended that an investigation be undertaken for contamination and geotechnical purposes.

5.5 Constructive Evaluation 2015, Phase 2 Site Investigation Report

Constructive Evaluation (CE) undertook a ground investigation in December 2014 at 555 Stonefield Way, Ruislip HA4 0NU (approximately 85 m west of the site). The investigation involved the advancement of two cable percussive boreholes to a maximum depth of 24.00m bgl, excavation of six trial pits where three of these trial pits were extended by means of light weight window sampling to a maximum depth of 3.00m bgl. Monitoring wells were installed in both cable percussive holes to 8.00m bgl.

Ground conditions comprised Made Ground comprising concrete over sandy gravel fill material containing brick, flint and concrete to 1.00m bgl. Locally a horizon of reworked clay was noted to 0.60m bgl.

Organic clay was recorded under lying the Made Ground in two locations (TP1 and TP2), proven to the base of both locations, described as soft becoming stiff greenish brown clay with an organic odour. Clay was encountered underlying the Organic Clay to 13.20m bgl generally described as stiff light brown to grey fissured clay, underlain by multicoloured Clay considered to represent the Lambeth Group, to 21.50m bgl, underlain by very sandy clay to 24.00m bgl.

Six soil samples were analysed against Generic Assessment Criteria for a commercial end-use including, metals and metalloids, asbestos, TPH CWG, BTEX, MTBE, PAHs, pH, SOM, total phenols and total cyanide. All determinands returned concentrations below their GAC, with the exception of asbestos

It was noted during the site investigation that black discolouration and an odour was noted at TP7 (0.45-0.60 m bgl). Loose fibres of chrysotile asbestos were identified at TP5 (0.30 m bgl) and TP7 (0.50 m bgl). It was concluded that the potential risk to end users was low.

Two rounds of ground gas monitoring were undertaken between 18th December 2014 and 8th January 2015. The results indicated that the site could be classified as CS1 (Very Low Risk).

Recommendations

The following was recommended:

- Additional ground gas monitoring;
- Watching brief particularly during ground work stage; and,
- Validation report.

5.6 Constructive Evaluation 2015, Additional Ground Investigation

Constructive Evaluation (CE) undertook an additional ground investigation in May 2015 at 555 Stonefield Way, Ruislip HA4 0NU. The investigation involved the advancement of three window sampler boreholes to a maximum of 5.0m bgl and three hand dug excavated trial pits to a maximum of 0.52m bgl.

No visual or olfactory evidence of contamination was noted during the site investigation. soil samples were analysed against Generic Assessment Criteria for a commercial end-use including, metals and metalloids, asbestos, TPH CWG, BTEX, MTBE, PAHs, pH, SOM, total phenols and total cyanide. All determinands returned concentrations below their GAC.

Three gas monitoring rounds were undertaken between 29th May and 16th June 2015. The site was classified at CS2 based on the calculated GSV at 0.16 l/hr based on peak flow rates of 1.5 l/hr and peak carbon dioxide of 10.5%. It was recommended that ground gas protection measures would be required.

6.0 Preliminary Risk Assessment

6.1 Source – Pathway – Receptor

UK legislation and guidance on assessing potentially contaminated land recommends the use of a risk assessment process based on a review of source/pathway/receptor relationships for various environmental media. The first stage of any risk assessment is to identify, using the desk study data and site information, the presence and extent of any hazard at the site, theoretical or demonstrable.

A key component of the overall risk assessment process is identification of "significant contaminant linkages" between contaminants and receptors. This can be accomplished through development of a site-specific conceptual model in which the potential contaminants, pathways and receptors identified on-site are described.

Each element can be defined as follows:

- **Contaminant source:** A substance either on or under the land and which has the potential to cause harm or pollution to human or environmental receptors.
- **Pathway:** A route or means by which a receptor can be exposed to or affected by a source.
- **Receptor:** A living organism or an ecological system, or controlled water, or property including buildings, crops and livestock.

The presence of all three of the above elements identifies a contamination linkage and a potentially unacceptable risk. To ensure that any risk present to, or, from the site can be appropriately managed each of these contamination linkages will be targeted by the investigation.

6.2 Hazard Identification

6.2.1 Potential On-Site Sources

Based on the desk study, the following potential sources of contamination have been identified;

- Made Ground (from the construction of the existing commercial buildings) – potential for heavy metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, asbestos and hazardous ground gas; and,
- Historical use of the site as a car body workshop repairs and respraying (planning application ref. 2391/F/98/0682) – potential for heavy metals, petroleum hydrocarbons and polycyclic aromatic hydrocarbons.

6.2.2 Potential Off-Site Sources

Historically, the surrounding land uses have included, railway line, warehouses, depot, works with associated tanks, factories, builders yards and residential development – potential for heavy metals, petroleum hydrocarbons, PAHs and hazardous ground gas.

6.3 Initial Conceptual Site Model

Contamination linkages arise as a result of the interconnection of the contaminant source, contamination pathways and potential receptors. These contamination linkages are used to design the site investigation (if required), guiding the type of investigation, location of exploratory boreholes and the required sample analysis.

6.4 Risk Estimation

The objective of the qualitative risk assessment is to determine the significance of the risk, if any, which may occur as a result of the creation of pollutant linkages, which connect a potential receptor to an identified potential contaminant source at the site.

The perceived risk is based on a consideration of both the likelihood of an event (probability) occurring, and the severity of the potential consequence. Classification of these two factors is detailed in Appendix J.

6.5 Qualitative Risk Assessment

A qualitative risk assessment is undertaken, detailed in table below on the following page, in line with guidance provided in CIRIA's Contaminated Land Risk Assessment: a guide to good practice CIRIA C552, 2001. The purpose of this assessment is to determine the relative significance of the identified contamination linkages by assessing the probability of an impact occurring and by assessing the perceived severity of an impact to a receptor.

Those linkages considered of low risk or less on the basis of the available site data will not be considered any further in this assessment. Linkages considered to be more significant are identified as presenting potentially unacceptable risk to the identified receptor. In these instances, further works may be considered necessary.

Source(s)	Pathway(s)	Receptor(s)	Comments	Risk
Potentially contaminated soils and/or groundwater located beneath the site.	Direct contact/ingestion and, inhalation of dust and vapours	Future site users, principally within landscaped areas. (human health)	Potential sources of contamination have been identified associated with the historical use of the site as a car bodyshop repairs and respraying. Furthermore, the current building on the site represents a potential for Made Ground/infill materials to exist. Potential localised contamination may be identified. Intrusive investigation will be required to quantify the potential contamination risks. Site workers may become exposed to localised contaminated soils and shallow groundwater during intrusive groundworks undertaken at the site. Safe working practices should be undertaken and appropriate Personal Protective Equipment (PPE) should be used that will reduce the risk to low.	**Low to Moderate**
		Maintenance workers. (human health)		
	Leaching to groundwater, lateral and vertical flow, followed by migration within the aquifer.	Roxbourne ditch (approx. 615 m north)	On-site potential sources of contamination are limited to the potential presence of Made Ground associated with the current building in the western area of the site. If mobile contaminants had the potential to leach, they would be limited by the impermeable bedrock. Furthermore, given that there are no potable groundwater abstractions within 1 km of the site and that the Site is not located within a groundwater SPZ, and that the groundwater table is likely at significant depth beneath the site, the risk is considered to be low. This should be confirmed, however, during further intrusive ground investigation at the site.	**Low**
		Underlying Unproductive Strata (London Clay Formation)		
Ground Gas	Vertical and lateral migration of ground gases	Current and proposed commercial site end users (human health)	Potential sources of ground gas have been identified at the site associated with Made Ground/infill materials associated with the current development. Organic clay has been identified within an	**Low to Moderate**

Source(s)	Pathway(s)	Receptor(s)	Comments	Risk
			offsite ground investigation which could also represent a potential source of ground gas, should it be present at the site. A ground gas risk assessment is recommended to assess the characteristic situation for the site and requirement for any ground gas protection measures within new buildings.	
Potentially contaminated soil and groundwater from off-site sources	Migration of contaminants	Current and proposed commercial site end users and Groundwater beneath site.	Potential off-site sources of contamination have been identified associated with surrounding commercial land uses (railway line, warehouses, works, depots, factories and tanks), however, given the impermeable bedrock underlying the site and wider area, contamination migration towards the site is considered unlikely. An environmental investigation will be required to assess the groundwater quality beneath the site and the risk to future site users.	**Low**

7.0 Site Investigation

An intrusive ground investigation was carried out from 8th and 9th January 2025 in order to provide an assessment of the ground conditions and provide geotechnical data.

7.1 Intrusive Investigation Scope

The intrusive investigation comprised the following activities:

- Service avoidance and topographic survey undertaken in all intrusive locations by a specialist third party contractor to obtain x,y,z coordinates;
- All works logged in general accordance with BS5930:2015+A1:2020 Code of Practice for Ground Investigations;
- Drilling of four dynamic sample boreholes (DS101 – DS104) to a maximum depth of 5.00 m bgl;
- Two Foundation Inspection Pits (FIP101 and FIP102) to a maximum depth of 0.56 m bgl; and,
- The installation of two ground gas and groundwater monitoring wells within DS101 and DS104 up to 5.00 m bgl.

Field analysis comprised the examination of each of the samples for visual and olfactory indications of contamination.

An Exploratory Hole Location Plan is included as Figure 2 within Appendix A. Foundation Inspection Pits drawings are presented in Appendix A as Figure 3a.

7.1.1 Exploratory Hole Location Rationale

Intrusive positions were chosen to provide general coverage of the site, as detailed below.

Exploratory Holes	Rational	Contaminants of Concern
DS101 – DS104	To provide site coverage in the areas of the two building extensions.	Polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons, MTBE, BTEX, heavy metals and metalloids and asbestos
FIP101 and FIP102	To investigate the design of existing foundations at the site in the location of the two building extensions.	-

Exploratory Holes	Rational	Contaminants of Concern
DS101 and DS104	Installed monitoring wells to provide ground gas and groundwater level data, beneath each of the proposed building extensions.	Hazardous ground gas, metals and metalloids, petroleum hydrocarbons and volatile contaminants in the groundwater.

7.1.2 Limitations

The following limitation were noted during the works:

- Intrusive locations were constrained by the existing services, existing buildings and current use of the site;
- FIP101 was terminated at 0.24 m bgl due to concrete obstruction of the pavement and FIP102 was terminated at 0.56 m bgl due to the ingress of perched groundwater;
- The investigation scoped and geotechnical assessments provided are specific to the proposed development anticipated, and may not be relevant for other development schemes should these be considered in the future; and,
- The investigation was designed to provide preliminary information only and further information may be required in due course to discharge site specific planning conditions/ detailed design.

7.2 Ground Conditions

A summary of the ground conditions encountered at the site are summarised in the table below. Field logs are presented in Appendix E.

Exploratory Hole Locations					
Stratum	Depth Range Top of Strata (m bgl)	Thickness (m)		Description	Comments
		Min	Max		
Made Ground	0.00	0.35	0.67	Macadam and concrete underlain by light brown sandy gravel. Gravel inclusions of brick, concrete, glass, metal, wood, quartzite and siltstone.	*Encountered within all exploratory hole locations.* *Minimum thickness where proven.*

Exploratory Hole Locations					
Stratum	Depth Range Top of Strata (m bgl)	Thickness (m)		Description	Comments
		Min	Max		
London Clay Formation	0.35 – 0.67	*Not proven (>4.33)*		Soft to firm light brown occasional mottled light grey slightly silty clay and silty clay.	*Encountered within DS101 – DS104.* *Rare bands of sandy mudstone gravel within DS101, DS102 and DS104.* *Rare selenite crystals were encountered within all dynamic sampler boreholes.*

The ground conditions encountered during the site investigation comprised a sequence of hardstanding and Made Ground to depths between 0.35 and 0.67 m bgl (where proven) underlain by the bedrock geology of the London Clay Formation comprised of soft to firm slightly silty clay and firm silty clay with rare selenite crystals to a maximum borehole depth of 5.00 m bgl.

7.2.1 Groundwater Strikes

Groundwater strikes identified during the ground investigation are summarised in the below table.

Exploratory Hole Location	Water Strike (m bgl)	Water Strike (m AOD)	Strata	Comments
FIP102	0.50	38. 94	Made Ground	Seepage.
DS104	0.50	39.07		
DS101	3.00	36.19	London Clay Formation	

7.2.2 Potential Observed Contamination

No visual or olfactory evidence of contamination was noted during the ground investigation.

7.3 Ground Gas and Groundwater Monitoring

Monitoring wells were installed in two boreholes (DS101 and DS104). Wells were installed with 50mm HDPE plastic pipe. Wells were monitored over four visits for ground gas and groundwater depth following completion of the ground investigation.

The ground gas data is discussed in Section 9.0.

The groundwater monitoring data is present in Appendix F and also summarised in the below table.

Monitoring Well	Response Zone (m bgl)	Depth to Water (m bgl)	Depth to Water (m AOD)
DS101	1.50 – 5.00	1.70 – 1.88	37.31 - 37.49
DS104	1.00 – 5.00	0.44 – 0.81	38.76 - 39.13

Perched groundwater levels during monitoring varied between 37.31 - 39.13 m AOD in the Made Ground and London Clay Formation.

8.0 Environmental Laboratory Analysis

8.1 Environmental Analysis Rationale

Samples were analysed for contaminants associated with historical and current use of the site in line with guidance provided in CIRIA's Contaminated Land Risk Assessment: a guide to good practise (CIRIA C552, 2001).

All samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the laboratory under the laboratory's chain of custody documentation. The laboratory used for the ground investigation on this occasion was i2 Analytical, a UKAS and MCERTS accredited laboratory.

Soil samples were selected from a range of depths and strata and from across the site, to gain an understanding of site-wide ground conditions. The analysis scheduled for collected soil and groundwater samples is shown in the table below.

Analysis	Rational	Number of Samples Analysed	
		Soil	Groundwater
Asbestos	Common potential contaminant.	2	-
Heavy metals, Total Petroleum Hydrocarbons, Criteria Working Group Method (TPHCWG), Benzene, Toluene, Ethylbenzene and Xylene (BTEX), speciated Polycyclic Aromatic Hydrocarbons (PAH)	Common potential contaminants of concern	6	2
Total Organic Carbon (TOC)	To allow comparison of soil results against their relevant assessment criteria and assess the potential for organic material in the underlying soils	3	-
Acid Soluble Sulphate and Total Sulphur	To assess the potential for aggressive ground conditions with respect to below ground concrete.	4	-
pH, Water Soluble Sulphate		3	2

8.2 Soil Testing Results

The soil results have been assessed relating to potential risks to human health receptors. It is understood that the site may be proposed for future redevelopment to a commercial end use. GAC concentrations associated with a conservative 1% Soil Organic Matter (SOM) have been utilised.

No elevated concentrations of contaminants were recorded when compared against the Generic Assessment Criteria (GAC) for a commercial end use, with respect to human health. The detailed results of laboratory analyses undertaken on soil samples are presented in Appendix G.

Loose fibres of amosite and chrysotile asbestos were identified at DS103 within the shallow Made Ground in the eastern area of the site. Quantification of the sample indicated asbestos at a concentration of 0.010 %.

8.3 Groundwater Testing Results

8.3.1 Controlled Waters

The identified controlled water receptors include the Roxbourne ditch (approximately 615 m north), the underlying Unproductive aquifer associated with the London Clay Formation.

Due to the proximity of the Roxbourne, the groundwater testing results have been compared against inland surface water GAC thresholds (Water Framework Directive/Environmental Quality Standard). The detailed results of laboratory analyses undertaken on groundwater samples are presented in Appendix I. Laboratory results above the applied GAC are summarised in the table below.

Contaminant	Max Conc. (µg/l)	GAC (µg/l)	GAC Source	No. Exceed GAC / No. of Samples	Location of Exceedances = Concentration (µg/l)
Metals					
Cadmium	0.09	0.08	WFD 2015a	1/2	DS101 = 0.09
Copper	2.4	1.0	WFD 2015b	2/2	DS101 = 2.4 DS104 = 2.2
Lead	49	1.2	WFD 2015a	1/2	DS104 = 49
Nickel	6.7	4	WFD 2015a	2/2	DS101 = 6.7 DS104 = 4.2
Zinc	22	12.1	WFD 2015b	1/2	DS104 = 22

Notes:

WFD2015 a – Water Framework Directive (Standards and Classification) Directions (England & Wales) 2015. Schedule 3 Part 3 Table 1 – EQS for Priority Substances and Other Pollutants used to clarify chemical status.

WFD2015 b – Water Framework Directive (Standards and Classification) Directions (England & Wales) 2015. Schedule 3 Part 2 Table 1 – Standards for Specific Pollutants.

Elevated concentrations of cadmium, copper, lead, nickel and zinc have been identified above the laboratory detection limits and above the applied Generic Assessment Criteria.

9.0 Ground Gas Monitoring

9.1 Monitoring Duration

Gas monitoring has been carried out on four occasions for the assessment of the ground gas regime.

Monitoring wells were installed in two boreholes (DS101 and DS104) highlighted on Figure 2.

9.2 Characteristic Situation

The presence of a hazardous ground gas source does not determine that a risk will be present. Whether a risk is present will be assessed through the potential for generation and subsequent migration of gas. Therefore, the gas concentrations will be considered alongside the recorded gas flows.

The Gas Screening Value (GSV) is the product of the maximum borehole flow rate and the gas concentration, per borehole across all monitoring visits completed. A Characteristic Situation (CS) can be derived from an assessment of the ground gas data and forms the basis of determining mitigation measures (as outlined in BS8485:2015+A1:2019).

9.3 Results

Detailed monitoring data from the visits is presented as Appendix F.

The barometric pressure was recorded during each monitoring visit, which ranged from 996 mBar and 1034 mBar. Round 1, 2 and 4 were undertaken after falling atmospheric pressures for the preceding 3 day trend.

Monitoring data obtained from the four rounds of monitoring is summarised in the table below.

Monitoring Well	Response Zone (m bgl)	Max Flow l/hr	Max Methane Conc % $^{v}/_{v}$*	Methane CS	Max Carbon Dioxide Conc % $^{v}/_{v}$*	Carbon Dioxide CS	Flooded?
DS101	1.00 – 4.00	0.2	<0.1	CS1	0.5	CS1	N
DS104	1.00 – 4.00	0.1	<0.1	CS1	0.6	CS1	Y (4/4)
Note * = Maximum Steady State Conditions							

9.4 Discussion

9.4.1 Methane GSV

Methane was not identified above the instrument detection level (0.1%v/v) within any borehole during the monitoring. Maximum steady flow rates were detected as 0.2 l/hr and therefore has a calculated CS1 for methane (GSV = 0.0002).

9.4.2 Carbon Dioxide GSV

Carbon dioxide was identified at a maximum concentration of 0.6 %v/v within DS104. Maximum flow detected was 0.2 l/hr and therefore has been calculated as CS1 for carbon dioxide (GSV=0.0012).

9.4.3 Flow Rates

Maximum negative flow rates of -3.0l/hr (Round 2) and -2.7l/hr (Round 4) were noted within locations DS104 and DS101, respectively. The maximum flow rate of -3.0 in DS104 is discounted due to the well being flooded and is likely due to the piston effect. The flow rate of -2.7l/hr in DS101 is considered an outlier in the data as no source has been identified for the negative flow rate and as such, is discounted.

9.4.4 Conclusion

In consideration of the ground model (i.e. no significant gas generating sources on or in proximity to the site), and in combination with the consistent negligible flow rates (generally below the instrument detection limit) indicating low flows of gas across all other boreholes and rounds, it is considered that the site should be classified as a CS1 whereby no ground gas protection measures are required. Further ground gas monitoring is not considered to be required.

9.5 Mitigation of Ground Gas Risk

The ground gas regime at the site has been classified as CS1 in accordance with the CIRIA guidance and it is recommended that a CS1 situation is assumed for design purposes. No ground gas protection measures are necessary under this scenario.

9.6 Organic Vapours

No sources of volatile vapours have been identified as part of the ground investigation.

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10.0 Geotechnical Assessment

10.1 Geotechnical Analysis

10.1.1 Geotechnical Analysis Rationale

Alongside the environmental intrusive investigation, in-situ testing, soil sampling and geotechnical laboratory analysis was undertaken to inform preliminary foundation, floor slab and concrete assessment.

A summary of geotechnical testing is presented in the table below.

Laboratory Test	Rational	Number of Samples
Moisture Content	For general classification and to assess the potential for cohesive soils to shrink and swell due to changes in the water content of a soil associated with the presence, removal or addition of trees and shrubs.	5
Liquid and Plastic Limits (Atterberg Test)		4
Particle Size Distribution (wet sieve)	For general classification of material.	1

10.2 Geotechnical Testing

10.2.1In-Situ Tests

Standard Penetration Tests (SPTs) were undertaken every 1.00 m up to a maximum depth of 5.00 m bgl within the dynamic sampler boreholes. A depth vs corrected SPT (N_{60}) plot is presented in Appendix A Figure 4.

10.2.2Geotechnical Laboratory Results

A summary of the geotechnical test results is presented in the table below. Full details of the geotechnical results are presented in Appendix H.

Parameter	No of Tests	Minimum	Maximum	Average
London Clay Formation				
Water Content (%)	5	28.6	34.2	31
Plasticity Index (%)	4	41	48	45
Plastic Limit (%)	4	26	32	29
Liquid Limit (%)	4	69	77	74

Parameter	No of Tests	Minimum	Maximum	Average
London Clay Formation				
Modified Plasticity Index (%)	4	39	45	41
Volume Change Potential	-	Medium to High		
Uncorrected SPT 'N'	20	6	30	16
Corrected SPT 'N60'		8	38	20

Classification

Particle Size Distribution (PSD) testing using sedimentation techniques was carried out on one sample of London Clay Formation between 3.00 and 3.00 m bgl, which recorded the following constituents:

- *Cobbles: 0%;*
- *Gravel: 0%;*
- *Sand: 1%;*
- *Silt: 23%; and,*
- *Clay: 76%.*

Strength

Using the correlation by Stroud, whereby undrained shear strength Cu = f_1 x N_{60}, an f_1 = 4.3 is considered appropriate for the London Clay Formation is based on the Plasticity Index results. This corresponds approximately to undrained shear strength values generally >30 kN/m^2, which is indicative of a low to high strength cohesive material, consistent with field records.

10.3 Assessment Introduction

It is understood the proposed development of the site comprises the construction of two extensions to the existing Safestore facility, to the north and east of the current building.

10.4 Preliminary Geotechnical Risk Register

The table below is intended as a register of the potential geotechnical hazards associated with the development. It provides an assessment of whether the site is likely to be affected by the hazard, the possible consequences and engineering requirements.

Hazard	Hazard Potential (N/A / Low / Medium / High)	Potential Engineering Consequences / Remarks
Variable ground conditions (lateral and vertical)	Medium	The ground conditions comprised Made Ground to proven depths ranging between 0.35 m and 0.67 m bgl, underlain by the bedrock geology of the London Clay Formation to end borehole depths of 5.00 m bgl. The variable ground conditions may preclude certain engineering solutions.
Compressible ground / low bearing capacity soils (i.e., soft clays, peat, loose Made Ground)	Medium	The Made Ground is variable in nature and thickness and has the potential to be of low strength and high compressibility. In addition, variable soft clays have been identified within the London Clay Formation at depths between 1.00 and 1.20 m bgl.
Volume change potential (shrinking and swelling characteristics)	Medium to High	Based on the modified plasticity index the London Clay Formation is considered to have a medium to high volume change potential.
Retaining wall / slope stability issues	Low	An existing retaining wall was present along the eastern boundary of the site. If the existing retaining wall is proposed to be reused for the development of the site, it should be checked and verified by a structural engineer. The southern boundary of the site slope upwards towards the railway line adjacent the site. Due to the location of the proposed extension of the building, the risk is considered to be low.
Infilled and Made Ground (including embankments)	Medium	Made Ground to a maximum depth of 0.67 m deep was encountered across the site.
Groundwater	Medium	Perched groundwater was encountered during drilling at depths ranging between 0.50 and 3.00 m bgl (39.07 m and 36.19 m AOD) within the Made Ground and London Clay Formation. Subsequent groundwater level monitoring recorded at depths ranging between 0.44 and 1.88 m bgl (39.13 – 37.31 m AOD).
Obstructions / buried structures (including foundations, basements, tunnels, and services)	Medium	The ground conditions below the buildings and the foundations utilised are currently unknown due to concrete obstruction encountered at FIP101 at 0.24 m bgl and ingress of perched groundwater encountered at FIP102 at 0.50 m bgl. Below ground services were identified across the site.
Dissolution features	N/A	The ground conditions at the site are not consistent with this risk being present.
Mining	N/A	The ground conditions at the site are not consistent with this risk being present.
Concrete Classification	Medium to High	Testing has indicated a Design Sulphate Class of DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) Classification of AC-3 would be appropriate for all buried concrete structures within the Made Ground and the London Clay Formation

		would classify as DS-5 and ACEC-4s and as such may be required for all buried concrete infrastructure.
Seismicity	Low	The PGA for a site under the 475 year return period is approximately 0.00 g to 0.02 g which is considered very low.

10.5 Geochemical Testing

Geochemical analysis was undertaken on six soil samples of Made Ground and London Clay Formation and two groundwater samples, tested for selective contaminants (BRE Special Digest: 1:2005 (3rd Edition), Concrete in Aggressive Ground), the results of which are summarised in the table below.

Tests	No. of Tests	Minimum	Maximum
Made Ground			
Soil – pH	3	8.3	9.5
Soil – Water Soluble Sulphate	3	127 mg/L	1740 mg/L
Soil – Acid Soluble Sulphate	1	0.27 %	
Soil – Total Sulphur	1	0.25 %	
London Clay Formation			
Soil – pH	3	6.6	8.3
Soil – Water Soluble Sulphate	3	147 mg/L	3130 mg/L
Soil – Acid Soluble Sulphate	3	0.048 %	4.10 %
Soil -Total Sulphur	3	0.019 %	1.600 %
Water – pH	2	7.2	7.4
Water - Sulphate	2	1640 mg/L	2580 mg/L

10.6 Preliminary Foundation Assessment Assumptions

The following foundation assessment is considered to be preliminary in nature given the following limitations:

- It is understood that the site is being considered for redevelopment to a commercial end use;
- No preliminary building and foundation dimensions or loadings to inform ultimate and serviceability limit state assessment have been provided to Geo^2 for review; and,

- It is assumed there are no significant basements, slopes or retaining features required as part of the proposed development.

In the event that any of the above assumptions and limitations change as the project or design progresses, or the structural dimensions and loadings become available, Geo^2 recommend this preliminary assessment is revised accordingly.

10.6.1 Spread Foundations

The Made Ground is considered to be too unpredictable, variable, weak and compressible in its existing condition for conventional shallow foundations at the site.

The London Clay Formation should be encountered within economic reach (approximately 2.0 m bgl) for traditional pad foundations (up to 3 m x 3 m). Therefore, for preliminary foundation design purposes the cohesive soils (with a minimum undrained shear strength of 65 kPa) are likely to achieve an allowable bearing capacity of 125 kPa (with settlement limited to 25 mm).

Consideration should be given to ensure that foundations across the building footprint are cast in uniform strata in order limit the potential for differential settlement. All foundation excavations should be inspected by a suitably qualified engineer prior to casting to ensure the appropriate depth, founding medium and strength characteristics have been achieved.

10.6.2 Floor Slabs

A lightly loaded ground bearing floor slab is likely suitable for the proposed development following excavation and removal of Made Ground and any soft soils, and replacement with engineered granular backfill. Alternatively, floor slabs could be suspended.

10.7 Volume Change Potential

The volume change potential should be considered in any foundation schedule for structures and services located within the influence zone of trees or bushes (proposed, existing or to be removed) and appropriate precautions and/or founding depths should be designed accordingly. In cohesive soils, it is recommended that foundations should be designed in accordance with NHBC Standard Chapter 4.2 “Building Near Trees”.

Based on the modified plasticity index, the London Clay Formation is considered to have a medium to high shrinkage potential.

As described in BRE Digest 412 “Desiccation in Clay Soils”, one method of determination the likely desiccation status of soils is using an empirical criterion for the onset of desiccation can be considered where the soil moisture content is at 40% of the Liquid Limit, and where this is less than 40%, soils may be considered to be in a significantly desiccated condition. Likewise, assessment of Liquidity Index; where a value of zero or greater indicates the soil’s water content to be at or above the plastic limit, while negative values indicate the soil to be drier than the plastic limit can be used to assess whether the soils are artificially deficient in natural moisture content.

Samples collected from the London Clay Formation suggest that the soils are not considered to be desiccated.

10.8 Chemical Attack on Buried Concrete

Made Ground

In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the shallow soils at the site would therefore be classified as Design Sulphate Class DS-3 for soils, when considering the most appropriate type of concrete to be used at the site for shallow foundations in order to resist chemical attack from elevated sulphate present in the soils (assuming non-pyritic soils).

London Clay Formation

In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the shallow soils at the site would therefore be classified as Design Sulphate Class DS-5 and ACEC Class AC-4s for soils and groundwater, when considering the most appropriate type of concrete to be used at the site for shallow foundations in order to resist chemical attack from elevated sulphate present in the soils (assuming static groundwater in pyritic soils).

10.9 Excavation, Support and Earthworks

It is expected that conventional mechanical excavators will readily remove the Made Ground likely to be encountered in shallow excavations although a breaker may be required to remove any existing macadam and concrete hardstanding.

FIP101 was terminated at 0.24 m bgl due to suspected concrete obstruction associated with the pavement. Therefore, some breaking out and removal of obstructions is likely to be required prior to redevelopment. The presence of buried obstructions should be considered further with respect to any deep piled or ground improvement techniques adopted at the site as obstructions can hinder design and installation.

It should be assumed that shallow excavations on site are unstable and may need support in accordance with CIRIA 97 Trenching Practice. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those >1.20m deep, in accordance with Health and Safety Regulations.

10.10 Groundwater

Perched groundwater was encountered during drilling at depths ranging between 0.50 and 3.00 m bgl (39.07 m and 36.19 m AOD) within the Made Ground and London Clay Formation. Subsequent groundwater level monitoring recorded at depths ranging between 0.44 and 1.88 m bgl (39.13 – 37.31 m AOD).

Should any perched groundwater be encountered, then local dewatering via sump and pump should be suitable, however, treatment prior to disposal to sewer may be required.

11.0 Risk Estimation

11.1 Discussion of Investigation Findings

Each of the identified potential contamination linkages in the preliminary conceptual site model is reviewed based upon the findings of the site investigation which allows a greater understanding of the ground conditions at the site, site observations, soil and groundwater quality and chemical analysis.

The qualitative risk assessment is undertaken, detailed in the table on the following page, in line with guidance provided in CIRIA's Contaminated Land Risk Assessment: a guide to good practice CIRIA C552, 2001. The purpose of this assessment is to determine the relative significance of the identified contamination linkages by assessing the probability of an impact occurring and by assessing the perceived severity of an impact to a receptor.

The perceived risk is based on a consideration of both the likelihood of an event (probability) occurring, and the severity of the potential consequence. Classification of these two factors is detailed in Appendix J.

Those linkages considered of low risk or less on the basis of the available site data will not be considered any further in this assessment. Linkages considered to be more significant are identified as presenting potentially unacceptable risk to the identified receptor. In these instances, further works may be considered necessary.

Source(s)	Pathway(s)	Receptor(s)	Risk	Comments/Mitigation
Loose fibres of amosite and chrysotile asbestos within the shallow Made Ground at DS103 east of the site. Exceedances of heavy metals within the groundwater across the site	Direct contact, ingestion and/or inhalation of soil/dust	Human health – future site users	**Low**	Detectable concentrations of heavy metals, PAHs and petroleum hydrocarbons have been identified within shallow soils, however, are below the applied commercial guidance values. Asbestos has been identified as loose fibres of amosite and chrysotile within the Made Ground. Chrysotile and amosite have been identified at a concentration of 0.010%. Buildings and hardstanding will be present across the majority of the site preventing direct exposure to end users. Due to the proposed extension of the current building on site, there are not understood to be new proposed soft landscaping areas.
		Human health – construction workers	**Low to Moderate**	Groundworkers and sub-surface maintenance workers should be made aware of the possibility of encountering contaminated soils and asbestos through toolbox talks. Safe working procedures should be implemented, good standards of personal hygiene should be observed and appropriate levels of PPE/RPE provided and utilised. The groundworks Contractor should be made aware of the possibility of encountering potential Asbestos Containing Materials (ACMs) and fibres within the Made Ground across the Site and an appropriate protocol to mitigate exposure of the workforce and general public should be in place with due respect to his duties under the Control of Asbestos Regulations 2012 and with reference to the Joint Industry Working Group Asbestos in Soil and Construction & Demolition (C&D) Materials guidance (published by CL:AIRE) titled “Control of Asbestos