

12. SITE CONCEPTUAL MODEL AND GROUND CONTAMINATION RISK ASSESSMENT

12.1 Introduction

In general, ground contamination can occur through several causes, particularly from historical operations and activities. Contamination can result from either on-site sources or from on-site migration from off-site sources, leading to long term liabilities under recent legislation for any site owner.

The Environmental Protection Act 1990 (Part IIA) makes provisions for a risk-based framework for the identification, assessment, management and redevelopment of contaminated land within the UK. The provisions of the Act came into effect in England and Wales in July 2001 and are aimed at ensuring that actions taken with respect to contaminated land are directed by a technically well-founded assessment of risk.

The process of risk assessment is an evaluation of the probability of harm, and comprises the identification of sources of contamination, receptors that may be affected by the contamination and pathways by which the receptors may be harmed forming a pollution linkage. The site conceptual model (presented below) forms the basis for the qualitative assessment of ground contamination risks associated with the site.

12.2 Site Conceptual Model

The conceptual model for the site reflects the findings and observations during the site investigation. The key source, pathway, receptor model is outlined below within the context of the anticipated future residential development on the site.

12.2.1 Sources

The following sources of potential contamination have been identified from the site investigation and subsequent monitoring rounds:

- General contamination associated with Made Ground on site;
- Potentially Mobile Contamination within shallow soils (TPH and PAH from soil derived leachate samples);

- Potential asbestos within Made Ground;

Although no ground gas monitoring was undertaken at the site, given the absence of widespread thicknesses of made ground or organic soils, ground gas generation potential is considered likely to be low. If greater thicknesses of made ground are identified across the site during the construction phase it may be necessary for further assessment from a ground gas specialist in order to determine the requirement for ground gas protection measures for the new development. However, it would be prudent to further investigate the potential for ground gas generation from the Made Ground if significant thicknesses are identified during the construction.

12.2.2 Pathways

The primary pathways by which sensitive receptors may come into contact with ground contamination are considered to be the following:

- Direct dermal contact or ingestion of soils, or inhalation of dust (i.e. human interaction with surface and sub-surface materials);
- Disturbance of potential asbestos impacted soils and subsequent inhalation of asbestos fibres;
- Leaching and horizontal or vertical migration through the unsaturated ground, whether through permeable sub-surface materials and/or preferential pathways;
- Lateral and vertical migration of groundwater through permeable sub-surface materials and/or preferential pathways;
- The migration and accumulation of ground gases or vapours through permeable sub-surface materials and/or preferential pathways.

12.2.3 Receptors

The following are considered to be sensitive receptors:

- Current Site Users
- Site construction workers;
- Future Site users (within the context of the proposed early years education facility);



- Groundwater within underlying Aquifer;
- Nearby surface water features.

12.3 Ground Contamination Risk Assessment Table

The pollution linkages and a qualitative risk assessment are presented in the table below. The risk assessment considers the site within an area context and assesses potential risks to identified receptors in relation to the existing site setting and the proposed development. CIRIA C552 has been used to define the risk rating presented in the Qualitative Risk Assessment matrix, methodology for which is presented in Appendix F.

Table 10 - Ground Contamination Assessment Risk Table

Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements
General contamination associated with Made Ground on site / Potentially Mobile Contamination within shallow soils (TPH and PAH from soil derived leachate samples);	Direct dermal contact or ingestion	Current site users	Medium	Unlikely	Low Risk	The soil laboratory results have not indicated the presence of contaminants of concern in excess of their GAC. The site is also covered in a layer of hardstanding that cuts any potential pathway for current and future site users. Construction workers wearing appropriate PPE and practising good hygiene should also be low risk. The overall risk human health is considered to be low.
		Future site users		Unlikely	Low Risk	
		Construction workers		Unlikely	Low Risk	
	Leaching and horizontal or vertical	Groundwater (Secondary A Aquifer)	Medium	Unlikely	Low Risk	The laboratory results of the soil derived leachate testing indicated elevated concentrations of TPH and PAH compounds against the screening criteria.

Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements
	migration	Surface waters		Unlikely	Low Risk	Given the conservative nature of the leachate testing methodology, the relatively minor exceedances identified in the soil derived leachate samples and the distance to the closest surface water body, the recorded concentrations are not considered to pose a significant risk to controlled waters. Furthermore the clayey nature of the Glacial Till deposits would afford protection to the groundwater present within the Hughes Member Sandstone. Contamination concentrations would be reduced via the retardation processes as they migrate through the unsaturated zone. Furthering this, the current and proposed development at the site, comprising hard standing and buildings should restrict soil infiltration rates across the site, thus reducing the leachability of any shallow soil contamination.
Asbestos within Made Ground	Inhalation	Current and future site users	Medium	Unlikely	Low Risk	No ACM was identified during the site investigation. However, the presence of ACM within the Made Ground cannot be discounted. In the event that ACM is encountered during the development process, further assessment will be required to provide an updated risk assessment process.
		Construction Workers	Medium	Low likelihood	Moderate to Low Risk	

13. CONCLUSIONS AND RECOMMENDATIONS

13.1 Ground Contamination

13.1.1 Summary

Made Ground has been identified across the site to be usually no more than 0.20m in thickness but has been locally observed up to 1.10m bgl in depth in SA01. It is important to note that SA01 was not located beneath the proposed building footprint. No soil phase contamination exceedances have been identified in the context of the proposed development.

With respect to the presence of potentially mobile contamination, a limited number of TPH fractions and PAH compounds have been identified in exceedance of the relevant EQS screening criteria within soil derived leachate samples. When the recorded concentrations are considered within the context of the conservative nature of the testing methodology and the presence of infiltration limiting hardstanding/buildings as part of the current and future site development the risks to the wider environment are considered to be low.

Asbestos containing materials have not been identified within the shallow soils on the site, however, the potential presence of asbestos containing materials within the Made Ground cannot be discounted. In the event that previously unidentified asbestos contamination is encountered during the development phase, works should stop to allow additional investigation and risk assessment to be undertaken and additional risk management procedures put in place, if required.

13.2 Geotechnical

Traditional shallow foundations taken down to a minimum of 0.50m bgl and founded on the coarse-grained or fine grained Glaciofluvial Deposits, may be designed to an allowable net bearing pressure of 135kPa. Floor slabs may be ground bearing for light dead and live loads of up to 15kN/m²

The soakaway testing undertaken in SA01 to BRE 365 resulted in three failed tests. Two of the tests were extrapolated providing a permeability value for the Glacial Till of 8.01×10^{-7} and 8.89×10^{-7} . Further testing, groundwater monitoring and ground investigation may be required to support a full SAB application or to inform the development of the final design process.

The Design Sulphate Class for the site can be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1.

13.3 Recommendations

Within the context of ground contamination, no further risk management procedures are recommended with respect to the proposed development of the site. However, it is recommended that a proactive approach is adopted during the future development of the site to identify and assess any previously unidentified contamination which may be encountered during development works.

Locally, Made Ground has been observed to at increased thickness (1.10m bgl) to the north of the proposed development. In the event that greater thicknesses of made ground are encountered below the proposed development during construction, it is recommended that this material is assessed and tested for suitability as a founding material.

Although no land gas assessment is required by the contaminated land officer for this development should significant thicknesses of Made Ground be identified not currently encountered as part of the ground investigation then a land gas assessment should be undertaken.