Refined Conceptual Site Model

Based on the plausible exposure scenarios an outline conceptual linkage model has been developed. Table E4-1 summarises the qualitative risks as evaluated in accordance with guidance provided by and in CLR11[1] and NHBC (2008)[2].

Table E4-1 Outline Conceptual Site Model

Potential Source	Pathway	Receptor	Severity of Risk	Likelihood	Potential Risk
Soil Contamin-ation (including low level radioactive waste, asbestos fibres and UXOs)	**Construction Phase**				
	Inhalation of airborne dust and vapours Ingestion of soil through handling Dermal absorption through handling	Construction workers	Medium	Likely	Moderate
	Inhalation of airborne dust	Adjacent Users	Mild	Likely	Moderate/ Low
	Migration of leaching contaminants and spills along preferential pathways during construction (i.e. foundations, service trenches etc.)	Groundwater	Medium	Low Likelihood	Moderate/ Low
	Migration - Uncontrolled surface water run-off from exposed contaminated soil.	Surface Water	Medium	Likely	Moderate
	Post Development				
	Inhalation of airborne dust and vapours Ingestion of soil through handling, including from plant uptake and dust on home grown produce Dermal absorption through skin through handling	Site users (including maintenance workers)	Medium	Likely	Moderate
	Direct Contact with building materials and services	Building materials and services	Medium	Likely	Medium
	Plant uptake of phytotoxic contaminants	Soft landscaping (plants and trees)	Minor	Likely	Low
	Migration of leaching contaminants and spills along preferential pathways	Groundwater	Medium	Unlikely	Low
	Migration - Uncontrolled surface water run-off from exposed contaminated soil.	Surface Water	Medium	Likely	Moderate
Ground Gases	**Construction Phase**				
	Accumulation - Entry into trenches or other confined spaces.	Construction workers	Severe	Unlikely	Moderate - Low

1 DEFRA and Environment Agency. (2004). Model procedures for the management of land contamination. R&D Publication CLR11.

2 NHBC. (2008). Guidance for the safe development of housing on land affected by contamination. R&D Publication 66. National House Building Council.

Potential Source	Pathway	Receptor	Severity of Risk	Likelihood	Potential Risk
Ground Gases ctd	**Post Development**				
	Accumulation – migration and ingress into indoor building spaces	Buildings materials and services	Medium	Unlikely	Low
		Site users (note that building structures are not proposed)	Severe	Unlikely	Moderate - Low
Ground-water Contamin-ation	**Construction Phase**				
	Dermal absorption through handling Inhalation of vapours	Construction workers	Medium	Unlikely	Low
	Migration of contaminated groundwater along preferential pathways during construction (i.e. foundations, service trenches etc.)	Groundwater / Surface water	Medium	Low Likelihood	Mod/Low
	Migration - Uncontrolled discharge of groundwater	Surface water drainage system	Medium	Unlikely	Low
	Post Development				
	Migration of contaminated groundwater along preferential pathways (i.e. foundations, service trenches etc.)	Surface water drainage systems and Tributary	Medium	Low Likelihood	Mod/Low
	Migration of dissolved phase contaminants to controlled water receptors	Groundwater	Medium	Unlikely	Low
	Accumulation – migration and ingress of volatile vapours into indoor building spaces	Site Users	Medium	Unlikely	Low

Assessment of Plausible Pollutant Linkages

A summary of potential risks associated with the plausible pollutant linkages identified at the site based on the known historical activities, site investigation observations and laboratory results are provided in Table E4-2. Design and control measures to mitigate the potential risks are also included in the table.

Table E4-2. Summary of Assessment of Plausible Pollutant Linkages

Receptor	Potential Risk	Conclusion / Likely Mitigation Measures
Human Health - (Construction & Maintenance Workers)	Moderate	Conclusions: • Direct exposure to soil and dust was identified as a moderate risk where site users may be exposed to contaminated soil (e.g. during construction) because the site history review and site investigation identified that the site had been used for potentially contaminating activities. • Because of the potential for dust to contain contamination that poses a potential risk to human health, construction / maintenance workers procedures must be in place to prevent exposure to dust. • Potential for contamination in the soil such as asbestos, hydrocarbons, heavy metals, metalloids, water soluble sulphate, pH, low level radiation, ground gases and UXOs. Actions : • Appropriate measures during ground works to screen the soil for asbestos, low level radiation (from medical waste) and to check for the presence of UXOs. • Construction & maintenance workers briefed on the issues and modify their work practices as appropriate, (procedures in place in case UXOs are uncovered, screen soil for medical waste low level radiation, air monitoring for asbestos fibres as per the Asbestos Regulations (2006)). • Refer to the Approved Code of Practice Work with Materials containing Asbestos, L143, ISBN 978 0 7176 6206 7 • Asbestos Essentials, HSG 210, ISBN 978 0 7176 6263 0. • Construction and maintenance workers must wear appropriate PPE. • During construction appropriate management of dust, such as wetting down, should occur to reduce dust levels. • Implement adequate control measures to prevent excessive dust and to ensure personal hygiene.

Receptor	Potential Risk	Conclusion / Likely Mitigation Measures
Human Health – Construction Phase (Neighbours)	Moderate	Conclusions: • Neighbours to the proposed development area may be at risk to nuisances such as asbestos, contaminants, dust, noise and odours. Actions : • As indicated above appropriate management of site to reduce dust generation is required. • Noise would be managed by the use of best practice construction methodologies (e.g. controlling the hours of work near property boundaries, use of mufflers on vehicles etc.). • Odour from stockpiled arising is unlikely to be an issue however odour suppressants could be used if nuisance odours became a problem. • The air may need monitoring near site boundaries and neighbouring houses may require monitoring for asbestos dust.
Human Health - Post Development Phase (Site Users)	Moderate to Low	Conclusions : • Potential for historic contaminating activities at the site and the results of the site investigation meant the risk assessment indicates a moderate to human health. Direct exposure to soil and dust was identified as a moderate risk where site users may be exposed to contaminated soil from benzo(a)pyrene and asbestos (e.g. in proposed garden or play areas). UXOs (identified in one trial pit) and low level radioactive waste (not identified on site however may be located in discrete areas or on adjacent land) are also a concern. Actions • Additional assessment is required as per the EHO recommendations. Discussions are currently underway with the EHO to ascertain regulatory requirements at the site. • Discussions to date with the EHO indicate additional shallow sampling and if required statistical analysis of the benzo(a)pyrene issue to determine its significance. • Measure the concentrations of asbestos in the soil and measure asbestos fibres in the air to ascertain the significance of the asbestos issue in the site soil (the source) and the site air (pathway), including the air at the site boundaries. Temporal monitoring is required as well drained sites are susceptible to releasing dust and asbestos fibres during dry periods. Air monitoring must therefore cover a dry summer period. • If risk assessment and/or monitoring identifies the need, then breakage of the asbestos linkage between the source (Made Ground) and park users / neighbours by either identifying the location of the asbestos and physically removing it or by covering the site with an appropriate cover system. • Approval by the EHO on an appropriate course of action.

Receptor	Potential Risk	Conclusion / Likely Mitigation Measures
Controlled Waters	Moderate to Low	Conclusions : • The site lies on a Secondary Aquifer and 200 m from a culverted brook. • The site is not located within a source protection zone of a public water supply, and no abstractors were identified nearby. • Impacts on controlled waters from the development were identified as a low –moderate risk because it is possible sediment could impact surface water quality and enter surface water drainage systems. • The scale of the development site is so small relative to the distance to the potential controlled water receptors that any effects are unlikely to be significant. • Discussions are currently underway with the EA to ascertain their requirements. Actions : • Surface waters are primarily at risk from uncontrolled sediment loads from run off from exposed soils to surface water drainage networks. This can be mitigated with the implementation of appropriate control measures (best practice construction and / or drainage management). • The EA may require investigation of groundwater as a pre cautionary measure.
Soft Landscaping – Plants and Trees	Low	Conclusions: • Phytotoxic contaminants such as barium, copper, nickel and zinc may pose a risk to plants. Even if these contaminants are present the UK risk assessment approach identifies this risk as 'low' because its significance of harm to plants (relative to human health) is lower. Actions : • Horticultural advice will need to be sought for any landscaping works.

Receptor	Potential Risk	Conclusion / Likely Mitigation Measures
Building Materials and Structures	Moderate	Conclusions: • Anderson shelters and voids were identified at the site at TP5 and TP13. • Approximately 40% of trial pits meet obstructions, likely to be former foundations or paving from the site's previous use. • UXOs and low level radiation are a continued concern both on site and on surrounding land. • Building materials such as buried concrete and plastic pipe work can be vulnerable to certain types of contaminants, which can cause accelerated degradation / deterioration of the material and some types of contaminants can penetrate certain types of materials (e.g. chlorinated solvents can pass through pressurised plastic water pipes by the process of chemical diffusion). • Elevated concentrations of sulphate, low pH values, or other contaminants such as ammonia may also have the potential to impact on the integrity of buried concrete. • Asbestos, TPHs and PAHs were identified as present in soil on the site. • Ground gases can enter habitable structures and confined spaces. • Potentially contaminated excess arisings from excavation of foundations and service trenches and pits may require management. Actions : • The site needs to be made safe by locating and backfilling voids and assessing the soil to determine if remediation of soil contamination is required; • The bedding, backfill and surround to all services constructed at the site must be in clean soil such that installation of new pipework and future maintenance is as far as practical in clean soil. • Review the pH and water soluble sulphate concentrations in the soil and chose an appropriate concrete design class to mitigate chemical attack. Testing at the site has so far indicated concrete to design standard DS1 AC1 may be suitable. • Appropriate management of waste materials (e.g. arisings) and their disposal by a licenced waste transport operator to a licenced landfill (or licenced waste treatment site if appropriate). • Water supply pipes will be installed on the site in accordance with the guidance "UKWIR, Pipe Materials Selection and Specification for use in Contaminated Land - Final Project Report 04/WM/03/0, 2004a". The local water supply company must be consulted to ascertain detailed requirements for the site. • Monitor and complete checks for asbestos containing material in soil during site ground works. Monitor UXO and low level radioactive waste issues during ground works also. • Because habitable structures are not proposed ground gases are not considered an issue for the playground redevelopment. If structures are ever proposed for the site then ground gases will need assessment and if required adequate protection measures must be installed in accordance with British Standards and building control requirements.