

8.0 Conceptual Model and Qualitative Risk Assessment

A Preliminary Conceptual Site Model is formed by presenting all identified and suspected sources, pollutant pathways and receptors identified during this Report. Where a potentially significant source, pathway and receptor is identified, a pollutant linkage is considered to potentially exist that should be investigated through intrusive ground investigation. This is presented in the following sections. The Principles of Environmental Risk Assessment is presented in [Appendix 4](#).

The significance of the presence of these elements is considered by carrying out a risk assessment of all potential pollutant linkages in the context of the proposed development of the site.

Where potential pollutant linkages have been identified, a Preliminary Conceptual Site Model has been created and detailed in the following Sections. This is presented in [Drawing 72054/9005](#), [Appendix 1](#).

8.1. Source Characterisation

All potential sources of contamination within the vicinity of the site have been established based on the site walkover ([Section 2.2.3/Appendix 3](#)); the historic map review ([Section 3.0](#), [Table 1](#) and [Appendix 2](#)), review of statutory and non-statutory consultations ([Section 5.0](#) and [Appendix 5](#)) and the review of environmental information from the Envirocheck Report ([Section 6.0](#)). These are considered further with regards their potential significance and whether or not they should be progressed to the Qualitative Risk Assessment (QRA) stage. The assessment is shown as [Tables 11](#) and [12](#).

Table 11: Initial assessment of potential onsite sources of contamination

Potential Source	Information Source	Location	QRA?	Comments
Tank Farm (1977-1980)	Historic Mapping Walkover Survey	Onsite	Yes	There was an area labelled tanks in the mapping. It is unknown what substances were stored or the nature of the tanks (i.e. bunded) and if there were any significant spills/leaks, therefore the historic activities/operations are considered to have the potential to have caused contamination.
In-filled dam (associated with Nether Carinhill Farm)	Historic Mapping	Onsite	Yes	Historic infilling operations with unknown materials are considered to have the potential to have caused contamination. It is considered that this potential source may present a risk of contamination to the proposed development.
Property: Upper Cairnhill	Historic Mapping	Onsite	Yes	The walkover confirmed the presence of an above ground self-bunded heating oil tank adjacent to the property. It is likely that this was superseded by a historic non-compliant tank. Additional investigation should be undertaken to confirm that no record of any spills/incidents which would have the potential to have caused contamination at the site.
Property: The Steading	Walkover Survey	Onsite	Yes	Suspected Asbestos (cement bound roofing tile) has been visually confirmed as being present in the outbuilding. There is the potential to have caused contamination at the site within the soils. Additionally, the premises was not able to be fully accessed (private property) to assess if there was a heating oil tank present. Additional investigation should be undertaken to confirm the presence of a tank at the property and whether there is any record of spills/incidents which would have the potential to have caused contamination at the site.
Radon	Geology Mapping	Onsite	Yes	The site is within an 'Intermediate' Radon probability area. Radon may be a potential issue as the site and appropriate investigation and/or remedial measures should be undertaken to assess and/or mitigate the potential risk to the proposed development.

Table 12: Initial assessment of potential offsite sources of contamination

Potential Source	Information Source	Location	QRA?	Comments
Former Petrol Filling Station (northbound) Former Petrol Filling Station (southbound)	Historic Mapping	Offsite	Yes	The northbound station is no longer in operation. It is currently the premises of a double glazing/conservatory company (<i>Advanced Group</i>). The southbound filling station is currently occupied by a used car display forecourt and Indian Restaurant. It is unknown if they site was fully decommissioned following their closure or if there were any spills/leaks during their operation, it is considered that due to their location, that they could be potential sources which would present viable sources of migrating contamination to the Phase 1A development.
Garage Premises	Historic Mapping Walkover Survey	Offsite	Yes	The walkover confirmed it is currently used as a store for motors/machinery and small garage (<i>Twentieth Century Classics</i>). It is considered that due to its location, It is considered that this potential source would present a viable source of migrating contamination to the Phase 1A development.
Electricity Sub Station (1)	Historic Mapping Walkover Survey	Offsite	Yes	The sub-station was noted in the historic mapping from 1977. The walkover survey confirmed several areas of surface staining on the hardcore and concrete slabs. It is considered that this potential source would present a viable source of migrating contamination to the Phase 1A development.
In-filled Old Quarry	Historic Mapping	Offsite	Yes	Historic infilling operations with unknown materials are considered to have the potential to have caused contamination. It is considered that this potential source would present a viable source of migrating contamination to the Phase 1A development.
Nether Cairnhill Nether Carinhill Cottage East Windyedge Windyedge The Chimneys Clairville/ Schoolhouse Smithy Croft Hillhead Croft Smithy Cottage	Historic Mapping Walkover Survey	Offsite	Yes	The properties could not be fully accessed during the walkover (private property). Investigation should be undertaken to confirm the presence of a tank/potential historic tank and associated infrastructure (i.e. slurry pit/chemical storage) at the property to assess if there is the potential to create a viable source of migrating contamination to the Phase 1A development.
Rockhead (demolished)	Historic Mapping	Offsite	No	Due to the distance from the site and anticipated geological conditions and historic nature of the identified offsite sources, it is considered that these potential sources would not present a viable source of migrating contamination.

Table 13: Contaminants of Concern of onsite sources

Source	Heavy Metals	Fuels Oils	BTEX	MTBE	PCB	PAHs	SVOCs VOCs	Asbestos	SO ₃ SO ₄	Phenol	pH	Nitrate Nitrite	Pesticides	Ground Gas/Vapour
Tank Farm (1977-1980)		✓		✓		✓								✓
In-filled dam (Nether Carinhill Farm)	✓	✓				✓		✓			✓			✓
Property: Upper Cairnhill		✓				✓								✓
Property: The Steading		✓				✓		✓						✓
Radon														✓

Table 14: Contaminants of Concern for offsite sources

Source	Heavy Metals	Fuels Oils	BTEX	MTBE	PCB	PAHs	SVOCs VOCs	Asbestos	SO ₃ SO ₄	Phenol	pH	Nitrate Nitrite	Pesticides	Ground Gas/Vapour
2no. filling station (southbound)														✓
Garage Premises														✓
Electricity Sub Station (1)														✓
In-filled Old Quarry														✓
Nether Cairnhill														✓
East Windyedge														✓
Windyedge														✓
The Chimneys														✓
Clairville/ Schoolhouse														✓
Smithy Croft														✓
Smithy Cottage														✓
Hillhead Croft														✓

8.2. Pathway Characterisation

The potential pathways by which receptors might be exposed to contaminants (sources) at a site will vary depending on the proposed or current land use (i.e. residential properties, public open space, retail). A [residential with home-grown produce](#) scenario is applicable for the Phase 1A Development Site.

For [Humans \(site end-users\)](#), the possible routes of exposure to contaminants are:

- Inhalation of dusts or ground gas/vapours;
- Ingestion of dusts or soil either by hand-to-mouth activity or by eating plants grown in contaminated soils;
- Dermal (skin) contact with contaminated soils and waters and transfer of contaminants through the skin into the body;
- Ingress of contaminants into water-supply pipes contaminating drinking water supplies.

[Buildings and Utilities \(Property\)](#) may be affected by contaminants in the following ways:

- Soil gas or vapour pooling in voids within or beneath structures;
- Direct contact of building fabric with contaminated soils;
- Service trenches acting as preferential migration pathways.

For the [Water Environment](#), the possible pollutant potential pathways are:

- Leaching of contaminants from the soil to on-site groundwater;
- Migration of contaminated groundwater to off-site groundwater;
- Movement of contaminants via groundwater to surface water bodies; and
- Run-off from the site surface entering surface water courses present on the site.

8.3. Receptor Characterisation

Potential receptors at the site are related to the development proposals. The location of the site relative to sensitive environmental receptors and the ground and groundwater conditions at and below the site has been considered. This Report has identified the following potential receptors:

- Humans: End Users
- Construction Workers (during re-development)
- Buildings: Building Fabric and Services
- The Groundwater Environment.

8.4. Pollutant Linkages

The significance of potential pollutant linkages at the site is qualitatively assessed by considering the likely magnitude of the hazard and the probability of the linkages occurring based on the information gathered. This is illustrated in the following tables.

Table 15: Preliminary Qualitative Risk Assessment for identified onsite sources of contamination

Source	Contaminants of Concern	Potential Pathways	Potential Receptors	Assessment	Likelihood of Occurrence	Severity of Consequences	Action/ Investigation Required
Presented in Table 13	Presented in Table 13	Ingestion, Inhalation & Direct Contact	Human: End-users	Review of the historic mapping suggests that there has been in-filling of certain areas of the site with unknown materials (Made Ground). A risk is present from the inhalation of ground gases (and potentially vapours) which may form an active pollutant linkage to the end users of the site and require to be investigated and risk assessed. There was an area labelled tanks in the mapping (tank farm). It is unknown what substances were stored or the nature of the tanks (i.e. banded) and if there were any significant spills/leaks, therefore the historic activities/operations are considered to have the potential to have caused contamination. Investigation should be undertaken to confirm the presence of a tank/potential historic tank and associated infrastructure at premises which were unable to be accessed during the walkover to assess if there is the potential to have caused contamination at the site. The site is within an 'Intermediate' Radon probability area.	High	High	Investigation, sampling & testing of the site in accordance with BS10175/CIRIA 665 and CLR11 Risk Assessment Gas and PID Monitoring to CIRIA 665 followed by Ground Gas Risk Assessment of elevated levels of gases encountered at the site in accordance with CIRIA 665 Radon Monitoring and/or mitigation require to be included within the proposed development.
				There is a potential risk of contact with contaminated soils and groundwater during the construction and routine maintenance. A potential risk also exists from inhalation of ground gas/vapours which may pool beneath the buildings and within service trenches and create a complete pollutant linkage.	Moderate	High	<i>Appropriate PPE</i> <i>Safe systems of work</i>
		Run-off, leaching, migration to groundwater and surface water	Water Environment	The site is within an 'Intermediate' Radon probability area. There was an area labelled 'tanks' in the mapping. It is unknown what substances were stored or the nature of the tanks (i.e. banded) and if there were any significant spills/leaks, therefore the historic activities/operations are considered to have the potential to have caused contamination. Cognisance should be taken of the historic mapping and the number of wells noted throughout the site to provide a preferential pathway for potential contaminants to the groundwater environment.	Moderate	Moderate	Investigation, sampling & testing of the site in accordance with BS10175 and CLR11 Risk Assessment
		Direct contact with ground contamination	Building fabric and services	Possibility of complete pollutant linkage to buildings and services at the site by direct contact with contaminated and/or aggressive soil conditions.	Moderate	High	Investigation of the site in accordance with CIRIA C665. Sampling, Testing and Analysis to BRE SD 212 Brownfield Concrete Assessment