Brown 2 Green

Geotechnical and Geo-environmental Consultants

GEO-ENVIRONMENTAL
PHASE I DESK STUDY AND PHASE II SITE INVESTIGATION REPORT

BARNS AT MULBERRY HOUSE FARM
WENDEN ROAD
ARKESDEN
CB11 4HD

Reference Number 3404/Rpt 1v1
October 2023

Prepared for

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Report Title	Geo-environmental Phase 1 Desk Study and Phase II Site Investigation Report: Barns at Mulberry House Farm, Wenden Road, Arkesden, CB11 4HD
Reference Number	3404/Rpt 1v1
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EXECUTIVE SUMMARY

This report describes the findings of a Geo-environmental Desk Study and Site Investigation of Mulberry House Farm, Arkesden. It is proposed to convert the site for residential usage.

At the time of the walk-over the site was occupied by three barns. The area was mainly covered with concrete hard standing. The concrete was in reasonable condition. The site walk-over did identify potential sources of contamination.

The review of the historical maps identified that the central parts of the site were occupied by buildings since before 1877 and that the site has been used as a farmyard.

The review of the industrial setting did not identify any sources of contamination.

A review of the environmental setting indicated the site to be underlain by superficial argillaceous deposits of the Lowestoft Formation. The solid geology is the Lewes Nodular Chalk Formation and the Seaford Chalk Formation. The solid geology is classified as a Principal Aquifer. The superficial deposit is classified as a Secondary (Undifferentiated) Aquifer. The nearest surface water feature is a pond located 50m to the northwest.

The conceptual model prepared for the site did identify potentially active pollution linkages between the historical land use of the site and the future use as residential.

The investigation consisted of the excavation of trial pits. After the trial pitting, soil samples were obtained and submitted for chemical analysis.

The following conclusions were made:

The Tier I Human Health Risk Assessment has identified concentrations of individual PAHs and aromatic hydrocarbons within the made ground beneath the track and localised zones within the yard area at concentrations that would pose an unacceptable level of risk should exposure pathways be introduced by the redevelopment of the site. These pathways would typically be present within arras to be developed as soft landscaping.

The Tier I Controlled Water Risk Assessment has determined that there are no concentrations of potential contaminants within the underlying soils that would pose an unacceptable risk to controlled waters.

The risk assessment for bio-genic ground gas concluded that there are no concentrations at levels that would pose an unacceptable risk to human health and the proposed development.

The risk assessment in respect to the future planting and towards sensitive ecological receptors identified that the determinants at the site are at levels that would not pose an unacceptable level of risk to future planting and sensitive ecological receptors.

The risk assessment in respect to water supply infrastructure identified that the determinants at TP10 (0.2-05m) would pose an unacceptable level of risk to the integrity of PE or PVC pipework.

General recommendations for remediation were made.

1 INTRODUCTION

1.1 Background

Brown 2 Green Associates Ltd have been commissioned by Amherst Homes to undertake a Geo-Environmental Phase I Desk Study, including a preliminary risk assessment and Phase II Site Investigation of land at Mulberry House Farm, Arkesden, CB11 4HD. The site is centred on National Grid Reference 548450, 235230. The site location is presented in Figure 1.

1.2 Proposed Development

The work was commissioned to provide information for a planning application to redevelopment the subject site. It is proposed to convert the existing barns for residential usage.

1.3 Objectives

The objectives of the work are to provide an assessment of the risk from contaminated land to inform about potential re-development of the site, address the requirements of the National Planning Policy Framework[1] and Planning Practice Guidance. These objectives are achieved by:

- Undertaking a site inspection to identify any current areas of potential environmental concern;
- Reviewing historical plans, geology, hydrogeology, site sensitivity, flood-plain issues, mining records and any local authority information available in order to complete a Desk Study in line with Environment Agency Contaminated Land Risk Management.
- Investigation of any identified pollution linkages to determine any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors; and,
- Provide a factual and interpretive report and recommendations on any potential development issues.

The information obtained in this study has been used to develop an initial Conceptual Site Model (CSM) and outline potential risks from contamination at the site. This CSM examines potential Source-Pathway-Receptor contaminant linkages in relation to identified or potential contamination issues at the site and vicinity, incorporating them into a Preliminary Risk Assessment. This report has been completed in accordance with Environment Agency Contaminated Land Risk Management.

The Preliminary Risk Assessment seeks to establish firstly whether unacceptable risk as defined in Part 2A of the Environmental Protection Act 1990 is present and secondly whether a possibility of harm to controlled waters, human health or property is present and further investigation is therefore needed to better inform about risk assessment.

Based on the findings of the Preliminary Risk Assessment a Phase 2 intrusive investigation has been undertaken with the objective of assessing if the pollution pathways identified within the site specific conceptual model are active.

Consideration of geotechnical/engineering aspects of the proposed development falls outside the

[1] National Planning Policy Framework, Department for Communities and Local Government, July 2021.

scope of this assessment.

1.4 Sources of Information

Background information relating to the site was acquired and referenced from the following sources:

- Historical mapping (Appendix III);
- Environmental Database Search. All relevant data is summarised in the text of the report. A full copy is presented in Appendix IV;
- On-line planning records held by Uttlesford District Council;
- British Geological Survey website (www.bgs.ac.uk).

A site walkover was carried out by a Geo-environmental Consultant from Brown 2 Green Associates on the 2nd October 2023.

2 SITE LOCATION AND DESCRIPTION

2.1 Site Location and Surrounding Area

The site is located in a rural area at the junction of Wenden Road and Newland End Lane. The land uses immediately adjacent to the site are summarised below:

Direction	Land Use
North	Residential, agricultural land and pond
East	Wended Road, residential and agricultural land
South	Mulberry House (residential) and former farmyard
West	Former farmyard and Newland End Lane

The topography of the surrounding area slopes down towards Wicken Water, located towards the south.

The site location is presented in Figure 1.

2.2 Site Descriptions and Reconnaissance

The site layout is presented in Figure 2. A photographic record of the site is included in Appendix II.

The subject parcel of land is irregular in shape and covers approximately 0.44 hectares. Access to the site is via a track/drive off of Wenden Road.

The northeastern boundary is defined by a flint wall. The northern boundary is defined by a cutting which varies from 0.5m (south-west) to approximately 1.2m (north) deep. The southern boundary consists of fencing panels. The western boundary consists of temporary fencing.

At the time of the site investigation, the site was occupied by three buildings. Buildings 1 and 2 were located in the western part of the site and were refurbished at the time of the visit. Only the metal structure and the roof were in place at the time of the visit. The roofs were made of corrugated cement sheets suspected to contain asbestos. The concrete floors had been removed. Building 1, located to the south, was formerly used as a cattle barn, while Building 2, situated a couple of meters to the north was previously used as a combine barn.

Building 3 was located to the north-east of the previously mentioned buildings and was formerly used as a grain/drying barn. The building was partially cladded with corrugated iron and cement sheets. The cement sheets are suspected to contain asbestos. The barn had a concrete floor.

The areas around the buildings were used for storage of construction materials.

The topography of the site slopes down towards the south.

2.2.1 Storage of Chemicals and Hazardous Substances

Above Ground Storage Tanks (ASTs)

No above ground storage tanks (ASTs) or evidence of former ASTs were observed at the site.

Underground Storage Tanks (USTs)

No underground storage tanks (USTs) or evidence of USTs were observed at the site.

Other Chemical Storage

No significant storage of chemicals was noted at the time of the walkover.

Polychlorinated Biphenyls

No equipment that may potentially contain polychlorinated biphenyls (PCBs) was observed at the site.

2.2.2 Asbestos Containing Materials

The roofs and walls of the buildings were constructed with materials suspected to contain asbestos.

No asbestos survey reports were made available.

2.2.3 Waste Disposal

No waste disposal activities were identified.

2.2.4 Site Drainage

A formal drainage survey has not been completed but it is assumed the site is connected to the foul sewer which is likely to be located within Wenden Road to the east. No trade effluent is generated by the site. No oil/water interceptors were identified. No soakaways were identified. Rainwater will either infiltrate into the ground or is lost through surface water run-off or evapotranspiration.

2.3 Visual and Olfactory Evidence of Contamination

No specific visual or olfactory evidence of contamination was noted.

2.4 Potential Sources of Contamination

During the review of the site setting and reconnaissance the following plausible potential sources of contamination were identified:

- Building materials suspected to contain asbestos.
- Former use of site as farmyard.
- General quality of the made ground present across the site.

3 HISTORICAL LAND USE

3.1 Historical Mapping

The maps at scales of 1: 2,500, 1:10,000 and 1:10,560 were reviewed to determine the history of the site. A summary of the site history is presented below. The historical maps are included in Appendix III.

Date	Site	Surrounding Area
1877 1:2,500	The site is part of a farm courtyard. The northern edge of a building is located in the north-central part of the site and it is likely associated with Hobs Aerie immediately north of site.	Wooded area immediately southwest of site. Hobs Aerie immediately east. A pond is located 35m northwest. A rod is present adjacent to the eastern boundary of the site, while another one runs parallel with the western boundary.
1881 1:10,560	No change.	Several hamlets and villages surrounded by agricultural land.
1921 1:2,500	No change.	Field boundary changes around Hobs Aerie.
1923 1:10,560	No change.	No change.
1950 1:10,560	No change.	No change.
1960 1:10,000	No change.	Development begins on land 200m southwest of site
1979 1:2,500	Three buildings have been developed in the northern, central and south-western part of the site.	Buildings constructed on present day farmyard. Orchard Bungalow constructed immediately south of site on wooded area. Field boundary changes around Hobs Aerie and small pond no longer shown. Residential dwellings constructed 200m southwest of site.
1982 1:10,000	As 1979.	Plash Wood 330m south of site becomes agricultural land.
1993 1:2,500	A building has been developed to the north-west of the site. The north-eastern extension has been demolished.	Construction of another building on adjacent farmyard. Field boundaries for Beacons House 220m northwest and Hobs Aerie changed. Both properties have tennis courts constructed.
1999 1:10,000	As 1979.	No change.
2023 1:10,000	As 1979.	No change.

A plan showing the results of a topographical survey detailed the presence of an above ground storage tank to the west of Building 3. The tank was not present during the site walkover. The use of the tank is not detailed. A review of photographs contained on Google Earth indicates that the tank that was located adjacent to Building 3 appears to be a water tank.

3.2 Listed Buildings and Historical Sites

The nearest listed building is Hobs Aerie which neighbours the site to the northeast, approximately 20m from the site boundary.

3.3 Local Authority – Planning

A review of on-line planning records from Uttlesford District Council was completed on 11th October 2023.

In 1978 planning application UTT/0734/78 was granted for a proposed pig building. The conditions of approval referenced asbestos roof cladding.

3.4 Potential Sources of Contamination

During the review of the historical land use of the site and surrounding area, the following potential sources of contamination were identified where it is considered that there is a plausible pollution pathway:

- Asbestos containing materials used in the construction of buildings on site.
- Former use of site as farmyard.
- Former above ground storage tank.
- General quality of the made ground.

4 INDUSTRIAL SETTING

4.1 Contemporary Trade Directory Entries

There are no contemporary trade directory entries for the site, nor within a 250m radius.

Within 500m radius of the site there are no entries for filling stations.

4.2 Landfill Sites and Waste Disposal Facilities

There are no historical or operational landfill sites or waste management facilities within 250m radius of the site.

4.3 Environmental Permits, Incidents and Registers

The following information is a summary of the data contained Environmental Database presented in Appendix IV.

	On Site	0 – 250m	Details of Nearest	Potential Risk to Site
Authorised industrial processes (IPC/IPPC/LAPPC)	0	0	-	No
Radioactive Substances Authorisations	0	0	-	No
Licensed Discharge Consents	0	1	97m to the south. Effective from 1999. Sewage discharge of final/treated effluent to land/soakaway.	No
Consents issued under the Planning (Hazardous Substances) Act 1990	0	0	-	No
Control of Major Accident Hazard (COMAH/NIHHS/Explosive) sites	0	0	-	No
Pollution Incidents	0	0	649m to the south. Occurred in 1996. Involved septic tank effluent. Classified as minor.	No
Contaminated Land Register Entries and Notices (Part 2A EPA 1990)	0	0	-	No

4.4 Ground Workings, Mining and Natural Cavities

There are no BGS recorded mineral site on or within 250m radius of the subject site.

The database states that the site is not located in a Cheshire Salt Brine Subsidence Compensation Board District.

The database states that the site is not located in an area affected by coal mining.

The data base indicates that the site is not located within an area where there is the potential for mining instability.

The database states that the site is located within a non-coal mining area.

5 ENVIRONMENTAL SETTING

5.1 Geology and Hydrogeology

The British Geological Survey mapping indicates that the site is underlain by the following geology:

Drift/Solid	Geological Unit	Description
Drift/Superficial	Lowestoft Formation	Diamicton
Solid	Lewes Nodular Chalk Formation and Seaford Chalk Formation	Chalk

Geological logs held by the British Geological Survey were reviewed. The nearest is located 1,500m to the south. The log indicates the area is underlain by the following geological conditions:

Description	Thickness (m)	Depth to base (m)
Top soil	1.0	1.0
Stiff brown/grey boulder clay	36.0	37.0
Chalk with flints	38.0	75.0

The Superficial Deposits are classified as a Secondary (Undifferentiated) Aquifer. The solid geology is classified as a Principal Aquifer.

The combined groundwater vulnerability for the site is classified as Medium.

There are no licenced groundwater abstraction points within 1km radius of the site.

The site is located within a Zone II (Outer Zone) Source Protection Zone.

5.2 Geochemistry

The British Geological Survey estimates of the geochemistry of the soils beneath the site are:

Determinants	Soil Type	Concentration (mg/kg)
Arsenic	Rural	16.18
Cadmium		0.41
Chromium		69.51
Nickel		29.59
Lead		43.25

5.3 Hydrology

The Ordnance Survey Water Network Lines indicates the nearest surface water feature is a pond located 50m to the northwest. Wicken Water flows towards the south and discharges into the River Cam, located 3.85km to the east.

There are no licensed surface water abstraction points within 500m radius of the site.

The nearest licensed surface water abstraction point is located 1573m to the north, where A Duke & Son is licenced to abstract water from a local stream. The water is used for irrigation.

The database indicates that the site does not lie in a fluvial or tidal floodplain. Flood risk rating from flooding from rivers and the sea (RoFRaS) is Very Low.

5.4 Ecologically Sensitive Areas

The subject site is located within a Nitrate Vulnerable Zone.

5.5 Radon

The site is located in an area where less than 1% of homes are above the Action Levels and Radon protective measures are not necessary in the construction of new dwellings or extensions.

5.6 Natural Hazards

BGS GeoSure Data presented within the Environmental Database presented in Appendix IV identifies the following ground conditions:

Hazard	Designation	Hazard
Potential for Shrinking or Swelling of Clays	Low	Ground conditions predominantly medium plasticity
Potential for Landslide Ground	Very low	Slope instability problems are unlikely to be present
Potential for Ground Dissolution	Very low	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions
Potential for Compressible Ground	Negligible	No indicators for compressible ground identified
Collapsible Ground	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.
Potential for Running Sands	Very low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water.

6 PREVIOUS REPORT

No previous site investigation reports were identified or made available.

7 INITIAL CONCEPTUAL MODEL

Brown 2 Green Associates Ltd has developed a conceptual model to identify potential sources, migration pathways and receptors within the study area. Assuming there is an active pollution pathway linkage between the source and receptor an assessment has been made of the level of risk. The level of risk is a consideration of both:

- the likelihood of an event (probability) [takes into account both the presence of the hazard and receptor and the integrity of the pathway]; and
- the severity of the potential consequence [takes into account both the potential severity of the hazard and the sensitivity of the receptor].

The classifications of the probability of an event occurring based on C552 CIRIA, 2001[2] are presented below:

Probability		Definition
High Likelihood	> 90% of hazard receptor linkage	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor that there is harm or contamination
Likely	45-90% of hazard receptor linkage	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term
Low likelihood	10-50% of hazard receptor linkage	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	10% of hazard receptor linkage	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

The classification of the severity of an event is presented below:

Severity	Category	Definition	Examples
Severe: It is likely that the hazard source could cause harm to a designated receptor and harm would be significant.	Humans	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Water	Short term risk of pollution of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to building or property	Explosion causing building to collapse.
	Ecological systems	A short term risk to a particular ecosystem, or organism forming part of such an ecosystem.	Loss of ecosystem.
Medium: It is possible that the hazard source could cause harm to a designated receptor, but it is unlikely that the harm would be significant	Humans	Chronic damage to human health ("significant harm" as defined in the DETR, 2000).	Concentrations of a contaminant from site exceeds the generic, or site specific assessment criteria
	Controlled Water	Pollution of sensitive water resources.	Leaching of contaminants from a site to a Principal Aquifer.
	Ecological systems	A significant change in a particular ecosystem, or organism forming part of such an ecosystem.	Death of a species within a designated nature reserve.

[2] Contaminated land risk assessment. A guide to good practice (C552), D J Rudland, R M Lancefield and P N Mayell.

Severity	Category	Definition	Examples
Mild: It is possible that the hazard source could cause significant harm to a designated receptor, however it is likely to be mild	Controlled Waters	Pollution of non-sensitive water resource.	Pollution of non-classified groundwater
	Property	Significant damage to buildings/structures and crops ("significant harm" as defined in the DETR, 2000). Damage to sensitive buildings/structures or the environment.	Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor: The potential hazard source cannot cause significant harm to the receptor.	Financial or project	Harm, although not necessarily significant harm, which may result in a financial loss, or an expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as Personal Protective Clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings/structures	The loss of plants in landscaping scheme. Discolouration of concrete.

The comparison of Likelihood against Severity is presented below:

		Severity			
		Severe	**Medium**	**Mild**	**Minor**
Likelihood	**High Likelihood**	**Very High Risk**	**High Risk**	**Moderate Risk**	**Moderate / Low Risk**
	Likely	**High Risk**	**Moderate Risk**	**Moderate / Low Risk**	**Low Risk**
	Low Likelihood	**Moderate Risk**	**Moderate / Low Risk**	**Low Risk**	**Very Low Risk**
	Unlikely	**Moderate / Low Risk**	**Low Risk**	**Very Low Risk**	**Very Low Risk**

The potential consequence of risk classifications is presented below:

Very High Risks	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risks	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risks	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate / Low Risks	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be medium to mild and professional judgement is required. Some remediation works may be required in the long term where high sensitivity receptors are involved.
Low Risks	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risks	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

7.1 Potential Sources of Contamination

On-site Potential Sources

Based on the findings of the site walk-over and the desk study information review the following potential on-site sources of contaminants that may plausibly impact the site were identified:

- Asbestos containing materials used in the construction of buildings on site.
- Former use of site as farmyard.
- Former above ground storage tank.
- General quality of the made ground.

Off-site Potential Sources

No plausible off-site sources of ground contamination have been identified within a 250m radius of the subject site that may result in impact to the site that would result in an unacceptable level of risk.

7.2 Potential Pathways

Plausible pathways identified for each contaminant are presented in the initial conceptual model detailed overleaf.

7.3 Potential Receptors

Brown 2 Green Associates Ltd has identified the following possible receptors:

- Human health - future users of the site (residential with private gardens).
- Human Health – neighbouring residents.
- Human health - construction workers
- Controlled water (groundwater and surface water).
- Buildings and construction materials (concrete).
- Water supply pipework.
- Ecological systems.
- Listed buildings and historical sites.

7.4 Discussion of Potential Pollutant Linkages

Potential pollution linkages identified are presented in the initial conceptual model detailed overleaf.

Initial Conceptual Model and Risk Assessment

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Likelihood***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
On-site Sources						
Made ground						
Metals (As, Cd, Cr, Pb, Hg, Se, Ni, V)	Ingestion of contaminated soils and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor). Contact with contaminated soils	Future site users	High likelihood	Medium	High	Potentially active in areas of soft landscaping and private gardens. Further assessment required.
	Inhalation of windblown dust (indoor and outdoor).	Neighbouring residents	Low	Minor	Very low	Neighbouring properties are close by, however potential for the generation of significant quantities of contaminated dust is considered to be very low.
	Ingestion of contaminated soils by direct. Inhalation of dust (indoor and outdoor).	Construction workers	Likely	Minor	Low	Potentially active but short term exposure. General site practices and site PPE (gloves) will reduce exposure.
Metals (Bo, Cu, Ni, Zn)	Uptake by plants	Planting and soft landscape areas	Likely	Minor	Low	Potentially active in areas to be developed as soft landscaping and gardens. Further assessment required.
Total Petroleum Hydrocarbons, PAHs.	Ingestion of contaminated soil and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Future site users	Likely	Medium	Moderate	Potentially active in areas of soft landscaping and private gardens. Further assessment required.

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Likelihood***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
	Inhalation of windblown dust (indoor and outdoor).	Neighbouring residents	Very Low	Minor	Very low	Neighbouring properties are close by, however potential for the generation of significant quantities of contaminated dust is considered to be very low.
	Ingestion of contaminated soil and dust by direct contact. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Construction workers	Likely	Minor	Low	Potentially active but short term exposure. General site practices and site PPE (gloves) will reduce exposure.
	Downward and lateral migration.	Groundwater Surface Water	Low likelihood	Medium	Moderate/Low	Potentially active. Site is in a Zone 2 Source Protection Zone which is to protect groundwater within the chalk aquifer. The site is directly underlain by clay of the Lowestoft Formation, estimated to be 20m thick. The presence of the Lowestoft Formation will act as a barrier to downward and lateral migration of contaminants.
	Contact with contaminated soils.	Water supply infrastructure	Likely	Medium	Moderate	Potentially active when placed in contaminated soils. Further assessment required.
Asbestos	Inhalation of fibres.	Future site users and construction workers	Likely	Severe	Moderate	Potentially active if asbestos fibres are released.
Ground gas	Through soil.	Future users and buildings	Unlikely	Medium	Low	Potentially active should made ground be identified at thickness greater than 2m and with high organic matter content to act as source.

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Likelihood***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
Use of site as farmyard and associated storage and above ground storage tank						
Total Petroleum Hydrocarbons, PAHs, petrol, diesel, oils	Ingestion of contaminated soil and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Future site users	Likely	Medium	Moderate	Potentially active in areas of soft landscaping and private gardens. Further assessment required.
	Ingestion of contaminated soil and dust by direct contact. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Construction workers	Likely	Minor	Low	Potentially active but short term exposure. General site practices and site PPE (gloves) will reduce exposure.
	Contact with contaminated soils.	Water supply infrastructure	Likely	Medium	Moderate	Potentially active.
	Downward and lateral migration.	Groundwater Surface Water	Low likelihood	Medium	Moderate/Low	Potentially active. Site is in a Zone 2 Source Protection Zone which is to protect groundwater within the chalk aquifer. The site is directly underlain by clay of the Lowestoft Formation, estimated to be 20m thick. The presence of the Lowestoft Formation will act as a barrier to downward and lateral migration of contaminants.
Organic compounds including fuels, pesticides and herbicides.	Ingestion of contaminated soil and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Future site users	Likely	Medium	Moderate	Potentially active in areas of soft landscaping and private gardens. Further assessment required.

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Likelihood***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
	Migration of vapours through the unsaturated zone. Release of vapours from the dissolved phase within groundwater	Neighbouring residents	Very Low	Minor	Very low	
	Ingestion of contaminated soils by direct contact. Inhalation of dust (indoor and outdoor). Contact with contaminated soils.	Construction workers	Likely	Minor	Low	Potentially active but short term exposure. General site practices and site PPE (gloves) will reduce exposure.
	Downward and lateral migration.	Groundwater Surface Water	Low likelihood	Medium	Moderate/Low	Potentially active. Site is in a Zone 2 Source Protection Zone which is to protect groundwater within the chalk aquifer. The site is directly underlain by clay of the Lowestoft Formation, estimated to be 20m thick. The presence of the Lowestoft Formation will act as a barrier to downward and lateral migration of contaminants.
	Contact with contaminated soils.	Water supply infrastructure	Likely	Medium	Moderate	Potentially active.

8 SITE INVESTIGATION

8.1 Exploratory Fieldwork

Twelve trial pits (TP1 to TP12) were excavated with a 1.5t mini-digger on 2nd October 2023 to a maximum depth of 1.1m below surface.

The sample locations were based on the site conceptual model to provide a general assessment of the quality beneath the soils beneath site and the potential source areas listed in the table below. The sampling locations are illustrated in Figure 3.

Sample Location	Rational/Potential Source Area
TP1	General assessment of the ground beneath the eastern part of the track.
TP2	
TP3	
TP4	
TP5	General assessment of the ground from the central part of the site.
TP6	Assessment of the ground adjacent to the west of Building 3 and former above ground storage tank.
TP7	General assessment of the ground from the central part of the site.
TP8	General assessment of the ground from the north-western part of the site and north of Building 2.
TP9	
TP10	General assessment of the ground from the western part of the site.
TP11	General assessment of the ground from the south-western part of the site and south of Building 1.
TP12	

Soil samples destined for chemical testing were collected in laboratory prepared jars. Samples for organic analysis were placed in amber glass jars, samples for volatile analysis in vials with septums and samples for inorganic analysis in plastic tubs. During the site works recovered soils were geologically logged by an experienced Geo-environmental Engineer. The geological logs are presented in Appendix V.

8.2 Chemical Analysis

The soil samples were submitted to Eurofins/Chemtest Ltd of Newmarket, Suffolk. The chemical analysis was carried out under UKAS/MCERTS accreditation protocols. The chemical analysis was carried out in accordance with the findings of the Desk Study and the observations made during the site works. The chemical testing programme included.

- Metals Suite (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn, V);
- Speciated PAH (USEPA 16);
- TPH – CWG;
- BTEX and MTBE;
- Pesticides and Herbicides;
- pH;
- Soluble Sulphate; and
- Asbestos fibres.

9 RESULTS

9.1 Summary of Site Investigation Observations

Ground Conditions

The geological logs are presented in Appendix V.

Made Ground

The trial pits indicate the presence of up to 0.5m of made ground. The made ground generally consists of yellowish-brown sand and gravel with bricks. In TP1, the made ground consists of dark brown slightly sandy, slightly gravelly clay with occasional fragments of brick. Fragments of asbestos containing materials were also noted near surface. In TP10, three types of made ground were encountered between ground level and 0.5m bgl. The layer between 0.1m and 0.5m bgl consisted of black slightly clayey, slightly sandy gravel and presented faint hydrocarbon odour.

Natural Strata

The made ground is underlain by light brown mottled grey slightly sandy, slightly gravelly clay to the depth of the trial pits.

Visual and Olfactory Evidence of Contamination

Hydrocarbon odours were noted in TP10 between 0.1m and 0.5m bgl. Fragments of asbestos containing materials were noted in TP1 between ground level and 0.2m bgl.

Groundwater Conditions

During the investigation, no groundwater strikes or seepages were recorded. All trial pits were dry on completion of excavations.

It should be noted that groundwater levels can fluctuate seasonally and therefore, may be encountered at higher or lower elevations than those recorded in this site investigation.

9.2 Laboratory Results

The chemical analysis of the soil samples was undertaken by Eurofins/Chemtest Ltd of Newmarket under MCERT and UKAS accreditation. The test certificates are included in Appendix VI.

10 RISK ASSESSMENT

10.1 Human Health

10.1.1 Approach

Brown 2 Green Associates Ltd has undertaken a Tier 1 Human Health Risk Assessment to determine if any potential contaminants within the underlying soil pose an unacceptable level of risk to the identified human health receptors.

At a Tier 1 stage the long term (chronic) human health toxicity of the soil has been assessed with reference to Generic Assessment Criteria (GAC) detailed in Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3086). If no generic GAC (CIEH/LQM) is available, reference has been made to Category 4 Screening Values or GAC have been determined by Brown 2 Green Associates Ltd using CLEA 1.06 with adjustments based on input data used in the calculation of Category 4 Screening Values.

Where appropriate, as detailed in the Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration (CL:AIRE, 2020), a comparison of the 2-way confidence interval with the relevant GAC threshold is applied to determine whether the degree of contamination detected is statistically significant.

For the assessment of risk to human health from groundwater a qualitative risk assessment has been undertaken. Within this section we have only considered the risk to users of the site. An assessment of risk to human health beyond the boundaries of the site is considered as part of the risk to controlled waters.

10.1.2 Risk from Soil

Risk to Future Site Users

For the purposes of the Tier 1 assessment Brown 2 Green Associates Ltd have initially compared the laboratory test data directly to the relevant Brown 2 Green Associates Ltd Tier 1 human health screening criteria for residential with plant uptake end use with a soil organic matter content of 1%. The results of this direct comparison are presented below:

Determinant	Units	GAC	n	Max Conc.	Locations above GAC	Path-way	Assessment
Arsenic	mg/kg	37	15	37	-	1	No Further Action
Cadmium	mg/kg	11	15	0.5	-	5	No Further Action
Chromium (III)	mg/kg	910	15	37	-	4	No Further Action
Copper	mg/kg	2400	15	30	-	5	No Further Action
Mercury (Inorganic)	mg/kg	40	15	0.3	-	1	No Further Action
Nickel	mg/kg	130	15	36	-	1	No Further Action
Lead *	mg/kg	200	15	80	-	1, 4	No Further Action
Selenium	mg/kg	250	15	1.0	-	1	No Further Action
Vanadium	mg/kg	410	15	54	-	5	No Further Action
Zinc	mg/kg	3700	15	150	-	5	No Further Action
Naphthalene	mg/kg	2.3	19	1.6	-	5, 2	No Further Action
Acenaphthylene	mg/kg	170	19	3.1		5	No Further Action

Determinant	Units	GAC	n	Max Conc.	Locations above GAC	Path-way	Assessment
Acenaphthene	mg/kg	210	19	3.9	-	5	No Further Action
Fluorene	mg/kg	170	19	4.0	-	1, 5	No Further Action
Phenanthrene	mg/kg	95	19	31.0	-	5	No Further Action
Anthracene	mg/kg	2400	19	13.0	-	5	No Further Action
Fluoranthene	mg/kg	280	19	98.0	-	5	No Further Action
Pyrene	mg/kg	620	19	89.0	-	1, 5	No Further Action
Benzo(a)anthracene	mg/kg	7.2	19	57.0	TP10 (0.2-0.5m)	1	Further Assessment (see below)
Chrysene	mg/kg	15	19	53.0	TP10 (0.2-0.5m)	1	Further Assessment (see below)
Benzo(b)fluoranthene	mg/kg	2.6	19	8.1 3.9 80.0 5.9	TP1 (0.0-0.2m); TP6 (0.0-0.1m); TP10 (0.2-0.5m); TP12 (0.0-0.2m).	1	Further Assessment (see below)
Benzo(k)fluoranthene	mg/kg	77	19	29.0	-	1	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	19	6.4 2.8 67.0 4.6	TP1 (0.0-0.2m); TP6 (0.0-0.1m); TP10 (0.2-0.5m); TP12 (0.0-0.2m).	1	Further Assessment (see below)
Indeno(123-cd)pyrene	mg/kg	27	19	44.0	TP10 (0.2-0.5m)	1	Further Assessment (see below)
Dibenz(ah)anthracene	mg/kg	0.24	19	0.77 0.48 0.30 7.8 0.55	TP1 (0.0-0.2m); TP6 (0.0-0.1m); TP10 (0.0-0.1m); TP10 (0.2-0.5m); TP12 (0.0-0.2m).	1	Further Assessment (see below)
Benzo(ghi)perylene	mg/kg	320	19	40.0	-	1	No Further Action
TPH C_5-C_6 (aliphatic)	mg/kg	42	11	<0.05	-	2	No Further Action
TPH C_6-C_8 (aliphatic)	mg/kg	100	11	<0.05	-	2	No Further Action
TPH C_8-C_{10} (aliphatic)	mg/kg	27	11	<0.05	-	2	No Further Action
TPH C_{10}-C_{12} (aliphatic)	mg/kg	130	11	14	-	2	No Further Action
TPH C_{12}-C_{16} (aliphatic)	mg/kg	1100	11	31	-	1	No Further Action
TPH C_{16}-C_{35} (aliphatic)	mg/kg	65,000	11	91	-	1	No Further Action
TPH C_{35}-C_{44} (aliphatic)	mg/kg	65,000	11	<10	-	1	No Further Action
TPH C_5-C_7 (aromatic)	mg/kg	70	11	<0.05	-	2	No Further Action
TPH C_7-C_8 (aromatic)	mg/kg	130	11	<0.05	-	2	No Further Action
TPH C_8-C_{10} (aromatic)	mg/kg	34	11	<0.05	-	2	No Further Action
TPH C_{10}-C_{12} (aromatic)	mg/kg	74	11	36	-	2	No Further Action
TPH C_{12}-C_{16} (aromatic)	mg/kg	140	11	280	TP10 (0.2-0.5m)	1	Further Assessment (see below)
TPH C_{16}-C_{21} (aromatic)	mg/kg	260	11	5300	TP10 (0.2-0.5m)	1	Further Assessment (see below)
TPH C_{21}-C_{35} (aromatic)	mg/kg	1100	11	3800	TP10 (0.2-0.5m)	1	Further Assessment (see below)
TPH C_{35}-C_{44} (aromatic)	mg/kg	1100	11	310	-	1	No Further Action
Benzene	mg/kg	0.087	11	<0.001	-	2	No Further Action
Ethylbenzene	mg/kg	47	11	<0.001	-	2	No Further Action
Toluene	mg/kg	130	11	<0.001	-	2	No Further Action
m-xylene	mg/kg	59	11	<0.001	-	2	No Further Action
p-xylene	mg/kg	56	11	<0.001	-	2	No Further Action
o-Xylene	mg/kg	60	11	<0.001	-	2	No Further Action
MTBE **	mg/kg	49	11	<0.001	-	2	No Further Action

Notes
Main Exposure Pathways: 1 = Soil and dust Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact, 4 = Dust

Inhalation, 5 = consumption of home grown produce.

Abbreviations: GAC = General Assessment Criteria, n = number of samples.

Tier 1 GAC are based on Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. **Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3086.**

* - Category 4 Screening Level.
** - EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment January 2010.
*** - Brown 2 Green HH-GSV using CLEA V 1.06 and tox data from DEFRA/Environment Agency SGV.

One sample was analysed for pesticides and herbicides. The results show that all concentrations were less than the laboratory detection limits.

For determinants that exceed their respective GAC, statistical assessment has been completed. The results are summarised below.

Within the made ground of TP1, TP6, TP10 and TP12, concentrations of PAHs (benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene and dibenzo(a,h)anthracene) and aromatic hydrocarbons (EC12 – EC35) exceed the relevant GAC. Faint hydrocarbon odour was noted in TP10 between 0.2m and 0.5m bgl. For PAHs and aromatic hydrocarbons (EC12 – EC35), the principal exposure pathway is soil and dust ingestion. This pathway would be active within parts of the site to be developed as soft landscaping, where there is the potential that the concentration may pose an unacceptable level of risk should pollution pathways be created. In the areas that will be covered by hard standing or building footprints, the pollution linkage will be broken by the presence of the above-mentioned barriers. Therefore, in these areas it is considered that the elevated PAH concentrations will not pose an unacceptable level of risk to human health.

To further determine the source of the polycyclic aromatic hydrocarbon compounds, an assessment based upon a source signature double ratio plot has been derived using four polycyclic aromatic hydrocarbon compounds (benzo(a)anthracene, chrysene, fluoranthene and pyrene). This has determined whether the high concentrations of polycyclic aromatic hydrocarbons are anticipated to be petroleum, combustion, or coal derived. It is possible to differentiate petroleum based hydrocarbon concentrations from natural organic units by determining the rates of combustion and the relative losses of polycyclic aromatic hydrocarbon compounds within samples analysed. Forensic environmental scientists, have investigated the relationships between many combinations of polycyclic aromatic hydrocarbon compounds and it is generally considered the four compounds mentioned above have a suitable and representative correlation for this assessment. The method of assessment has been derived from Jones Environmental Forensics' extensive knowledge with regards to PAH signatures as well as the extensive work completed by Environmental Forensic scientists such as H J Costa and T C Sauer. Jones Environmental Forensics Ltd have been using this method for tracing hydrocarbon sources for many years and have pooled their extensive database of material type traces for their graphic representation. The results of the double ratio plot indicate that the source of the polycyclic aromatic hydrocarbons is a coal derived product. A copy of the chart is presented in Appendix VII. The PAHs identified in TP10 would appear to be road plannings.

Risk to Construction Workers

In respect to the risk to construction workers, this report and the generic assessment criteria (GAC) consider long term and chronic risk to humans based on defined exposure scenarios set out in the CLEA model. In some cases contaminants may also pose acute hazards to workers at a site, or a worker's exposure scenario may differ from the scenarios considered when deriving the GAC. As

exposure times for construction workers are generally short term, risks from site contamination are generally addressed through the use of appropriate working procedures and the use of personal protective equipment (PPE) in line with the Management of Health and Safety at Work Regulations (1999), Construction (Design) Management Regulations (2007) for some sites and the Control of Substances Hazardous to Health Regulations (2002).

10.1.3 Risk from Asbestos in Soils

Fragments of cement sheeting that contains asbestos (chrysotile) were identified in the made ground near surface in TP1. No loose asbestos fibres were recorded within the made ground.

For the assessment of risk from the fragments of cement sheeting to future site users reference has been made to The Decision Support Tool for the Qualitative Risk Ranking of Work Activities and Receptors Involved in or Exposed to Asbestos in Soil and Construction & Demolition Materials (CL:AIRE Version 2.1, March 2017). The tool indicates the following:

- Hazard ranking: Very Low (1);
- Exposure ranking: Low (9);
- Receptor ranking: High (8);
- Combined hazard, exposure and receptor ranking: Low;
- Pathway ranking: Medium (4D);
- Overall ranking: Low.

A copy of the assessment is presented in Appendix VIII.

From the results of the site investigation and assessment of risk using the CL:AIRE Model Qualitative Risk Ranking, it is considered that the risk to future site users from the asbestos present within the made ground is low.

In respect to the risk to construction workers excavation activities will need to be undertaken. The results from the CL:AIRE Decision Support Tool for the Categorisation of Work Activities Involving Asbestos in Soil and Construction and Demolition Materials in accordance with the Control of Asbestos Regulations 2012 (Version 2.1, March 2017) (Joint Industry Working Group (JIWG)) are as follows:

- Hazard ranking: Low (7);
- Exposure ranking: Low (7);
- Combined hazard and exposure ranking: Low (14).

A copy of the assessment is presented in Appendix VIII.

The assessment completed by Brown 2 Green Associates is based on typical construction site activities such as the excavation of the soil and the movement of plant and machinery. It does not consider the screening and crushing activities. Therefore, during the construction phase, as required by the Management of Health and Safety at Work Regulations (1999), Construction (Design) Management Regulations (2007) and the Control of Asbestos at Works Regulations (2012) risk assessments should be completed to determine the level of risk from all project specific construction activities.

10.1.4 Risk from Groundwater

As no pollution linkages have been identified, it is considered contamination in the groundwater beneath the site will not pose an unacceptable level of risk to human health.

10.2 Ground Gas

From the results of the site investigation, no sources of ground gas that would result in the generation of volumes of biogenic gas that would pose an unacceptable level of risk to human health and the proposed development have been identified. The Conceptual Site Model prepared for the Preliminary Risk Assessment did not identify any off- site sources. From the assessment it is considered that ground gas will not pose a significant risk to human health and the development.

10.3 Risk to Controlled Water

To assess risk to controlled waters from the leaching of determinants from soil, a Qualitative Risk Assessment has been made based on the concentrations identified within the soil samples and site conditions. From the results it is considered that concentrations will not be mobilised at concentrations that would pose an unacceptable level of risk to controlled waters. The presence of the clay will prevent downward migration to the chalk aquifer.

10.4 Risk to Planting

An assessment of risk to from potentially phytotoxic metal compounds has been completed. In the absence of published assessment criteria specifically for contaminated land, GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

For the assessment values defined in The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as amended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990 have been adopted. In addition the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land. The specified limits of concentrations of selected elements in soil are presented in the 2nd Edition of the DoE Code of Practice and are designed to protect plant growth. The GAC are presented below:

As all concentrations are below their respective assessment criteria, it is considered that the concentrations of phytotoxic metals are not at levels that would pose an unacceptable level of risk to planting.

10.5 Risk to Construction Materials

The assessment of the risk to concrete from the concentrations of sulphate and the pH in the soil has been made using BRE guidance Special Digest 1:2005 Concrete in Aggressive Ground.

Sulphate concentrations of between <10mg/l and pH values of 8.6 to 10.3 were recorded in the soils. The site has been assessed as brownfield due to the presence of previous developments and made ground of unknown origin and a static groundwater regime apportioned in view of the findings of the pits.

Following the guidance set out in the Digest the characteristic sulphate content is <10mg/l and the characteristic pH is 8.6 in the soil; the Design Sulphate class for the site is DS-1 and the Aggressive Environment for Concrete Class is AC-1. Based on the results of the assessment it is considered that the made ground beneath the site will not pose an unacceptable level of risk to concrete through acid attack.

This recommendation is based on samples taken in the near surface materials on site. If deeper

foundations are required additional testing should be undertaken and the conclusions of this section should be re-assessed in light of the additional test results available.

10.6 Risk to Water Supply Pipe

The assessment of risk to pipe work used in the potable water supply has been made using UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)" January 2011 and supplement "Contaminated Land Assessment Guidance" dated January 2014. The results from samples of made ground (through which any new water supply pipes are likely to pass) have been compared with the threshold values listed in the UKWIR guidance. It should be noted that the threshold values are for use by designers in the selection of appropriate pipe materials. Exceedance of a threshold value indicates only that there could be a 'water quality issue'. Threshold values are generally protective of taste and odour quality of water in plastic water pipes and only threshold values for benzene and MTBE are protective of human health.

Samples from TP1 (0.0-0.2m), TP6 (0.0-0.1m) and TP12 (0.0-0.2m) contained concentrations of TPH above the threshold for mineral oils that is defined in the guidance. The review of the chemical data identified that the source of the hydrocarbons are coal fragments identified within the made ground. As the water supply pipework will be placed within the soil beneath this depth that did not record the presence of hydrocarbons and the source is coal fragments, it is considered that the concentrations will not pose an unacceptable level of risk to polymer-based pipe work. However, for concentrations identified in the sample from the made ground from TP10 (0.2-0.5m) there is the potential to permeate polymer-based pipe work and impact on the quality of potable water or cause degradation of the pipe construction.

If pipework is placed within the vicinity of TP10 hydrocarbons resistant water pipe should be adopted. Beneath the remainder of the site the results indicate that concentrations are at levels that enable PE/PVC pipe work to be adopted. It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

10.7 Risk to Sensitive Ecological Receptors

As no receptors were identified, it is considered that contamination will not pose an unacceptable risk to ecological receptors.

10.8 Risk to Historical Structures and Monuments

As no receptors were identified, it is considered that contamination will not pose an unacceptable risk to historical structures and monuments or sites of historical interest.

11 REVISED CONCEPTUAL MODEL

In light of the results of the site investigation, results of the chemical analysis and the risk screening assessment presented in the previous sections the conceptual model developed has been updated. The conceptual model is presented below.

Source	***Potential migration pathway***	***Potential Receptors***	***Discussion, Remedial or Precautionary Measures and Mitigating Factors***
Hydrocarbons compounds (TPH and PAH)	Contact with contaminated soils Ingestion of contaminated soils and dust	Residents and construction workers	Clean capping in landscaped areas is required
	Contact with contaminated soils around TP10	Water supply infrastructure	Protected water supplies are required in localised part of the site.
Asbestos fragments present in TP1	Inhalation of dust should major disturbance occur	Residents and construction workers	Removal and disposal of ACMs off site in a safely manner.

12 GEO-ENVIRONMENTAL CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

The Tier I Human Health Risk Assessment has identified concentrations of individual PAHs and aromatic hydrocarbons within the made ground beneath the track and localised zones within the yard area at concentrations that would pose an unacceptable level of risk should exposure pathways be introduced by the redevelopment of the site. These pathways would typically be present within arras to be developed as soft landscaping.

The Tier I Controlled Water Risk Assessment has determined that there are no concentrations of potential contaminants within the underlying soils that would pose an unacceptable risk to controlled waters.

The risk assessment for bio-genic ground gas concluded that there are no concentrations at levels that would pose an unacceptable risk to human health and the proposed development.

The risk assessment in respect to the future planting and towards sensitive ecological receptors identified that the determinants at the site are at levels that would not pose an unacceptable level of risk to future planting and sensitive ecological receptors.

The risk assessment in respect to water supply infrastructure identified that the determinants at TP10 (0.2-05m) would pose an unacceptable level of risk to the integrity of PE or PVC pipework.

12.2 Recommendations

At the time of writing the report there was no final layout for the proposed landscaping scheme for the development was not available. A general risk assessment for the site considers that in areas that will be developed as soft landscaping within the vicinity of TP1, TP6 and TP10, the made ground should be removed in its entirety and replaced with clean, validated, imported soils. Also, the material identified between 0.0m and 0.2m bgl in TP12 should be removed and replaced with clean, validated imported soils.

Within TP1, cement based asbestos containing materials were identified in the made ground. The level of risk identified as being negligible. As a point of good site practice, a watching brief should be maintained and if any other fragments of product that contain asbestos are identified, these should be removed. Following the excavation of the ACMs from TP1, a visual inspection of the area will be required to confirm the complete removal of the asbestos materials.

Due to the presence of the hydrocarbon compounds hydrocarbon in TP10, pipework may be required within localised areas. The extent would be dependent on the line of the pipework in relation to the hydrocarbon concentrations. It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

If any suspected contamination, underground storage tanks or chambers not previously identified is revealed during the course of construction contact should be made with an Environmental Consultant to determine suitable action to be undertaken.

Where top and sub-soil is imported to the site to be used within gardens and areas of public open space, the soil should be chemically suitable for use. All imported soil should conform to the following chemical specification: