GEO-ENVIRONMENTAL DESK STUDY / PRELIMINARY RISK ASSESSMENT REPORT

FOR

45 – 49 STATION ROAD, HAMPTON, TW12 2BU.

JONAS

Specialists in the investigation & reclamation of brownfield sites

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EXECUTIVE SUMMARY

G Kingsbury & Son Ltd ('The client') commissioned Jomas Associates Ltd ('JAL') to undertake a geo-environmental desk study at 45 – 49 Station Road, Hampton. The principle objectives of the study were as follows:

- To determine the nature and where possible the extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within the Environment Agency (EA) report R&D CLR11 and relevant guidance within the National Planning Policy Framework (NPPF);
- To obtain documentary or other information to assess whether the land appears to be contaminated land, under the definition set out in Part IIA of the Environmental Protection Act 1990;
- To assess whether the site is safe and suitable for the purpose for which it is intended, or can be made so by remedial action.

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.

Desk Study	
Site History	A review of historical ordnance survey maps indicates the presence of buildings within the site from at least 1865, with the site occupied by a number of residential style buildings and associated garden areas. The buildings within the site expand slightly over subsequent mapping editions until the 1950s, when a number of the buildings are no longer shown, and a commercial style building identified as a Garage is shown within the northern and central portion of the site. This Garage expands over subsequent mapping editions to eventually cover the whole site area, as it does today. The surrounding area has been utilised predominantly for agricultural and residential use with industrial features. As time has passed, the surrounding area has been used less for agriculture and more for residential use. Industrial uses include; waterworks, goods shed, engine houses, garages and nurseries.
Current Site Use	Garage/workshop with adjoining office/reception, showroom and car parks.
Proposed Site Use	Demolition of the existing buildings and construction of new residential units with associated garden areas and some basements.
Site Setting	Information provided by the British Geological Survey indicates that the site is directly underlain by superficial deposits of the Kempton Park Gravel Formation (sand and gravel). Superficial deposits of the Taplow Gravel Formation, and Alluvium are reported close to the north-west and south of the site respectively, and may encroach into the site area. These are underlain by solid deposits of the London Clay Formation (clay and silt). Artificial deposits are not reported within the site. The superficial deposits underlying the site are identified as a Principle Aquifer with the underlying solid deposits identified as Unproductive. A review of the EnviroInsight Report indicates that there are no source protection zones within 500m of the site. Nearest groundwater abstraction reported 680m NE of the site for general use. Nearest surface water abstraction reported 459m SW of the site for water supply (storage) for

Desk Study	
	potable use. Nearest Detailed River Entry reported 181m south west of the site, identified as a Primary River (Thames). Nearest surface water features reported 82m south of the site. Environment Agency Zone 2 floodplains reported 17m SE of the site. Environment Agency Zone 3 flood plain reported 55m south of the site.
Potential Sources	• Potential for contaminated ground associated with previous site use – on site (S1) • Potential for Made Ground associated with previous development operations – on site (S2) • Potential buried tanks associated with former use as a Garage – on site (S3) • Potential hydrocarbon impacted ground from previous industrial use – on site (S4) • Current and previous industrial use – on and off site (S5) • Potential asbestos containing materials within existing buildings – on site (S6) • Potential asbestos impacted soils from demolition of previous buildings – on site (S7)
Potential Receptors	Construction and maintenance workers, neighbouring and future site users, buried foundations and services, controlled waters (Aquifer).
Preliminary Risk Assessment	The risk estimation matrix indicates a **moderate** risk as defined above. A high risk has been designated due to possible asbestos. An asbestos survey of existing building should be undertaken to further asses. It is understood that the proposed development comprises the demolition of existing commercial properties for construction of residential properties with associated garden areas. A number of basements are also proposed. During the site walkover, the site contact highlighted the location of two potential underground storage tanks. It was suggested that the tanks were reported to have been filled with water although no details were provided on either the tanks or the decommissioning. It is recommended that an intrusive investigation is undertaken to clarify potential risks to the identified receptors, and assess the extent of made ground soils present at the site. Due to the potential for hydrocarbon impacted ground from the previous site use and potential buried tanks within the site, a programme of soil gas monitoring should be undertaken in accordance with CIRIA C665. The possible contamination implications for both on-site and off-site sources have been assessed based on the information presented in the report. This has been achieved using guidance publications by the Environment Agency, together with other sources. Based on recommendations within the guidance publications, an initial soil and water chemical testing suite would need to consider a range of contaminants as follows: • *Metals*: cadmium, chromium, copper, lead, mercury, nickel, zinc; • *Semi-metals and non-metals*: arsenic, boron, sulphur; • *Inorganic chemicals*: cyanide, nitrate, sulphate and sulphide; • *Organic chemicals*: aromatic hydrocarbons, aliphatic hydrocarbons, petroleum hydrocarbons, phenol, polyaromatic hydrocarbon; • *Others*: pH, Asbestos

Desk Study	
Potential Geological Hazards	The Groundsure data identifies only low to negligible risks – for full details see Section 5.1

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 G Kingsbury & Son Ltd ("The Client") has commissioned Jomas Associates Ltd ('JAL'), to assess the risk of contamination posed by the ground conditions at a site referred to as 45 – 49 Station Road, Hampton prior to redevelopment of the site for residential use.

1.1.2 To this end a desk based review has been undertaken in accordance with JAL's proposal dated 27 April 2015.

1.2 Objectives

1.2.1 The objectives of JAL's investigation were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
- To review readily available historical information (i.e., Ordnance Survey maps and database search information) for the site and surrounding areas, with respect to potentially contaminative land uses;
- To provide an assessment of the environmental sensitivity at the site and the surrounding area, in relation to any suspected or known contamination which may significantly affect the site and the proposed development;
- To assess the potential presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11.

1.3 Scope of Works

1.3.1 The following tasks were undertaken to achieve the objectives listed above:

- A walkover survey of the site;
- A desk study, which included the review of a database search report (EnviroInsight Report, attached in Appendix 2) and historical Ordnance Survey maps (attached in Appendix 3);
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.4 Limitations

1.4.1 Jomas Associates Ltd ('JAL') has prepared this report for the sole use of G Kingsbury & Son Ltd in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of JAL. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.4.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless JAL has actual

knowledge to the contrary, information obtained from public sources or provided to JAL by site personnel and other information sources, have been assumed to be correct. JAL does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.4.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

2 SITE SETTING & HISTORICAL INFORMATION

2.1 Site Information

2.1.1 The site location plan is appended to this report as Figure 1.

Table 2.1: Site Information

Name of Site	45 – 49 Station Road
Address of Site	45 – 49 Station Road Hampton TW12 2BU
Approx. National Grid Ref.	513821, 169570
Site Area (Approx)	0.27ha
Site Ownership	-
Site Occupation	Vehicle sales and maintenance garage
Local Authority	London Borough of Richmond upon Thames
Proposed Site Use	Demolition of existing buildings and construction of new residential units with basement levels and private gardens

2.2 Walkover Survey

2.2.1 A site walkover survey was undertaken by Jomas Associates on 03th September 2015.

Table 2.2: Site Description

Area	Item	Details
On-site:	**Current Uses:**	The site is occupied by 3No. interconnected buildings. A single storey showroom, a two storey office/reception building and a single storey garage/workshop. To the front and rear are forecourt areas used for car sales and cars awaiting work in the workshop. A small outbuilding stands in the corner of the front forecourt.
	Evidence of historic uses:	There was no evidence of historic uses of the site.
	Surfaces:	Much of the site is hard cover either by the buildings or hard standing. Front forecourt is mostly asphalt with some concrete, rear forecourt is concrete.
	Vegetation:	No trees on site but several medium to large trees immediately adjacent to it. No areas of soft landscaping were noted.
	Topography/Slope Stability:	Rear forecourt of the site slopes down to the south. The remainder of the site is flat to the front and appears to be generally on a level with surrounding areas.

Area	Item	Details
	Drainage:	The site is entirely covered in building footprint or hard standing. Drains are noted around the forecourt areas.
	Services:	Site is assumed to be supplied with the statutory services.
	Controlled waters:	No controlled waters were noted on site.
	Tanks:	Site contact indicated the presence of two underground tanks under the front forecourt, possibly filled with water. An above ground tank was noted to the side of the workshop next to generator, labelled Castrol Oil and 1818 litres capacity. Inside the workshop two IBCs were noted, appearing to contain engine oil. A black metal tank was also noted, labelled "waste engine oil" and an unlabelled green metal tank with a marked capacity of 1800 litres.
Neighbouring land:	**North:**	Commercial/residential
	East:	Residential, water works building and ultimately the River Thames
	South:	Residential
	West:	Residential

2.2.2 Photos taken during the site walkover are provided in Appendix 1.

2.3 Historical Mapping Information

2.3.1 The historical development of the site and its surrounding areas was evaluated following the review of a number of Ordnance Survey historic maps, procured from GroundSure, and provided in Appendix 3 of this report.

2.3.2 A summary produced from the review of the historical map is given in Table 2.3 below. Distances are taken from the site boundary.

Table 2.3: Historical Development

Dates and Scale of Map	Relevant Historical Information	
	On Site	**Off Site**
1865 – 1:2,500	The site is shown as being occupied by a number of small, unidentified buildings of possible residential nature. The majority of the site appears to comprise associated landscaped garden areas.	The surrounding area comprises predominantly residential and agricultural land uses. A large river / watercourse passes approximately 120m south of the site. A Water Works is shown approximately 250m west of the site.

Dates and Scale of Map	Relevant Historical Information	
	On Site	**Off Site**
1897 – 1:2,500	An additional small, unidentified building of possible residential character is shown within the site.	Residential development has occurred to the surrounding area. An extensive area of Filter Beds is shown associated with the water works, the nearest of which is shown approximately 80m south of the site.
1914 – 15 – 1:2,500	No significant changes noted to the site.	Further residential development has occurred to the surrounding area. Several Engine Houses, possibly associated with the Water Works are shown, with the nearest approximately 50m south of the site. Further Filter Beds are shown to the west.
1934 – 1:2,500	Several additional unidentified buildings of possible commercial use are now also shown within the centre of the site.	The engine houses have expanded and now include several Tanks. A Timber Yard is now shown approximately 70m north east of the site. Further residential development has occurred to the surrounding area.
1956 – 1:2,500	The majority of buildings originally within the site are no longer shown, with a large, commercial style building now shown within the northern and central portion of the site, identified as a Garage.	The Timber Yard to the north east has expanded. A Joinery Works is now also shown approximately 20m north east of the site. An Engineering Works is shown approximately 100m south east of the site. The water course to the south is identified as the Thames.
1968 – 72 – 1:2,500	The residential style building within the southern portion of the site is no longer shown.	The timber yard and joinery works are no longer shown, with the area shown as vacant ground. A number of unidentified buildings of possible commercial appearance are shown approximately 80m east of the site. Further residential development has occurred to the surrounding area. Several of the filter beds to the west are no longer shown, with the area occupied by residential housing. An Electrical Substation is shown approximately 60m north of the site.
1986 – 1:2,500	The Garage within the site has expanded. A number of previous small, unidentified structures are no longer shown.	The area of the former joinery works and timber yard is now occupied by a number of unidentified buildings of general commercial appearance. Partial map coverage.
1992 – 1:2,500	No significant changes noted to the site.	The engineering works to the south east is no longer shown. The commercial buildings in the area of the former timber yard and joinery works are now identified as a Works.
2002 – 1:10,000	No significant changes noted to the site	No significant changes noted
2010 – 1:10,000	No significant changes noted to the site	The filter beds to the south west and associated buildings of the water works are no longer shown, with the area shown as vacant ground.

Dates and Scale of Map	Relevant Historical Information	
	On Site	Off Site
2014 – 1:10,000	No significant changes noted to the site	No significant changes noted

2.4 Historical Industrial Sites

2.4.1 Groundsure have provided some information on historical industrial sites on and in the vicinity of the site. Table 2.3 below, summarises the information provided, which is presented in further detail in the Enviroinsight in Appendix 2.

Table 2.3: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Potentially Contaminative Uses identified from 1:10,000 scale mapping	Police Station from 1865	181No. identified within 500m of the site. Nearest reported 9m south of the site, identified as Water Works. Other uses include; Unspecified Commercial/Industrial, Water Works, Engine Houses, Filter Beds, Unspecified Tanks, Railway Sidings and Unspecified Works.	✓
Additional Information - Historical Tank Database	None	55No. records reported within 500m of the site. Nearest reported 91m SW of the site, for Tanks. No specific usage of the various tanks is identified.	✓
Historical Energy Features Database	None	21No. records identified within 500m of the site, all identified as Electricity Substations or Transformers. Nearest reported 27m south of the site.	✓
Historical Petrol & Fuel Site Database	None	None reported within 500m of the site	X
Historical Garage & Motor Vehicle Repair Database	Garage from 1956 to 1986	1No. Garage 310m SW of the site.	✓
Potentially infilled land	None	112No. records identified within 500m of the site. Nearest reported 75m south of the site, identified as a Pond. Other uses include; Filter Beds, Unspecified Heaps, Cuttings and Unspecified Wharfs.	✓

2.5 Previous Site Investigations

2.5.1 No previous site investigation reports have been provided at the time of writing.

2.6 Local Authority Information

Any consultation with the Local Authority was outside the scope of this report.

2.7 Proposed Development

2.7.1 The proposed development is to comprise the demolition of the existing buildings on the site to construct residential buildings with soft landscaping areas and private gardens.

2.7.2 For the purposes of the contamination risk assessment, the proposed development is classified as 'Residential with plant uptake'.

3 ENVIRONMENTAL SETTING

3.1.1 The following section summarises the principal environmental resources (geological, hydrogeological and hydrological) of the site and its surroundings. The data discussed herein is generally based on the information given within the Groundsure Reports (in Appendix 2).

3.2 Solid and Drift Geology

3.2.1 Information provided by the British Geological Survey indicates that the site is directly underlain by superficial deposits of the Kempton Park Gravel Formation (sand and gravel). Superficial deposits of the Taplow Gravel Formation, and Alluvium are reported close to the north-west and south of the site respectively, and may encroach into the site area. These are underlain by solid deposits of the London Clay Formation (clay and silt).

3.2.2 Artificial deposits are not reported within the site.

3.3 British Geological Survey (BGS) Borehole Data

3.3.1 As part of the assessment, publicly available BGS borehole records were obtained and reviewed from the surrounding area. The local records obtained are presented in Appendix 5.

3.3.2 The nearest such record was located approximately 39m west of the site. The log reported ground conditions to comprise an initial 1.5m thickness of Made Ground, overlying a medium dense, silty sandy Gravel, encountered to a depth of 2.5m bgl. Below this horizon and to the base of the borehole at 3.0m bgl a brown sandy gravelly clay was reported.

3.4 Hydrogeology & Hydrology

3.4.1 General information about the hydrogeology of the site was obtained from the Environment Agency website and the EnvironInsight Report.

Groundwater Vulnerability

3.4.2 The EA operates a classification system to categorise the importance of groundwater resources (aquifers) and their sensitivity to contamination. Aquifers were formerly classified as major, minor and non-aquifers, based on the amenity value of the resource. A major aquifer is a significant resource capable of producing large quantities of water suitable for potable supply. Minor aquifers produce water in varying quantities or qualities, and if utilised are of local importance. Non aquifers are low permeability strata, which contain no significant exploitable groundwater and have very limited capacity to transmit contaminants.

3.4.3 Since 1 April 2010, the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. This comprises;

- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as

fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

- **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

- **Principal Aquifer** – this is a formation with a high primary permeability, supplying large quantities of water for public supply abstraction.

- **Unproductive Strata** - These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Source Protection Zones (SPZ)

3.4.4 In terms of aquifer protection, the EA generally adopts a three-fold classification of SPZs for public water supply abstraction wells.

- Zone I - or 'Inner Protection Zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source.
- Zone II - or 'Outer Protection Zone' is defined by a 400-day travel time to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- Zone III - or 'Total Catchment' is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Hydrology

3.4.5 The hydrology of the site and the area covers water abstractions, rivers, streams, other water bodies and flooding.

3.4.6 The Environment Agency defines a floodplain as the area that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

3.4.7 There are two different kinds of area shown on the Flood Map for Planning. They can be described as follows:

Areas that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year;

- or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

(For planning and development purposes, this is the same as Flood Zone 3, in England only.)

- The additional extent of an extreme flood from rivers or the sea. These

outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

(For planning and development purposes, this is the same as Flood Zone 2, in England only.)

3.4.8 These two areas show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

3.4.9 Outside of these areas flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. The majority of England and Wales falls within this area. (For planning and development purposes, this is the same as Flood Zone 1, in England only.)

3.4.10 Some areas benefit from flood defences and these are detailed on Environment Agency mapping.

3.4.11 Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.

Table 3.1: Summary of Hydrogeological & Hydrology

Feature		On Site	Off Site	Potential Receptor?
Aquifer	**Superficial:**	Principal	Principal, Secondary (A) Aquifer and Secondary (undifferentiated) Aquifer	✓
	Solid:	Unproductive	Unproductive	X
Source Protection Zone		-	-	X
Abstractions		-	Nearest groundwater abstraction reported 680m NE of the site for general use. Nearest surface water abstraction reported 459m SW of the site for water supply (storage) for potable use.	✓
Surface Waters			Nearest Detailed River Entry reported 181m south west of the site, identified as a Primary River (Thames). Nearest surface water features reported 82m south of the site.	✓
Flood Risk		Very low	Environment Agency Zone 2 floodplains reported 17m SE of the site. Environment Agency Zone 3 flood plain reported 55m south of the site.	✓

3.5 Sensitive Land Uses

3.5.1 There is 1No. environmentally sensitive site reported 420m east of the site identified as Bushy Park and Home Park which is a Site of Special Scientific Interest (SSSI).

3.5.2 A Nitrate Vulnerable Zone is reported 217m south of the site.

3.5.3 A Nitrate Vulnerable Zone (NVZ) is a conservation designation of the Environment Agency for areas of land that drain into nitrate polluted waters, or waters which could become polluted by nitrates. Nitrate Vulnerable Zones were introduced by the UK government in response to the EU mandate that all EU countries must reduce the nitrate in Drinking Water to a maximum of 50 mg/l.

3.5.4 The NVZs cover large areas of land that have been identified as exceeding or being at risk of exceeding 50 mg NO_3/l.

3.6 Industrial and Statutory Consents

3.6.1 The Groundsure EnviroInsight Report also provides information on various statutory and industrial consents on and in the vicinity of the site. The following section summarises the information collected from the available sources.

Table 3.2: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Industrial Sites holding licences and/or authorisations.	None	1No. reported 206m NW of the site, for Dry Cleaners.	✓
Discharge Consents.	None	10No. recorded within 500m of the site. Nearest reported 139m SE of the site, identified as a Sewage Discharges	✓
Water Industry Act Referrals	None	None	X
Red List Discharges	None	None	X
List 1 and List 2 Dangerous Substances	None	None	X
Control of Major Accident Hazards (COMAH) and Notification of Installations Handling Hazardous Substances (NIHHS) Sites.	None	2No. recorded within 500m of the site. Nearest reported 491m SW of the site, identified as a Historical COMAH site.	X
Planning Hazardous Substance Consents	None	None	X
Category 3 or 4 Radioactive substances Authorisations	None	None	X
Pollution Incidents (List 2).	None	5No. reported within 500m of the site. Nearest reported 453m SW of the site, for construction and demolition materials and wastes. Minor impact reported to land, with no impact reported to air or water. Other pollution incidents include; petrol, mixed/waste oils and hydraulic oils. In all cases	X

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
		either minor impact or no impact reported to water and land, and no impact reported to air.	
Pollution Incidents (List 1)	None	None	X
Contaminated Land Register Entries and Notices.	None	None	X
Registered Landfill Sites.	None	None	X
Waste Treatment and/or Transfer Sites.	None	None	X
Fuel Station Entries	None	None	X
Current Industrial Site Data.	2No. on site for new vehicles and vehicle hire	3No. reported within 250m of the site. Nearest reported 31m south east for electrical features. Other uses include mooring and unloading facilities, and unspecified works or factories	✓

***** *From a land contamination perspective*

3.7 Radon

3.7.1 As reported, the site is not within a Radon affected area, as less than 1% of properties are above the action level.

3.7.2 Consequently, no radon protective measures are necessary in the construction of new dwellings or extensions as described in publication BR211 (BRE, 2007).

3.8 Geological Hazards

3.8.1 The following are brief findings extracted from the GroundSure GeoInsight Report, that relate to factors that may have a potential impact upon the engineering of the proposed development.

Table 3.3: Geological Hazards

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
Shrink swell	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems.	No
Landslides	Very low	Slope instability problems are unlikely to be present.	No
Ground dissolution soluble rocks	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to	No

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
		avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.	
Compressible deposits	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.	No
Collapsible Rock	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits	No
Running sand	Very low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.	No
Coal mining	No	-	No
Non-coal mining	No	-	No
Brine affected areas	No	-	No

3.8.2 In addition, the GeoInsight report notes the following:

- 22No. historical surface ground working features are reported within 250m of the site. Nearest reported 75m south of the site, identified as a Pond.
- No historical underground working features are reported within 1km of the site.
- 1No. BGS Current Ground Working Feature reported 664m south of the site, identified as producing Sand and Gravel. The operational status is given as Ceased.

4 QUALITATIVE RISK ASSESSMENT

4.1 Legislative Framework

4.1.1 A qualitative risk assessment has been prepared for the site, based on the information collated. This highlights the potential sources, pathways and receptors. Intrusive investigations will be required to confirm the actual site conditions and risks.

4.1.2 Under Part IIA of the Environmental Protection Act 1990, the statutory definition of contaminated land is:

"*land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:*

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) significant pollution of controlled waters is being caused, or there is significant possibility of such pollution being caused."

4.1.3 The Statutory Guidance provided in the DEFRA Circular 04/2012 lists the following categories of significant harm to **human health**:

- death; life threatening diseases (e.g. cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions.

4.1.4 Other health effects may also be considered by the local authority to constitute significant harm with a wide range of conditions that may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts.

4.1.5 In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health there are four categories to be considered. Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds.

4.1.6 For non-human receptors the following types of harm should be considered to be significant harm:

Ecological System Effects

- Harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or
- Harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.
- In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010.

Property Effects

- Crops: A substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.
- Buildings: Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should also be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.

4.1.7 Contaminated land will only be identified when a 'pollutant linkage' has been established.

4.1.8 A 'pollutant linkage' is defined in Part IIA as:

"A linkage between a contaminant Source and a Receptor by means of a Pathway".

4.1.9 Therefore, this report presents an assessment of the potential pollutant linkages that may be associated with the site, in order to determine whether additional investigations are required to assess their significance.

4.1.10 In accordance with the National Planning Policy Framework, where development is proposed, the developer is responsible for ensuring that the development is safe and suitable for use for the purpose for which it is intended, or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

- whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model;
- whether the development proposed will create new linkages, e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors; and
- what action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable development and future occupancy of the site and neighbouring land.

4.1.11 A potential developer will need to satisfy the Local Authority that unacceptable risk from contamination will be successfully addressed through remediation without undue environmental impact during and following the development.

4.2 Conceptual Site Model

4.2.1 On the basis of the information summarised above, a conceptual site model (CSM) has been developed for the site. The CSM is used to guide the investigation activities at the site and identifies potential contamination sources, receptors (both on and off-site) and exposure pathways that may be present. The identification of such potential "pollutant linkages" is a key aspect of the evaluation of potentially contaminated land.

4.2.2 The site investigation is then undertaken in order to prove or disprove the presence of these potential source-pathway-receptor linkages. Under current legislation an

environmental risk is only deemed to exist if there are proven linkages between all three elements (source, pathway and receptor).

4.2.3 This part of the report lists the potential sources, pathways and receptors at the site, and assesses based on current and future land use, whether pollution linkages are possible.

4.2.4 Potential pollutant linkages identified at the site are detailed below:

Table 4.1: Potential Sources, Pathways and Receptors

Source(s)	Pathway(s)	Receptor(s)
• Potential for contaminated ground associated with previous site use – on site (S1) • Potential for Made Ground associated with previous development operations – on site (S2) • Potential buried tanks associated with former use as a Garage – on site (S3) • Potential hydrocarbon impacted ground from previous industrial use – on site (S4) • Current and previous industrial use – on and off site (S5) • Potential asbestos containing materials within existing buildings – on site (S6) • Potential asbestos impacted soils from demolition of previous buildings – on site (S7)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4) • Accumulation and Migration of Soil Gases (P5) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5) • Controlled waters – aquifer (R6)

4.3 Qualitative Risk Estimation

4.3.1 Based on information presented in this report, a qualitative risk estimation was undertaken.

4.3.2 For each potential pollutant linkage identified in the conceptual model, the potential risk can be evaluated, based on the following principle:

Overall contamination risk = Probability of event occurring x Consequence of event occurring

4.3.3 In accordance with CIRIA C552, the consequence of a risk occurring has been classified into the following categories:

- Severe
- Medium
- Mild
- Minor

4.3.4 The probability of a risk occurring has been classified into the following categories:

- High Likelihood
- Likely
- Low Likelihood
- Unlikely

4.3.5 This relationship can be represented graphically as a matrix (Table 4.2).

Table 4.2: Overall Contamination Risk Matrix

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate risk	Low risk
	Low Likelihood	Moderate risk	Moderate risk	Low risk	Very low risk
	Unlikely	Low risk	Low risk	Very low risk	Very low risk

4.3.6 The risk assessment process is based on guidance provided in CIRIA C552 (2001) *Contaminated Land Risk Assessment – A Guide to Good Practice*. Further information including definitions of descriptive terms used in the risk assessment process is included in Appendix 4.

4.3.7 The degree of risk is based on a combination of the potential sources and the sensitivity of the environment. The risk classifications can be cross checked with reference to Table A4.4 in Appendix 4.

4.3.8 Hazard assessment was also carried out, the outcome of which could be:

- Urgent Action (UA) required to break existing source-pathway-receptor link.
- Ground Investigation (GI) required to gather more information
- No action required (NA)

4.3.9 The preliminary risk assessment for the site is presented in Table 4.3 below.

Table 4.3: Preliminary Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Consequence	Probability of pollutant linkage	Risk Estimation	Hazard Assessment
• Potential for contaminated ground associated with previous site use – on site (S1) • Potential for Made Ground associated with previous development operations – on site (S2) • Potential buried tanks associated with former use as a Garage – on site (S3) • Potential hydrocarbon impacted ground from previous industrial use – on site (S4) • Current and previous industrial use – on and off site (S5) • Potential asbestos containing materials within existing buildings – on site (S6) • Potential asbestos impacted soils from demolition of previous buildings – on site (S7)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium Severe for Asbestos	Likely	Moderate High for Asbestos	GI – Ground Investigation It is understood that removal of existing hard standing and excavation for proposed basements will take place which will involve the removal of potential buried tanks.
	• Accumulation and migration of soil gases (P5)		Medium	Likely	Moderate	
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Controlled Waters (Aquifer) (R6) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Likely	Moderate	

4.3.10 It should be noted that the identification of potential pollutant linkages does not necessarily signify that the site is unsuitable for its current or proposed land use. It does however act as a way of focussing data collection at the site in accordance with regulatory guidance in CLR 11.

4.4 Outcome of Risk Assessment

4.4.1 The risk estimation matrix indicates a **moderate** risk as defined above. A high risk has been designated due to possible asbestos. An asbestos survey of existing building should be undertaken to further asses.

4.4.2 It is understood that the proposed development comprises the demolition of existing commercial properties for construction of residential properties with associated garden areas. A number of basements are also proposed.

4.4.3 During the site walkover, the site contact highlighted the location of two potential underground storage tanks. It was suggested that the tanks were reported to have been filled with water although no details were provided on either the tanks or the decommissioning.

4.4.4 It is recommended that an intrusive investigation is undertaken to clarify potential risks to the identified receptors, and assess the extent of made ground soils present at the site.

4.4.5 Due to the potential for hydrocarbon impacted ground from the previous site use and potential buried tanks within the site, a programme of soil gas monitoring should be undertaken in accordance with CIRIA C665.

4.5 List of Key Contaminants

4.5.1 The possible contamination implications for both on-site and off-site sources have been assessed based on the information presented in the report. This has been achieved using guidance publications by the Environment Agency, together with other sources.

4.5.2 Based on recommendations within the guidance publications, an initial soil and water chemical testing suite would need to consider a range of contaminants as follows:

- *Metals*: cadmium, chromium, copper, lead, mercury, nickel, zinc;
- *Semi-metals and non-metals*: arsenic, boron, sulphur;
- *Inorganic chemicals*: cyanide, nitrate, sulphate and sulphide;
- *Organic chemicals*: aromatic hydrocarbons, aliphatic hydrocarbons, petroleum hydrocarbons, phenol, polyaromatic hydrocarbon;
- *Others*: pH, Asbestos

5 REFERENCES

Groundsure EnviroInsight Report Ref HMD-377-2381543 August 2015

Groundsure GeoInsight Report Ref HMD-377-2381544 August 2015

BRE Report BR211 ;Radon: Protective measures for new dwellings, 2007

Environment Agency (2004) *Model procedures for the management of land contamination*. CLR11. Bristol: Environment Agency

National Planning Policy Framework. Department for Communities and Local Government, March 2012

Code of Practice for Site Investigations BS5930: 1999

Investigation of Potentially Contaminated Sites – Code of Practice BS10175: 2011

APPENDICES

APPENDIX 1 – FIGURES

APPENDIX 2 – GROUNDSURE REPORTS

APPENDIX 3 – OS HISTORICAL MAPS

APPENDIX 4 – QUALITATIVE RISK ASSESSMENT METHODOLOGY

APPENDIX 5 – BGS BOREHOLE RECORDS