

DESK STUDY / PRELIMINARY RISK ASSESSMENT REPORT

FOR

**TUTHILL'S YARD
KELSHALL ROAD
THERFIELD
SG8 9TT**



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EXECUTIVE SUMMARY

Quanta Homes 6 ('The client') commissioned Jomas Associates Ltd to undertake a desk study and preliminary risk assessment at Kelshall Road, Therfield, SG8 9TT. The principal 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 contaminant 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 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	
Current Site Use	Former depot with concrete hardstanding throughout.
Proposed Site Use	It is understood that the proposed development will comprise 3No detached residential units with private gardens and a communal access courtyard area.
Site History	A review of earliest available 1877 historical maps indicates that the site comprised agricultural land. By the map dated 1974, the site is shown to be occupied by a single square structure located in the south eastern corner. Few changes then occur to the site until 1994 when the site is now labelled a depot. An up to date Enviroinsight aerial photo from 2015 confirms the presence of a telecommunications tower located in the south western corner. The surrounding area is remain as agricultural land and sparse residential, with some chalk and gravel pits further afield. Of note within the vicinity of the study site is a number of small waterbodies and ponds within 100m, an ancient castle mound 200m south and a water tower 75m south.
Site Setting	The British Geological Survey indicates that the site is directly underlain superficial deposits of the Lowestoft Formation which are underlain by undifferentiated solid deposits of the Lewes Nodular Chalk Formation and Seaford Chalk Formation. No artificial deposits are reported within the site. BGS Borehole records from the site vicinity indicates that the Lowestoft Formation may be ca 3m thick. The superficial deposits underlying the site are identified as an undifferentiated secondary with the underlying solid deposits identified as a principal aquifer. A review of the EnviroInsight Report indicates that the site is within a Zone 3 protection. There are no groundwater, surface water or potable water abstractions reported within 1km of the site. The nearest detailed river entry is reported 371m south east of the site. There are no surface water features reported within 250m of the site. There are no Environment Agency Zone 2 or 3 floodplains reported within 250m of the site.
Potential Sources	• Potential for Made Ground associated with previous development operations – on site (S1) • Potential ground contamination from previous industrial use – (S2)

Desk Study	
	- Depot on site - Car breakers on site • Potential off-site industrial uses (S3) - Farm buildings adjacent - recorded pollution incident involving oils and fuels 57m NE • Off-site ground gas sources – (S4) - Potentially infilled ponds – nearest approx. 20m off site - Therfield Tip 280m NE
Potential Receptors	• Construction and maintenance workers, • Neighbouring and future site users, • Buried foundations and services, • Controlled waters (SPZ 3, Principal and Secondary A Aquifer, river 329m SE).
Preliminary Risk Assessment	The risk estimation matrix indicates a moderate risk. 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. A preliminary investigation may comprise a series of window sampler holes and light cable percussive boreholes. Soil gas monitoring should be undertaken should be undertaken in accordance with CIRIA C665.
Potential Geological Hazards	The Groundsure data identifies low risks for shrink swells, landslides and ground dissolution. These require further investigation to assess the ground conditions. 2No. historical surface ground working features are reported within 250m of the site. Nearest reported 215m south east of the site for a pond. No historical underground working features are reported within 1km of the site. 2No. BGS Current Ground Working features are reported within 1km of the site. The nearest is reported 320m north east of the site, identified as Therfield Chalk Pit. The operational status is given as Ceased.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Quanta Homes 6 ("The Client") has commissioned Jomas Associates Ltd, to assess the risk of contamination posed by the ground conditions at a site at Tuthill's Yard, Kelshall Road, Therfield, SG8 9TT, prior to the redevelopment of the site.

1.1.2 To this end a desk-based assessment has been undertaken in accordance with Jomas Associates Limited's email proposal dated 16 October 2018.

1.2 Proposed Development

1.2.1 It is understood that the proposed development is to comprise 3No detached residential units with private gardens and a communal access courtyard area.

1.2.2 A plan of the proposed development is included in Figure 3.

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

1.2.4 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997 Part 1. GC 2 projects are defined as involving:

- Conventional structures.
- Quantitative investigation and analysis.
- Normal risk.
- No difficult soil and site conditions.
- No difficult loading conditions.
- Routine design and construction methods.

1.2.5 This will be reviewed at each stage of the project

1.3 Objectives

1.3.1 The objectives of Jomas Associates Limited'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;

- To identify and assess geotechnical issues that may affect the site.

1.4 Scope of Works

1.4.1 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 third party environmental database reports (attached in Appendix 2 and 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.

1.5 Supplied Documentation

1.5.1 A report previously prepared by a third party was supplied to Jomas Associates at the commencement of this investigation. Table 1.1 details the document supplied:

Table 1.1: Supplied Reports

Title	Author	Reference	Date
Soakaway Investigation & Contamination Risk Assessment Report	Southern Testing	J14326	19 th March 2020

1.6 Limitations

- 1.6.1 Jomas Associates Ltd has prepared this report for the sole use of Quanta Homes 6 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 Jomas Associates Limited. 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.
- 1.6.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas Associates Limited has actual knowledge to the contrary, information obtained from public sources or provided to Jomas Associates Limited by site personnel and other information sources, have been assumed to be correct. Jomas Associates Limited 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.
- 1.6.3 Whilst effort has been made to ensure the accuracy of the data supplied, and 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.
- 1.6.4 Any reports provided to Jomas Associates Limited have been reviewed in good faith. Jomas Associates Limited cannot be held liable for any errors or omissions in these reports, or for any incorrect interpretation contained within them.

- 1.6.5 This investigation and report has been carried out in accordance with the relevant standards and guidance in place at the time of the works. Future changes to these may require a re-assessment of the recommendations made within this report.
- 1.6.6 *Our investigations exclude surveys to identify the presence of injurious and invasive weeds.*
- 1.6.7 ***This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.***

2 SITE SETTING

2.1 Site Information

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

Table 2.1: Site Information

Name of Site	Tuthill's Yard
Address of Site	Kelshall Road Therfield SG8 9TT
Approx. National Grid Ref.	533134 237313
Site Area (Approx)	0.48ha
Site Occupation	Undeveloped open space with hardstanding
Local Authority	North Hertfordshire District Council

2.2 Walkover Survey

- 2.2.1 A site walkover survey was undertaken by Jomas Associates on 22 October 2018.

Table 2.2: Site Description

Area	Item	Details
On-site:	Current Uses:	The site is open space with concrete hardstanding at the surface, bordered by rough vegetation Currently small storage structures on site include 2No. small freight containers, a large wooden shed and a van storage container. 26No disused vehicles are located on site, these are currently being broken down for scrap parts. Areas of oil staining are noted on hard standing where a number of engines have been removed. 6No oil drum are located on a pallet, centrally in the southern section. These appear to be used for waste oil derived from the scrapping of motor parts. A notable pool of oil is apparent on the hardstanding below the oil drums. An IBC with a small amount of potential waste oil is also located to the rear of aforementioned wooden shed. This is

Area	Item	Details
		bunded and no evidence of leakage is apparent in the immediate vicinity. A telecommunications towers is located in the south western corner of the site.
	Evidence of historic uses:	A number of manhole covers were noted positioned in a linear fashion suggesting an interceptor may be on site.
	Surfaces:	Much of the site is concrete hard standing with turf and rough vegetation surrounding the site perimeter.
	Vegetation:	Much of the vegetation around site is either shrubs/bushes or trees. There are a large number of trees around site, with many located along the perimeter. Species include sloe and red currant trees. None of the vegetation seen appeared to be exhibiting any evidence of distress.
	Topography/Slope Stability:	Overall, the site is level with a slight upwards slope noted from the original access gate.
	Drainage:	The site appears to be connected to normal drainage facilities. Drain covers are situated around the site. A potential interceptor is noted centrally on site.
	Services:	A former telecommunication mast is located on site, therefore assumed buried services are located on site.
	Controlled waters:	No controlled waters were noted on site.
	Tanks:	None noted.
Neighbouring land:	North:	Agricultural land
	East:	Residential
	South:	Agricultural land
	West:	Agricultural land

2.2.2 Key features noted during the walkover are shown on a site walkover plan found in Figure 2, together with site photos Figure 4.

2.2.3 As of 2021 Jomas has been informed that the mast is no longer present on site.

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
1877 1:2,500 1:10,560	The site is undeveloped agricultural field linked to Tuthill Farm.	Small Ponds/waterbodies noted 20m south and south east, 60m and 100m north east, 110m north, as well as 160m and 200m to 250m south east. Ground workings in the form of cuttings located 100m north. Chalk Pit located 270m north east.
1882/83 1:10,560	No significant change.	Grave Yard located 375m south east.
1886 1:10,560	No significant change.	Chalk Pit located 800m north east.
1896 1:10,560	No significant change.	Chalk Pit located 1km south west. Old Gravel Pit located 1.25km south west
1898 1:2,500	No significant change.	No significant change
1901 1:10,560	Incomplete mapping.	No significant change.
1922 1:10,560	No significant change.	Castle mound with cuttings located 200m south east.
1924 1:2,500	No significant change.	No significant change.
1947 1:10,560	No significant change.	No significant change.
1960 1:10,560	No significant change.	Allotments 250m south.
1974/75/76 1:2,500	A single square structure located in the south eastern corner.	Small Ponds/waterbodies formerly noted 20m south and south east no longer present. Water Tower located 75m south. Tuthill Farm noted adjacent to eastern boundary
1982 1:10,000	No significant change.	No significant change.
1993 1:2,500	No significant change.	No significant change.
1994 1:2,500	Site is now labelled a Depot . Building formerly located in the south eastern corner no longer present. The site appears to be in its current configuration.	No significant change.
2002 1:10,000	No significant change.	No significant change.

Dates and Scale of Map	Relevant Historical Information	
	On Site	Off Site
2002 1:10,000	No significant change.	No significant change.
2002 1:10,000	No significant change.	No significant change.

Potentially polluting/contaminating uses/activities shown in **bold**

- 2.3.4 An aerial photograph supplied as part of the GroundSure EnviroInsight report and taken in 2015 generally shows that the site is in use for the storage of freight, HGV and various unknown materials. A telecommunications tower is also reported in the south western corner. This feature was confirmed during the site walkover; however, as of 2021 Jomas has been informed the mast is no longer present on site.

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 2.4 below summarises the information provided, which is presented in further detail in the Enviroinsight in Appendix 2. Where the identified features have appeared on more than one map they have been counted multiple times and therefore the reported numbers are higher than the actual count.

Table 2.4: 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	None	16No. reported, closest identified as a Graveyard 264m SE, 1877	X
Historical Tank Database	None	None	X
Historical Energy Features Database	None	None	X
Historical Petrol & Fuel Site Database	None	None	X
Historical Garage & Motor Vehicle Repair Database	None	None	X
Potentially infilled land	None	24No. reported, closest identified as a Pond 215m SE, 1877	✓
Tunnels	None	None	X

2.5 Industrial and Statutory Consents

- 2.5.1 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 2.5: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Discharge Consents.	None	3No. reported, closest identified as a Sewage Discharges 418m E, 1968-96	X
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	None	X
Planning Hazardous Substance Consents	None	None	X
Category 3 or 4 Radioactive substances Authorisations	None	None	X
Pollution Incidents (List 2).	None	1No. identified as an Oils and Fuel, 57m NE (Cat 3, Minor Land Impact), 2001	✓
Pollution Incidents (List 1)	None	None	X
Contaminated Land Register Entries and Notices.	None	None	X
Registered Landfill Sites.	None	2No. reported, north identified as a Therfield Tip, 287m - 408m NE	✓
Waste Treatment and/or Transfer Sites.	None	None	X
Fuel Station Entries	None	None	X
Current Industrial Site Data.	Depot (Transport, Storage and Delivery)	1No. identified as Water Pumping Stations, 90m SE	✓

* From a land contamination perspective

2.6 Previous Site Investigations

- 2.6.1 A report on a ground investigation undertaken in March 2020 on the Tuthill's Yard site by Southern Testing (Report Ref: J14326) has been provided to Jomas for review.
- 2.6.2 The reader is referred to the report for full details but the following salient information was recorded.

Table 2.6: Salient Report Information

	Summary Information
Brief scope	6No trial pits excavated to depths ranging up to 3.0m bgl.

	Summary Information
	4No In-situ soakaway testing. Chemical and Laboratory testing.
Ground conditions	Made Ground to depths ranging between 0.5m and 1.6m bgl, underlain by Pale brown chalky silty clay with some angular gravel and chalk to depths ranging between 0.5m and 3.0m bgl, underlain by Off white weathered chalk, recovered as putty chalk with intact gravel of chalk, occasional flint encountered up to 3.0m bgl Groundwater strikes were not observed during the excavation of trial pits
Geo- environmental findings	No elevated levels of contaminants were recorded in several soil samples tested. No asbestos was reported in samples analysed. A significant risk of harm to human health was not identified. A significant risk of pollution to controlled waters was not identified. A ground gas risk assessment was not undertaken.
Geotechnical findings	Soil infiltration rates between 2.37×10^{-7} m/sec and 3.5×10^{-5} m/sec were reported.

2.7 Local Authority Information

2.7.1 Jomas have made a request to North Hertfordshire District Council for information relating to contamination on the site and surrounding areas.

2.7.2 A response is pending.

2.8 Planning Information

2.8.1 A review of the local authority's planning portal was undertaken on 31 October 2018 at <https://pa2.north-herts.gov.uk/online-applications/>

2.8.2 No pertinent documentation was noted during the search.

2.9 Unexploded Ordnance

2.9.1 The initial data indicates that there is a low risk.

2.9.2 Low risk regions are those that show a bomb density of up to 10 bombs per 1000.

2.9.3 This does not comprise a full UXO risk assessment.

3 GEOLOGICAL & ENVIRONMENTAL SETTING

3.1.1 The following section summarises the principal environmental resources (geological, hydrogeological and hydrological) of the site and its surroundings.

3.1.2 The data discussed herein is generally based on the information given within the EnviroInsight Report and published information provided by the Environment Agency and British Geological Survey.

3.2 Solid and Drift Geology

3.2.1 Information provided by the British Geological Survey indicates that the site is mainly directly underlain by superficial deposits of the Lowestoft Formation.

3.2.2 The BGS describes the Lowestoft Formation as consisting of

“an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content.”

3.2.3 The Lowestoft Formation is extremely variable in thickness. It is thickest in buried valleys where locally up to 60m may be present. It is noted, however, that the site lies within a few hundred metres of the lateral margins of the Lowestoft Formation, and therefore the thickness of the Lowestoft Formation may not be as significant. Further, it is noted that the historical maps indicate a former chalk pit ca 270m north east, which provides additional evidence that the chalk bedrock is at relatively shallow depth.

3.2.4 The Lowestoft Formation is a Quarternary Age glacial till and was historically therefore often known as a “boulder clay”.

3.2.5 These are reported to overly undifferentiated deposits of the Lewes Nodular Chalk Formation And Seaford Chalk Formation.

3.2.6 The Lewes Nodular Chalk Formation is described by the BGS as

“composed of hard to very hard nodular chalks and hardgrounds (which resist scratching by finger-nail) with interbedded soft to medium hard chalks (some grainy) and marls; some griotte chalks. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron-stained (usually marking sponges). Brash is rough and flaggy or rubbly, and tends to be dirty. First regular seams of nodular flint, some large, commence near the base and continue throughout. “

3.2.7 Whilst the Seaford Chalk Formation is described by the BGS as

“firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large. “

3.2.8 No artificial deposits are not reported within 500m of the study site boundary.

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 42m east of the site, at the adjacent Tuthill Farm, and was formed in ca 1923.

- 3.3.3 This showed the underlying ground conditions to comprise 'Boulder Clay' overlying Chalk to a depth of 121m bgl. The 'Boulder Clay' is considered to represent the Lowestoft Formation. The depth of the Boulder Clay is not specified.
- 3.3.4 During the drilling of the borehole groundwater was reported 100m bgl. These were in the Chalk.
- 3.3.5 The borehole records indicate that the well installed within the borehole was dismantled by 1960 and sealed under the back yard.
- 3.3.6 A review of other logs in the surrounding area indicate that the Lowestoft Formation is generally approximately 3m thick in the area of the site.
- 3.3.7 All depths and measurements should be viewed as approximate, due to the age of the borehole and corresponding use of imperial measurements.
- 3.3.8 On the basis of the above, the site is expected to be underlain by some Made Ground, with the majority of the site assumed to be covered by natural superficial deposits of the Lowestoft Formation which will in turn be underlain by undifferentiated solid deposits of the Lewes Nodular Chalk Formation And Seaford Chalk Formation.

3.4 Hydrogeology & Hydrology

- 3.4.1 General information about the hydrogeology of the site was obtained from the EnviroInsight and / or the DEFRA "MAGIC" website.

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 Hydrogeology & Hydrology

Feature		On Site	Off Site	Potential Receptor?
Aquifer	Superficial:	Secondary (undifferentiated)	Secondary (undifferentiated)	✓
	Solid:	Principal	Principal	✓
Source Protection Zone		Zone 3	Zone 3	✓
Abstractions	Ground water	None	2No reported as Historical, closest identified as Groundwater Source of Supply, 1699m N, 2007	X
	Surface water	None	None within 2km of study site.	X
	Potable	None	None within 2km of study site.	X
Surface Waters		None	4No. reported as unnamed Inland River, 371m – 389m SE	✓
Flood Risk	EA Flood Zone 2	No		
	EA Flood Zone 3	No		
	RoFRaS	Very low		
	Flood Defences	There are no areas benefiting from Flood Defences within 250m of the study site		
	BGS	BGS has a “High” confidence that there is limited potential for “Clearwater” flooding		

3.5 Sensitive Land Uses

- 3.5.1 The site is located within a Nitrate Vulnerable Zone.

- 3.5.2 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.
- 3.5.3 The NVZs cover large areas of land that have been identified as exceeding or being at risk of exceeding 50 mg NO₃/l.
- 3.5.4 No other sensitive land use was identified within 1km of the site.
- 3.6 Radon**
- 3.6.1 As reported, the site is not within a Radon affected area, as less than 1% of properties are above the action level.
- 3.6.2 Consequently, no radon protective measures are necessary in the construction of new dwellings or extensions as described in publication BR211 (BRE, 2007).

4 POSSIBLE GEOLOGICAL HAZARDS

4.1 Database Information Review

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

Table 4.1: 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 possible increase in construction cost to reduce potential shrink-swell problems.	Yes
Landslides	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems.	Yes
Ground dissolution soluble rocks	Low	Significant soluble rocks are present. Low possibility of subsidence occurring naturally, but may be possible in adverse conditions such as high surface or subsurface water flow. Consider implications for stability when changes to drainage or new construction are planned. For new build site investigation should consider potential for dissolution problems on the site and its surroundings. Care should be taken with local drainage into the bedrock. Some possibility of groundwater pollution.	Yes
Compressible deposits	Very low	Very low potential for compressible deposits to be present. 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	No

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
		construction costs or increased financial risks are unlikely due to potential problems with running sand.	
Coal mining	No	The study site is not located within 1km of an identified mining area.	No
Shallow mine workings	No	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered	No
Brine affected areas	No	The study site is not located within 1km of an identified brine affected area.	No

- 4.1.2 In addition, the GeolInsight report notes the following:
- 2No. historical surface ground working features are reported within 250m of the site. Nearest reported 215m south east of the site for a pond.
 - No historical underground working features are reported within 1km of the site.
 - 2No. BGS Current Ground Working features are reported within 1km of the site. The nearest is reported 320m north east of the site, identified as Therfield Chalk Pit. The operational status is given as Ceased.
 - 3No. natural cavities are reported within 1km of the site. The nearest is reported 269m north east of the site, identified as solution pipes.
- 4.1.3 The clearance of the site, including removal of foundations and services is likely to increase the depth of Made Ground on the site.
- 4.1.4 Whilst buildings have been noted to historically been on site it is not known what the foundations for these buildings were and if they were removed when the buildings were removed.
- 4.1.5 Foundations should not be formed within Made Ground or organic rich material (e.g. Topsoil due to the unacceptable risk of total and differential settlement.
- 4.1.6 The presence of Made Ground derived from demolition material may be a source of elevated sulphate, associated with plaster from the previous structures. If such levels are noted then sulphate resistant concrete may be required.
- 4.1.7 The resultant thickness of Made Ground and the potential for clays beneath the proposed footprint may mean that a suspended floor slab would be required.
- 4.1.8 The use of soakaway drainage should not be used without an assessment of the underlying chalk.
- 4.1.9 A geotechnical investigation is recommended to inform foundation design and the potential risk for dissolution features.

5 QUALITATIVE RISK ASSESSMENT

5.1 Legislative Framework

5.1.1 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.

5.1.2 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."

5.1.3 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.

5.1.4 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.

5.1.5 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.

5.1.6 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.

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

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

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

5.1.9 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.

5.1.10 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.

5.1.11 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.

5.2 Conceptual Site Model

5.2.1 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.

5.2.2 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).

5.2.3 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.

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

Table 5.1: Potential Sources, Pathways and Receptors

Source(s)	Pathway(s)	Receptor(s)
- Potential for Made Ground associated with previous development operations – on site (S1) - Potential ground contamination from previous industrial use – (S2) - Depot on site - Car breakers on site - Potential off-site industrial uses (S3): - Farm buildings adjacent - recorded pollution incident involving oils and fuels 57m NE - Off-site ground gas sources – (S4) - Potentially infilled ponds – nearest approx. 20m off site - Therfield Tip 280m NE	- 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 – SPZ 3, Principal and Undifferentiated Secondary Aquifers, inland river 389m SE.

5.3 Qualitative Risk Estimation

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

5.3.2 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

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

- Severe
- Medium

- Mild
- Minor

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

- High Likelihood
- Likely
- Low Likelihood
- Unlikely

5.3.5 This relationship can be represented graphically as a matrix (Table 5.2).

Table 5.2: 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

5.3.6 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.

5.3.7 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.

5.3.8 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
- Watching Brief there is no evidence of potential contamination but the possibility of it exists and so the site should be monitored for local and olfactory evidence of contamination.
- No action required (NA)

5.3.9 The preliminary risk assessment for the site is presented in Table 5.3 below.

SECTION 5 QUALITATIVE RISK ASSESSMENT



Table 5.3: Preliminary Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Consequence of Impact	Probability of Impact	Risk Estimation	Hazard Assessment
• Potential for Made Ground associated with previous development operations – on site (S1) • Potential ground contamination from previous industrial use – (S2) - Depot on site - Car breakers on site • Potential off-site industrial uses(S3): - Farm buildings adjacent - recorded pollution incident involving oils and fuels 57m NE • Off-site ground gas sources – (S4) - Potentially infilled ponds – nearest approx. 20m off site - Therfield Tip 280m NE	• 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	Low likelihood	Moderate	GI – Ground Investigation
	• Accumulation and migration of soil gases (P5)		Severe for Asbestos	Low likelihood	Moderate	
				Severe	Low likelihood	
		• 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 – SPZ 3, Principal and Undifferentiated Secondary Aquifers, inland river 389m SE. • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Low likelihood	

- 5.3.10 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.

5.4 Outcome of Risk Assessment

- 5.4.1 The risk estimation matrix indicates a moderate risk as defined above.
- 5.4.2 A review of earliest available 1877 historical maps indicates that the site comprised agricultural land. By the map dated 1974, the site is shown to be occupied by a single square structure located in the south eastern corner. Few changes then occur to the site until 1994 when the site is now labelled a depot. An up to date Enviroinsight aerial photo from 2015 confirms the presence of a telecommunications tower located in the south western corner. A recent walkover survey confirmed that the site is in use as a car breakers, with evidence of oil staining and pooling on areas of hardstanding.
- 5.4.3 The surrounding area is maintained as agricultural land and sparse residential, with some chalk pits and gravel pits further afield. Of note within the vicinity of the study site is a number of small waterbodies and ponds within 100m, an ancient castle mound 200m south and a water tower 75m south.
- 5.4.4 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.
- 5.4.5 A preliminary investigation may comprise a series of window sampler holes and light cable percussive boreholes.
- 5.4.6 Soil gas monitoring should be undertaken should be undertaken in accordance with CIRIA C665.

5.5 List of Key Contaminants

- 5.5.1 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.
- 5.5.2 In the case of the site uses identified as part of the desk study research, reference to DoE industry profiles would not indicate a specific use reference, although reference has been made to the miscellaneous industries profile
- 5.5.3 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; volatile organic compounds
 - *Others*: pH, Asbestos

6 REFERENCES

Groundsure EnviroInsight Report Ref HMD-377-5543788 October 218

Groundsure GeoInsight Report Ref HMD-377-5543789 October 218

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

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Code of Practice for Site Investigations BS5930: 2015

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

Department of Environment Industry Profiles (1996) - Miscellaneous Land ISBN 1 85112 313 X

APPENDICES

APPENDIX 1 – FIGURES

APPENDIX 2 – GROUNDSURE REPORTS

APPENDIX 3 – OS HISTORICAL MAPS

APPENDIX 4 – QUALITATIVE RISK ASSESSMENT METHODOLOGY

APPENDIX 5 – BGS BOREHOLE RECORDS

APPENDIX 6 – LOCAL AUTHORITY CORRESPONDENCE