PROVIDENCE LAND LTD
THORLEY DRIVE, CHEADLE,
STAFFORDSHIRE

GROUND CONDITION DESK TOP STUDY

JANUARY 2016

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Providence Land Ltd

Thorley Drive, Cheadle,

Staffordshire

Ground Condition Desk Top Study

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0 Executive Summary

Brief	The brief was to undertake a site visit to inspect the site and, using the information provided in an environmental database search relating to the site, assess and report on the findings with respect to potential ground contamination and potential associated future liabilities in accordance with the Preliminary Risk Assessment procedure outlined in the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency.
Current Site Status and History	The site comprises fields surrounded by hedgerows with several mature trees within the hedgerows. The eastern half of the site is generally level; however, the very eastern edge adjacent to Ashbourne Road is undulating as evident by a number of shallow hollows and mounds. The site slopes generally from east to west, with a drop in elevation of approximately 11.34m across the site. According to the Ordnance Survey maps provided and reviewed from 1880 to 2012 (scales 1:2,500, 1:10.000, 1:1,250, 1:10,560) the site has remained undeveloped farm land from at least 1880 to the present day.
Geology	Reference to the British Geological Survey (BGS) Map indicates the site to directly overlie the Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone). No superficial deposits are identified to overlie the bedrock geology. The Woodhead coal seam is mapped outcropping directly to the east of the site.
Mining	Information provided by The Coal Authority indicates that the site is considered to be in an area of suspected historic (unrecorded) shallow coal mining, which is based on information published by the BGS showing the Woodhead coal seam is mapped outcropping directly to the east of the site
Hydrogeology	The Environment Agency Groundwater Vulnerability Map indicates that the site is underlain by a Secondary A Aquifer, interpreted at the Pennine Lower Coal Measures Formation.
Hydrology	The nearest surface watercourse to the site is a small unnamed drain/stream that issues 340m to the south west of the site and flows west towards Cecilly Brook, which is approximately 280m to the west of the site. A pond is also located approximately 90m to the south of the site.

Risk Assessment	The preliminary risk assessment identified the following possible contamination sources associated with the site: • Potential for reduced quality made ground associated with the potential former near surface mine working in the east of the site, potentially associated with the undulating ground observed. • Potential for widespread pesticides and other contaminants in topsoil associated with the agricultural use of the site. • Potential for ground gas from natural strata and off site landfill. It should be noted that additional sources of contamination may become apparent during future investigations of the site.
Conclusions and Recommendations	The risk of impact to identified receptors from the identified potential sources is generally considered to be **very low to low/moderate**. As such, a targeted intrusive investigation is recommended for the development to further assess the risks. It is recommended that this investigation target the area of undulating ground in the east of the site that may be associated with former mine working. In addition, it is recommended that sampling of the topsoil from across the site is undertaken to determine its suitability for reuse, particularly with regard to pesticides. A discovery strategy and appropriate PPE are also recommended as a precautionary measure during any redevelopment of the site to address any other contamination that may be identified during the works. A geotechnical investigation may be required in order to further assess the underlying ground conditions for the proposed redevelopment on-site.
This sheet is intended to provide a summary only of the initial indicative assessment study of the site in relation to ground contamination. It does not provide a definitive engineering analysis for the purposes of costing or construction, and is subject to the limitation of the agreed brief.	

1 Introduction

Instruction

1.1 Mayer Brown Ltd. was commissioned by Providence Land Ltd. to undertake a Ground Condition Desk Top Study of a plot of land at Thorley Drive, Cheadle, Staffordshire.

1.2 The brief was to undertake a site visit to inspect the site and, using the information provided in an environmental database search relating to the site, assess and report on the findings with respect to potential ground contamination and potential associated future liabilities in accordance with the Preliminary Risk Assessment procedure outlined in the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency.

1.3 This report is prepared in line with the agreed brief and is subject to the report conditions shown in Appendix A.

Legal Context

1.4 Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

1.5 Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

1.6 The guidance defines "risk" as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

Methodology

1.7 This report has been prepared in accordance with published Environment Agency guidance ('Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR) 11'). CLR 11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment). CLR 11 has adopted and refined the well recognised methodology and terminology that has been used in contaminated land risk assessment for a number of years.

Pollutant Linkage Concept

1.8 In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

1.9 Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant– pathway–receptor is described as a pollutant linkage.

Conceptual Model

1.10 An important thread throughout the overall process of risk assessment is the need to formulate and develop a **conceptual model** for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

Risk Assessment

1.11 CLR 11 advocates a phased approach to risk assessment comprising the following in order, as necessary:

1.12 **Preliminary Risk Assessment** – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

1.13 **Generic Quantitative Risk Assessment (GQRA)** - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

1.14 **Detailed Quantitative Risk Assessment (DQRA)** - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

1.15 This document constitutes a Preliminary Risk Assessment.

Proposed Use

1.16 It is currently understood that the site is proposed for residential development. A change in the proposed site use may result in the need for re-assessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

Report Scope and Limitation

1.17 This report is based upon a review of readily available historical and current information, a site walkover survey, our own geological and hydrogeological map library and information from an environmental database search. The assessment is based on the proposed residential use, as stated in Section 1.4 the outcomes of this assessment could change if the end uses change.

1.18 The information contained in this report is intended for the use of Providence Land Ltd. Mayer Brown can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2 Hazard Identification

Site Location and Description

2.1 The site comprises fields surrounded by hedgerows with several mature trees within the hedgerows. The eastern half of the site is generally level; however, the very eastern edge adjacent to Ashbourne Road is undulating as evident by a number of shallow hollows and mounds. The site slopes generally from east to west, with a drop in elevation of approximately 11.34m across the site.

2.2 The site is bordered to the north by a housing estate including Thorley Drive, to the south and west by farmland and Ashbourne Road forms the eastern boundary beyond which is agricultural land.

Site History

2.3 According to the Ordnance Survey maps provided and reviewed from 1880 to 2012 (scales 1:2,500, 1:10.000, 1:1,250, 1:10,560) the vast majority of the site has remained undeveloped agricultural land from at least 1880 to the present day.

2.4 The housing estate to the north of the site appears to have been constructed during the 1970s and the housing estate to the southwest appears to have been constructed in the late 1990s/early 2000s.

Documented Ground Conditions

2.5 Ground conditions recorded in readily available sources are summarised below.

Geology

2.6 Reference to the British Geological Survey (BGS) Map indicates the site to directly overlie the Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone). No superficial deposits are identified to overlie the bedrock geology. The Woodhead coal seam is mapped outcropping directly to the east of the site.

Hydrogeology

2.7 The Environment Agency Groundwater Vulnerability Map indicates that the site is underlain by a Secondary A Aquifer, interpreted at the Pennine Lower Coal Measures Formation.

2.8 Secondary A' aquifers are defined as '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.

Hydrology

2.9 The nearest surface watercourse to the site is a small unnamed drain/stream that issues 340m to the south west of the site and flows west towards Cecilly Brook, which is approximately 280m to the west of the site. A pond is also located approximately 90m to the south of the site.

Radon

2.10 Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building. National Radiological Protection Board data presented within the Landmark Envirocheck Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is <1%. Therefore the British Geological Survey recommends that radon protection measures are not necessary in new dwellings or extensions.

Environmental Data Search

2.11 A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in the following sections. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1: Data search results

Pollution incidents	There are no recorded pollution incidents to controlled waters within 250m of the site.
Water abstractions	There are no recorded water abstractions within 250m of the site.
Landfill sites	There is 1no recorded historic landfill site located 220m to the west of the site, beyond Cheadlemill Brook, and is identified as Allen Street Depot at the Bramley Close sports ground. No other information is available.

Department of Environment – Industry Profiles

2.12 Industry Profiles are not available for the current or identified past uses of the site.

Mining

2.13 The Coal Authority report that the site is not within the zone of likely physical influence on the surface from any past underground; however, it is in an area where it is believed that coal is present at or close to the surface, which may have been worked in the past.

2.14 The Coal Authority has no records of any mine entries on, or within 20 m, of the site.

2.15 The Coal Authority report that the site is not within the boundary, or within 200 m, of a site from which coal has been removed by opencast methods.

2.16 The Coal Authority report that the site is not within the likely zone of influence of any present underground workings.

2.17 The Coal Authority has no records of any mine gas emission requiring action within the boundary of the site.

2.18 The Coal Authority indicates that the site is not in an area for which a license has been granted to remove coal using underground methods.

2.19 The Coal Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

2.20 The site has not been subject to remedial works by, or on behalf of, The Coal Authority under its Emergency Surface Hazard Call Out procedures.

2.21 The Coal Authority has not received a damage claim or notice for the site.

2.22 Information provided by The Coal Authority indicates that the site is considered to be in an area of suspected historic (unrecorded) shallow coal mining, which is based on information published by the BGS showing the Woodhead coal seam is mapped outcropping directly to the east of the site dipping at a shallow angle, approximately 9 degrees, to the west.

2.23 Coal mining in the United Kingdom originated from working coal seams outcropping at the surface. There are few records of this early mining and as a result there is potential for unrecorded shallow workings in the vicinity of workable outcropping coal seams. The possibility of shallow mining having taken place beneath the site cannot be discounted.

3 Conceptual Site Model

Sources

3.1 The conceptual model, based on information obtained as part of the preliminary risk assessment, identified the following potential contaminant sources:

On-site – Historic and Current

- Potential for reduced quality made ground associated with the potential former near surface mine working in the east of the site, potentially associated with the undulating ground observed.
- Potential for widespread pesticides and other contaminants in topsoil associated with the farmland use of the site.
- Potential for ground gas from natural strata.

3.2 It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

Off-site – Historic and Current

- Allen Street Depot landfill (220m west)

Pathways

3.3 The key environmental pathways and exposure routes by which potentially toxic substances can reach the identified potential receptors are considered to be:

Indirect

- Vertical and lateral migration leading to accumulation in confined spaces
- Lateral migration via surface water

Direct

- Direct contact.
- Ingestion.
- Inhalation of contaminated dust.
- Inhalation of gas.

Receptors

3.4 Receptors that may be affected by the potential contamination are:

Human

- Future construction workers

- Occupiers/users/residents of the site.

Environmental

- New buried services.
- Stream (southwest of site)
- Secondary Aquifer

4 Risk Assessment

Risk Assessment Procedure

4.1 By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

4.2 The risk assessment has been undertaken with reference to BS10175:2001 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential magnitude of the hazard and the sensitivity of the target, based on the categories given overleaf.

Table 4.1: Sensitivity of receptor

Category	Examples
High	Residential with gardens/Groundwater Source Protection Zone
Medium	Residential without gardens/Principal (Major) Aquifer/sensitive watercourse
Low	Commercial and industrial use/Secondary (Minor) Aquifer
Very Low	Construction and maintenance workers/non-sensitive watercourse

Table 4.2: Magnitude of impact

Category	Examples
Gross Impact	Heavily contaminated gasworks or industrial site, hazardous waste landfill
Moderate Impact	Major leaks and spills from fuel infrastructure (e.g. petrol stations), domestic waste landfills
Slight Impact	Minor leaks and spills from fuel infrastructure, 'inert' waste landfills

Table 4.3: Level of severity of potential hazard

	Sensitivity of receptor			
Magnitude of impact	High	Medium	Low	Very Low
Gross Impact	Severe	Medium	Mild	Minor
Moderate Impact	Medium	Mild	Minor	Minor
Slight Impact	Mild	Minor	Minor	Minor

4.3 The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 4.4: Probability of risk definition

Category	Examples
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

4.4 The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 4.5: Level of risk for potential hazard definition

	Sensitivity of receptor			
Probability of risk	Severe	Medium	Mild	Minor
High likelihood	Very High	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low likelihood	Moderate	Low/Moderate	Low	Very Low
Unlikely	Low/Moderate	Low	Very Low	Very Low

4.5 The assessment is discussed below in terms of plausible pollutant linkages. A complete assessment of the pollutant linkages is presented in Table 4.6 overleaf.

4.6 A description of these risk classifications and likely action required are given in CIRIA 552 as:

4.7 Very high risk – High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

4.8 High risk – Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

4.9 Moderate risk – It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

4.10 Low risk – It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

4.11 Very low risk – It is a low possibility that harm could arise to a designated receptor. In the event of such harm being realised it is not likely to be severe.

Table 4.6: Pollutant linkage assessment

Source	Pathway	Receptor	Severity	Likelihood	Risk Level
Potential for reduced quality made ground associated with the former mine working in the east of the site.	Direct contact Ingestion Inhalation	Construction workers	Minor	Low Likelihood	Very Low
		Occupiers/ users/ residents of the site	Medium	Low Likelihood	Low/ Moderate
	Direct Contact	Buried services	Minor	Low Likelihood	Very Low
	Vertical migration leading to direct contact	Secondary Aquifer	Minor	Low Likelihood	Very Low
		Stream	Minor	Low Likelihood	Very Low
Potential for reduced quality topsoil impacted with pesticides and other contaminants.	Direct contact Ingestion Inhalation	Construction workers	Minor	Low Likelihood	Very Low
		Occupiers/ users/ residents of the site	Mild	Low Likelihood	Low
	Vertical migration leading to direct contact	Secondary Aquifer	Minor	Unlikely	Very Low
		Stream	Minor	Low Likelihood	Very Low
Potential for ground gas from natural strata and off site landfill	Vertical migration leading to accumulation and inhalation	Occupiers/ users/ residents of the site	Mild	Unlikely	Very Low

5 Conclusions and Recommendations

5.1 The following potential sources of contamination were identified:

- Potential for reduced quality made ground associated with the potential former near surface mine working in the east of the site, potentially associated with the undulating ground observed.
- Potential for widespread pesticides and other contaminants in topsoil associated with the agricultural use of the site.
- Potential for ground gas from natural strata and off site landfill.

5.2 The risk of impact to identified receptors from the identified potential sources is generally considered to be **very low to low/moderate**. As such, a targeted intrusive investigation is recommended for the development to further assess the risks. It is recommended that this investigation target the area of undulating ground in the east of the site that may be associated with former mine working. In addition, it is recommended that sampling of the topsoil from across the site is undertaken to determine its suitability for reuse, particularly with regard to pesticides.

5.3 A discovery strategy and appropriate PPE are also recommended as a precautionary measure during any redevelopment of the site to address any other contamination that may be identified during the works.

5.4 A geotechnical investigation may be required in order to further assess the underlying ground conditions in terms of foundation solutions for the proposed redevelopment on-site.

FIGURE 1: SITE LOCATION PLAN