



**GEOENVIRONMENTAL SITE INVESTIGATION REPORT
PHASE I PRELIMINARY RISK ASSESSMENT
OF LAND OFF
HILLOCK LANE
GRESFORD**

Prepared for: -

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LIST OF ACRONYMS

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DP	Dynamic Probe
DoE	Department of Environment
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HP	Hand Pit
HA	Hand Auger
LPA	Local Planning Authority
LQM	Land Quality Management
mbgl	Metres Below Ground Level
MP	Mackintosh Probe
NPPF	National Planning Policy Framework
NGR	National Grid Reference
OS	Ordnance Survey
SGV	Soil Guideline Value
SSV	Soil Screening Value
WSV	Water Screening Value
SPOSH	Significant Possibility of Significant Harm
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample

1.0 INTRODUCTION

1.1 Instruction

- 1.1.1 GeoCon Site Investigations Ltd (GeoCon) have been commissioned by Norris Jones Development Ltd (NJD) to undertake a Phase I Preliminary Risk Assessment (PRA) on land off Hillock Lane, Gresford.
- 1.1.2 It is understood that a PRA is required to assist with a planning application for a proposed residential development at the site.
- 1.1.3 This report is therefore provided to establish the potential for contamination at the site as a result of current and historic land uses both on site and within influencing distance of the site, to understand the potential type of contamination that may be present, and to identify the anticipated ground conditions and any potential geological and or geotechnical impact on the proposed development.
- 1.1.4 This report is written in accordance with the guidance set out in Land Contamination Risk Management (LCRM), Guiding Principles for Land Contamination (GPLC) 1 – 3, and the National Planning Policy Framework (NPPF).

1.2 Scope of Works

- 1.2.1 Prior to commencing the site works the proposed scope of investigation was as follows, however the proposed scope will be subject to change dependent upon site conditions, access, restrictions and obstructions. The actual works undertaken following the completion of the site works and any on site amendments are detailed in section 3.0.
 -  To appraise the land use history of the site by the examination of available historical plans.
 -  To assess the environmental setting of the site with specific reference to geology, mining & quarrying, hydrogeology and hydrology.
 -  To gain an understanding of any concerns of the regulatory authorities (Local Authority Planning, Building Control and Environmental Health departments and the Environment Agency) regarding local land filling, flooding, mining, quarrying and other concerns.
 -  To produce a Preliminary Conceptual Site Model (CSM).

1.3 Previous Investigations

- 1.3.1 GeoCon have not been provided with any previous investigation reports and are unaware that any have been carried out to date.

1.4 Reliance and Limitations

- 1.4.1 This report has been prepared using published information and information provided by the Client and their professional advisers which has been made available to GeoCon at the time of writing only. GeoCon accepts no liability for any changes resulting from new information which has become available since this time.
- 1.4.2 This report is provided for the sole use of the client and their professional advisors and is confidential to them unless agreed otherwise in writing. This report may only be used and relied on once the work has been paid for in full. GeoCon owes no duty of care and has no liability to any third party who is not authorised by GeoCon to use this report. Any unauthorised third parties using information contained in this report do so at their own risk.
- 1.4.3 This assessment has been carried out to determine the potential risks posed to future end users, along with other key receptors, resulting from potential contamination at the site, based on the proposed development. Should any revisions in the development proposals result in a change any assessment parameters detailed in this report, a re-assessment of the risk should be carried out.

- 1.4.4 Whilst this report may reference observations made regarding the presence of features/ issues such as invasive species, ACM, site drainage and evidence of structural abnormalities, this report does not constitute specialist surveys on these matters. Should further specialist surveys be carried out in this regard, the findings of these should be reported to GeoCon so that we may determine if this has any impact on the findings of this report.
- 1.4.5 The assessment and interpretation of the factual data obtained as part of this Phase I Preliminary Risk Assessment has been undertaken in accordance with standard consulting practise and with current national and international guidance.
- 1.4.6 This report presents the observations made during the Phase I Preliminary Risk Assessment and the factual data obtained. The conclusions and recommendations in this report are limited to those which can be made based on the findings of the survey and information provided by third parties. GeoCon assumes all third party data to be true and correct. No responsibility can be accepted by GeoCon for inaccuracies in the information provided by any other party.
- 1.4.7 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practises, and changes in legislation may require the reinterpretation of the report in whole or in part after its original issue. GeoCon reserve the right to alter their conclusions and recommendations in the light of further information that may become available.
- 1.4.8 It should be noted that ground conditions including contaminant concentrations and groundwater levels may vary spatially with time. This factor should be given due consideration in the event that the information contained within this report is used after any significant period of time has elapsed.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

- 2.1.1 The site is located at land off Hillock Lane, Gresford, at approximate National Grid Reference NGR: 336040:354470 (centre of the site).
- 2.1.2 A site location plan is presented as Drawing No. GSI 1183/01 in Appendix A.

2.2 Site Reconnaissance

- 2.2.1 At this stage, a site reconnaissance has not been carried out. A site walkover will be carried out during any intrusive investigation and report accordingly.

2.3 Site Description

- 2.3.1 It should be noted that a site reconnaissance has not been carried out at this stage, the site description has been taken in part from Google Earth and Google Street View imagery.
- 2.3.2 The site is an irregular shaped piece of land with an approximate area of 7.51Ha.
- 2.3.3 The topography of the site is generally flat.
- 2.3.4 The site is currently unoccupied and covered by grass.
- 2.3.5 An approximate distribution of the surface covering is given below in Table 2.1: Site Surface Covering

Table 2.1: Site Surface Covering

Type of Surface Cover	Distribution (%)
Soft Ground (grassed and landscaped areas)	100
Hardstanding	0
Roadways	0
Buildings	0
Water (ponds, streams)	0

- 2.3.6 The site is bounded by Hillock Lane to the North and North West, and open fields to the East, South and West.
- 2.3.7 Access to the site is via Hillock Lane from the North.

2.4 Surrounding Area

- 2.4.1 The current surrounding land use to the site is generally residential properties to the North and North West and open field in all other.
- 2.4.2 The topography of the surrounding area is generally flat.

2.5 Future Site Usage

- 2.5.1 It is currently proposed to construct 127 new residential properties on the site.
- 2.5.2 The proposed development plan as provided by NJD drafted by Owen Ellis Architects referenced 4124_SK15 dated 28th August 2019 is presented in Appendix A.

3.0 SITE HISTORY

3.1 Site History

- 3.1.1 The history of the site has been determined from available historical maps obtained as part of the Envirocheck Report and via the Envirocheck Analysis online historical mapping tool. The history of the site and of the surrounding area is summarised overleaf in Table 3.1: Site History. It should be noted that some of the maps come with little to no coverage.
- 3.1.2 The information presented overleaf in Table 3.1: Site History, is given based on the distance and direction from the closest point of each feature to the site. The table presents the data broken down into the following categories: - feature; the potential use of each feature where applicable; the date each particular feature is first observed; the direction of each feature from the site; the approximate distance of each feature from the site; the approximate area of each feature; and any other relevant information regarding the site and surrounding area in general.

3.2 Aerial Photography

2003 Aerial Photo:

- 3.2.1 The 2003 aerial photo is generally unclear; however, the site appears to be undeveloped and covered in grass with a small number of trees.

Recent Aerial Photograph:

- 3.2.2 Recent aerial photography shows the site is relatively unchanged since the 2003 aerial photograph and is still undeveloped and covered by grass a small number of trees. The surrounding area to the North is in an urban setting and is occupied by residential properties and minor roads.

Table 3.1: Site History

Feature		Date first observed	Date no longer shown	Direction from site	Distance (m) from site	Area (m2)	General notes
Electrical Substation		1962	Present	NE	0	42	-
Gravel Pit		1938	1962	N	46	9517	-
Pond		1872	1980	NW	157	306	-
Pond		1962	Present	S	195	42109	Previous Marshland area, as shown from 1899 before the pond is shown on the 1962 map.
Plant Nursery		1964	Present	E	154	55501	Unclear if still present currently as a plant nursery, or a naturally vegetated area.
Pond		1977	1980	N	230	155	-
Site and surrounding area in general		The first available map of the area is dated 1872-1881 and shows the site and surrounding area as dominantly rural. The site remains unchanged since firm shown to present day. From the 1962-1977 map onwards, the area North of the site becomes increasingly urbanised with residential housing. From the 1980 map onwards, the North West of the site becomes increasingly urbanised with residential housing.					

4.0 ENVIRONMENTAL SETTING

4.1 General

- 4.1.1 A number of third parties have been approached to collate information relating to the site, its environmental setting, and any issues pertaining. The following third party sources have been utilised which are outlined in Table 4.1: Sources of Information:

Table 4.1: Sources of Information

Source	Information
Landmark	Envirocheck Report Geology Report
British Geological Survey (BGS)	The BGS Geological Map Sheet 121 Wrexham combined solid & drift edition BGS Open Geoscience online geological mapping tool
Ordnance Survey	OS Open Data online mapping tool
Coal Authority	Online Gazetteer of England and Wales Coal Mining Report
Environment Agency (EA) Online	Water Quality Data and Aquifer designation

- 4.1.2 The Landmark Envirocheck report is provided in Appendix B and all relevant parts of other third party responses, where available, are presented within the indicated appendices.

4.2 Published Geology

- 4.2.1 The British Geological Survey shows the site to be underlain by the geological succession outlined below Table 4.2: Published Geology.

Table 4.2: Published Geology

Geology	Description /strata
Artificial	None recorded
Superficial	Glaciofluvial Sheet Deposits
Bedrock	Kinnerton Sandstone and Salop Formation (site crosses the boundary between the two formations)

- 4.2.2 There are no known artificial deposits recorded underlying the site.
- 4.2.3 The superficial geology recorded underlying the site is shown to be the Glaciofluvial Sheet deposits. There is no BGS description available.
- 4.2.4 The bedrock geology beneath the site is shown to be the Kinnerton Sandstone and the Salop Formation. The Kinnerton Sandstone is generally described as 'Sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified. Dominantly aeolian' (BGS general description). The Salop is generally described as 'Red and red-brown mudstone, and red-brown (mostly sublitharenite) sandstone containing beds of pebbly sandstone and conglomerate itself containing Carboniferous limestone and chert clasts, and thin 'Spirobis' limestone beds and caliche in the lower part of the unit.' (BGS description).

4.3 Mining, Subsidence and Foundations

- 4.3.1 There are no BGS recorded mineral sites within 250m of the site boundary.

4.3.2 The Coal Authority indicates that the site is located within a coal mining area and that a Coal Authority mining report is required for the site. Subsequently a Coal Authority mining report has been commissioned for the site; and the details are given below.

- ✚ The property is within the likely zone of influence from mining in one seam of coal between 820 and 860mbgl, and last worked in 1969. Any ground movement due to coal mining activity should now have ceased.
- ✚ The property is not within a surface area that could be affected by present underground mining.
- ✚ The property is not in an area where the Coal Authority has received application for and is currently considering whether to grant a licence to remove or work coal by underground methods, nor is there an existing licence. However, coal reserves exist in the local area which could be worked sometime in the future.
- ✚ There are no known mine entries within the site boundary or within 20m of the site boundary.
- ✚ The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.
- ✚ The Coal Authority has not received any damage notices for the property or properties within 50 m of the site since 31st October 1994.
- ✚ There is no record of any mine gas emissions requiring action by the Coal Authority at the site.
- ✚ The property has not been subject to remedial works by or on behalf of the Coal Authority.

4.3.3 The Coal Authority Report is presented in Appendix C.

4.3.4 The Coal Authority indicates that the site not located within a brine extraction area.

4.3.5 Landmark indicates that the risk from non-coal mining is negligible.

4.3.6 The British Geological Survey provide risk ratings for the potential geological hazards outlined below in **Error! Reference source not found..**

Table 4.3: Potential Geological Hazards

Potential Geological Hazard	Hazard Potential
Collapsible Ground	Very low
Compressible Ground	No hazard
Ground Dissolution	No hazard
Landslides	Low
Running Sands	Very low
Shrinking or Swelling Clay	Very low

4.4 Potential Contamination Sources

4.4.1 The following potential sources of contamination have been considered.

Fuel Storage

4.4.2 There are no fuel station entries within 500m of the site.

Potentially Contaminative Uses

- 4.4.3 There are no contemporary trade directories within 250m of the site.

Hazardous Substances

- 4.4.4 There are no hazardous substance uses recorded within 500m of the site.

Landfills and Waste

- 4.4.5 There are no landfill sites or other waste associated sites within 250m of the site boundary.
- 4.4.6 It should be noted that the listings above may represent the same landfill site that has been registered in more than one category.
- 4.4.7 There are six areas within 250m of the site identified by Landmark where the potential for infilling is possible which include six former ponds quarries, reservoirs that may have been infilled within unknown materials.
- 4.4.8 There are three areas within 250m of the site identified on the historical maps where the potential for infilling is possible which include two former ponds and one former gravel pit. These are no longer shown on more recent maps, indicating that they may have been infilled within unknown materials.
- 4.4.9 Made Ground may be present on the site with unknown thickness and composition.

4.5 Radon

- 4.5.1 The Building Research Establishment report “Radon: Guidance on Protective Measures for New Dwellings” 1999, BR211, indicates that the site is located in an area that may be affected by radon and that further geological assessment is required.
- 4.5.2 The Envirocheck report shows the West of the site is located within a higher probability radon area, as 10 to 30% of homes are estimated to be at or above the action level. Therefore, full radon protection measures are necessary in the construction of new dwellings or extensions.
- 4.5.3 The Envirocheck report shows the North East of the site is located within a lower probability radon area, as less than 1% of homes are above the action level. Therefore, no radon protection measures are necessary in the construction of new dwellings or extensions.

4.6 Hydrogeology

Superficial Deposits

- 4.6.1 The Environment Agency aquifer classification scheme indicates that the superficial aquifer designation for the site is classed as Secondary A aquifer which are generally described 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’* (EA general description).

Bedrock

- 4.6.2 The Envirocheck report indicates that there are two bedrock aquifer classifications across the site.
- 4.6.3 To the East of the site (Salop Formation), the Environment Agency aquifer classification scheme indicates that the bedrock aquifer designation for the site is classed as Secondary A aquifer which are generally described 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’* (EA general description). –Salop Formation
- 4.6.4 To the West of the site (Kinnerton Sandstone), the Environment Agency aquifer classification scheme indicates that the bedrock aquifer designation for the site is classed as Principle Aquifer which are

generally described as ‘these are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer’ (EA general description). – Kinnerton sandstone

Groundwater Abstractions

- 4.6.5 There are three licenced groundwater abstraction points within 1000m of the site. The nearest to the site is located approximately 745m to the East of the site, for general farming and domestic use. There are a further eight licensed groundwater abstraction points between 1000 and 2000m of the site for purpose.
- 4.6.6 There are no public drinking water abstractions within 2000m of the site.
- 4.6.7 It is possible that there may be private unlicensed water abstractions that exist locally in the area.
- 4.6.8 The site is located within a Source Protection Zone (SPZ) – Zone III Total Catchment.

4.7 Hydrology

- 4.7.1 There are no major surface water courses within 250m of the site.
- 4.7.2 The nearest surface watercourse to the site is an unnamed pond located approximately 189m to the South.
- 4.7.3 There is no EA General Quality Assessment (GQA) data available within relevant distance to the site.
- 4.7.4 There are no discharge consents within 250m of the site.
- 4.7.5 There is one pollution incident to controlled waters within 250m of the site. Further details are as follows: 6th August 1991, Vicarage Lane, pollutant type identified as oils (fats and grease), category 2 (significant incident), cause of incident listed as runoff.

Surface Water Abstractions

- 4.7.6 There are no licensed surface water abstraction points within 1000m of the site.
- 4.7.7 It is possible that there may be private unlicensed water abstractions that exist locally in the area.

4.8 Flooding

- 4.8.1 Envirocheck indicates that the site is not located within an area at risk of flooding or within 250m of an area at risk of flooding from rivers or sea.
- 4.8.2 Envirocheck indicates that the site is located within an area at risk of flooding or within 250m of an area at risk of flooding from surface waters (i.e. pluvial – rainfall, sewers, drains etc.).
- 4.8.3 Envirocheck indicates that the site is lies within 250m of an area that may be affected by flooding from groundwater at the surface.

4.9 Environmentally Sensitive Sites

- 4.9.1 There are three environmentally sensitivity sites recorded with 250m of the site, the nearest of which is located approximately 80m to the South of the site, for a Ramsar site (Midland Meres and Mosses Phase 2).

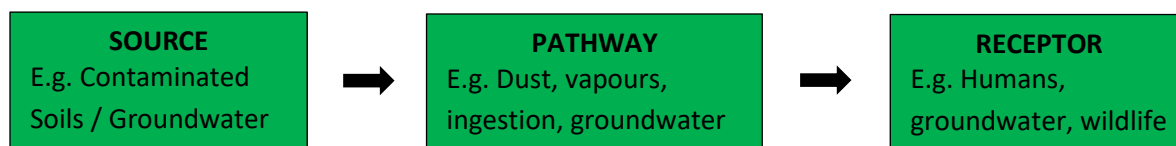
5.0 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

5.1 Introduction

- 5.1.1 In statutory guidance regarding potentially contaminated land, risk assessments are used as a technique on a site-specific basis to identify potential environmental issues. As recommended by BS 10175 an Initial Conceptual Generic Model has been formulated which defines the 'pollutant linkage' through source, pathway and receptor methodology. All three must be present in order to pose a risk to the end users and to the environment; i.e. if there is no pathway between the source and the receptor, then there is no 'pollutant linkage' and hence negligible risk to the receptor.

5.2 Risk Assessment Methodology

- 5.2.1 The purpose of a Phase I Preliminary Risk Assessment (PRA) is to obtain information regarding the site to gain a preliminary understanding of potential environmental issues and the potential for land contamination. This information includes existing and proposed site uses, the history of the site and surrounding area, and the environmental setting. The information obtained is used to develop a Conceptual Site Model (CSM), which describes sources (potential hazards), pathways, and receptors, which may be relevant to the site. The following definitions have been adapted from Part IIA of the Environmental Protection Act (EPA) 1990:



- 5.2.2 **Source** – A source can be defined as a potential contaminant, substance, or condition that has the potential to cause harm to the environment, humans or other flora and fauna.
- 5.2.3 **Pathway** – A pathway is defined as the route by which a source is brought into contact with a receptor. This can include the transport of contamination via groundwater, wind borne dust, vapours, excavation and deposition, dermal contact, ingestion and inhalation.
- 5.2.4 **Receptor** – Receptors are defined as anything that can be affected by a source such as human beings, flora and fauna, other living organisms, groundwater and surface water, physical systems and built structures.
- 5.2.5 Some of the above, such as groundwater, surface water, flora, and fauna can be considered as both pathways and receptors.
- 5.2.6 A risk may be considered present if all three of the above exist and thereby form a “**pollutant linkage**”.

5.3 Outline Conceptual Site Model

- 5.3.1 As part of this Phase I Preliminary Risk Assessment, the following potential sources, pathways and receptors have been considered and are discussed below.

Potential Sources (on and off site):

- 5.3.2 The following are potential sources of contamination that have been considered: -
- ✚ Made Ground / reworked soils and rock beneath the site associated with construction and demolition on site and of the surrounding area.
 - ✚ Potential for contamination to have occurred at the site as a result of historical and contemporary land uses and processes on the site and within influencing of the distance.
 - ✚ Potential for mobile and leachable contamination at the site associated with historical and contemporary land uses and processes both on site and within influencing of the distance.

- ✚ Potential for volatile and semi-volatile contamination at the site associated with historical and contemporary land uses and processes both on site and within influencing of the distance.
- ✚ Historic electrical substations on the site and within influencing of the distance.
- ✚ Potential for hazardous ground gasses associated with any Made Ground, landfill sites and other areas of potentially infilled land both on site and within influencing distance of the site.

Potential Pathways

5.3.3 The following potential pathways have been identified at the site:

- ✚ Ingestion of contaminated soils.
- ✚ Inhalation of site generated particulates.
- ✚ Dermal contact with contaminated materials.
- ✚ Ingestion of home grown produce.
- ✚ Inhalation of hazardous ground gasses.
- ✚ Build-up of hazardous ground gasses in confined spaces.
- ✚ Groundwater.
- ✚ Surface water courses within influencing of the distance.

Potential Receptors

5.3.4 The following potential receptors have been identified:

- ✚ Current site end users.
- ✚ Future site end users.
- ✚ Construction workers.
- ✚ Members of the public and neighbouring site users.
- ✚ Neighbouring land.
- ✚ Aquifers and drinking water.
- ✚ Surface water courses within influencing of the distance.
- ✚ Flora and fauna.
- ✚ Other ecosystems.

5.4 Preliminary Risk Assessment

- 5.4.1 The Preliminary Risk Assessment has been evaluated using a probability / consequence matrix, which is provided in Appendix D.
- 5.4.2 The proposed development comprises the construction of 127 new residences on the site.
- 5.4.3 The underlying geology of the site and surrounding area is indicated to be Glaciofluvial Sheet Deposits overlying Kinnerton Sandstone and Salop Formations which are of medium to high permeability.
- 5.4.4 The following risk assessment has been based on the above information and the proposed development plan as detailed in Section 2.0.

5.4.5 The discussion below assesses the likelihood of potential Contaminants of Concern (CoC's) with a justification on whether they would likely be present.

5.4.6 The CSM in Table 5.1 then provides a risk rating for the site.

Land Contamination

5.4.7 From the information available, the site itself has had no historical use. It is therefore unlikely that Made Ground will be present beneath the site associated with past construction and demolition on site and the surrounding neighbourhood, and site generated processes. Therefore, the potential for heavy metals, metalloids and inorganics to be present on or beneath the site is considered to be very low.

5.4.8 Historical and contemporary land uses likely to produce mobile, organic and leachable contamination both within 1000m of the site include: - boiler services, replacement and repairs, sports equipment manufacturers and distributors, commercial cleaning services, garage services and a petrol filling station. Considering the distances between the features and the site, and the generally permeable geology beneath the site, the potential for mobile, organic and leachable contamination to be present at the site is considered to be very low.

5.4.9 Historical and contemporary land uses likely to produce volatile contamination (VOC's & SVOC's) within 1000m of the site include: - garage services and a petrol filling station. Considering the distances between the features and the site, and the generally permeable geology beneath the site, the potential for VOC's & SVOC's to be present at the site is considered to be very low.

5.4.10 There is one electric substation within influencing distance of the site which may be a source of Polychlorinated Biphenyls contamination (PCB's). Further details are given below.

 Substation located on site, first observed on the 1962 map.

5.4.11 The above electric substation predates the 1981 ban on PCB's. Therefore, considering the feature is located on site, the potential for PCB contamination at the site is considered to be moderate.

5.4.12 It is possible that further electric substations or former electric substations are present within influencing distance to the site associated with the surrounding area that have not been identified on the historical maps.

5.4.13 Asbestos fibres and Asbestos Containing Materials (ACM's) could be present within any Made Ground and/or shallow natural soils beneath the site as a result of historic site uses, and phases of construction and demolition. Based on the above, the potential for ACM's to be present at the site is considered to be very low.

5.4.14 Therefore, based on the above, the site history, and the environmental information available, the potential contaminants identified on this site may include PCB's.

Hazardous Ground Gasses

5.4.15 There are six areas within 250m of the site, identified by Landmark where the potential for infilling is possible, which include six former ponds, quarries, reservoirs that may have been infilled within unknown materials.

5.4.16 There are three areas within 250m of the site identified on the historical maps where the potential for infilling is possible, this includes two former ponds and one former gravel pit, which are no longer shown on more recent maps, indicating that they may have been infilled within unknown materials.

5.4.17 Therefore, the likelihood of hazardous gases being associated with the site as either a source and/or a receptor is considered to be moderate.

5.4.18 Landmark indicates that the site is within both a higher (10 to 30% of homes are estimated to be at or above the action level) and a lower probability (as less than 1% of homes are above the action level)

radon area. Therefore, radon protection measures are necessary in the construction of new dwellings or extensions.

Plants and Native Grasses

- 5.4.19 Any plants that may be grown at the site in areas of landscaping may potentially be at risk from phytotoxic elements in any artificial soils beneath the site.

Groundwater

- 5.4.20 There are three licenced groundwater abstraction points within 1000m of the site. The nearest to the site is located approximately 745m to the East of the site, for general farming and domestic use. There are a further eight licensed groundwater abstraction points between 1000 and 2000m of the site for purpose.
- 5.4.21 There are no public drinking water abstractions within 2000m of the site.
- 5.4.22 The site is located within a Source Protection Zone (SPZ) – Zone III Total Catchment.
- 5.4.23 Based on the above, the underlying permeable geology and associated SPZ, the potential for contamination at the site to impact the groundwater is considered to be very low.

Surface Water

- 5.4.24 There are no major surface water courses within 250m of the site and the nearest surface watercourse to the site is an unknown feature located approximately 189m to the South.
- 5.4.25 There is no EA General Quality Assessment (GQA) data available within relevant distance to the site and there are no discharge consents within 250m of the site.
- 5.4.26 There is one pollution incident to controlled waters within 250m of the site. Further details are as follows: 6th August 1991, Vicarage Lane, pollutant type identified as oils (fats and grease), category 2 (significant incident), cause of incident listed as runoff.
- 5.4.27 Based on the above and the proximity of the nearest surface water feature, the potential for contamination at the site to impact surface waters is considered to be very low to low.

Flooding

- 5.4.28 Envirocheck indicates that the site is not located within an area at risk of flooding or within 250m of an area at risk of flooding from rivers or sea.
- 5.4.29 Envirocheck indicates that the site is located within an area at risk of flooding or within 250m of an area at risk of flooding from surface waters (i.e. pluvial – rainfall, sewers, drains etc.).
- 5.4.30 The site lies within an area that may be affected by flooding from groundwater at the surface.

Water Supply / Plastic Pipes

- 5.4.31 Any organic contamination present in the soils or groundwater beneath the site would pose a risk of premature failure to below ground services via chemical reaction.

Preliminary Conceptual Site Model

- 5.4.32 From the above information a Preliminary Conceptual Site Model (CSM) has been produced showing the preliminary conceptual model and potential pollutant linkages for the site and is presented overleaf in Table 0.1: Preliminary Conceptual Site Model and Potential Pollutant Linkages.

Table 0.1: Preliminary Conceptual Site Model and Potential Pollutant Linkages

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Likelihood	Severity	Pollutant Linkage	Risk Classification	Action / Mitigation
Made Ground both on site and within influencing distance of the site Current and former land uses both on site and within influencing distance of the site	PCB's	Ingestion Inhalation Dermal Contact	Human health animals and plants: Including current site users, future site users, neighbouring residents and constructions workers	Possible	High	Considered potentially active	Moderate	Site investigation to confirm presence, type and extent of any contamination beneath the site. If any made ground is encountered then chemical testing suite will need to be increased to include heavy metals, PAH and asbestos as a minimum.
Made Ground on site Current and former land uses on site	Heavy metals, sulphates and inorganics PAH's Mobile organic contamination SVOC's and VOC's PCB's Leachable contamination	Lateral and vertical migration and leaching of contaminants into surface water bodies via permeable strata and features.	Local water courses and associated flora and fauna	Unlikely	High	Considered potentially inactive	Very low	No further action, however, if Made Ground or any visual or olfactory evidence of contamination is encountered on site then this risk will need to be reassessed.
Made Ground on site Current and former land uses on site	Heavy metals, sulphates and inorganics PAH's Mobile organic contamination SVOC's and VOC's PCB's Leachable contamination	Lateral and vertical migration and leaching of contaminants into local groundwater	Underlying Aquifer (Drinking water)	Possible	High	Considered potentially active	Very low	No further action, however, if Made Ground or any visual or olfactory evidence of contamination is encountered on site then this risk will need to be reassessed.
Made Ground beneath the site Current and former site uses	Phytotoxic elements	Plant uptake	Plants and vegetation	Unlikely	Low	Considered potentially active	Very low	No further action, however, if Made Ground or any visual or olfactory evidence of contamination is encountered on site then this risk will need to be reassessed.

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Likelihood	Severity	Pollutant Linkage	Risk Classification	Action / Mitigation
Landfill sites Potentially infilled Land (ponds, quarries, reservoirs etc) Made Ground Natural organic soils Coal mining (on and off-site sources)	Hazardous ground gases including CO ₂ , CH ₄ , CO, H ₂ S Vapours	Inhalation	Human health animals and plants: Including current site users, future site users, neighbouring residents and constructions workers	Possible	High	Considered potentially active	Moderate	Site investigation to install gas monitoring wells with subsequent monitoring in accordance with CIRIA 665 is carried out at the site.
Landfill sites Potentially infilled Land (ponds, quarries, reservoirs etc) Made Ground Natural organic soils Coal mining (on and off-site sources)	Hazardous ground gases including CO ₂ , CH ₄ , CO, H ₂ S Vapours	Explosion	Buildings	Possible	High	Considered potentially active	Moderate	Site investigation to install gas monitoring wells with subsequent monitoring in accordance with CIRIA 665 is carried out at the site.

6.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

6.1 General

- 6.1.1 The underlying shallow geology is likely to consist of Glaciofluvial Sheet Deposits (no BGS description) overlying Kinnerton sandstone and Salop Formation overlying which generally comprise sandstones and conglomerates.
- 6.1.2 Made Ground may also be present on site.
- 6.1.3 Based upon the information reviewed, a list of potential geotechnical risks has been outlined below in Table 6.1: Potential Geotechnical Risks, which presents a summary of the likely geotechnical risks potentially present at the site.

Table 6.1: Potential Geotechnical Risks

Existing or Potential Features of Concern	Geotechnical Consideration	Geotechnical Risk to Proposed Development	Likelihood
Made Ground	Any potential Made Ground beneath the site.	Made Ground can cause total and differential settlement of any new structures.	Unlikely
Trees and vegetation	Large mature trees on site or within close proximity to the site boundaries.	Tree roots have the potential to cause clay soils to shrink causing settlement of new structures.	Possible
Shrinkage and expansion of clay soils	Clay soils beneath the site.	Potential for shrinkage and / or heave of clay soils causing damage to new structures.	Unlikely
Groundwater ingress	Shallow groundwater beneath the site.	Shallow ground water can have an impact on construction and foundation excavations. Pumping and / or dewatering may be required.	Possible
Existing / former foundations and underground structures	New buildings may be situated upon the sites of former demolished buildings or buildings that will be demolished as part of the proposed development.	Uneven founding, inconsistent ground conditions, and unsuitable bearing capacity for new structures.	Unlikely
Aggressive ground	Chemical content of the soils beneath the site.	Chemically aggressive ground may have the potential to attack buried concrete.	Possible
Soft / loose / weak soils and / or rock beneath the site	Unsuitable founding strata beneath the site.	Soft and loose soils or weak rock may be in adequate to found on. A suitable foundation option should be selected based on the actual ground conditions beneath the site.	Possible
Embankments	Unstable slopes and embankments.	Collapse onto or into any new developments	Unlikely
Shallow mine workings beneath the site	Coal seams or mine entries present on or beneath the site which may have been worked in the past.	Worked mine seams or areas of mineral extraction leave voids underground that have the potential to settle when new loads are placed above them.	Unlikely

Existing or Potential Features of Concern	Geotechnical Consideration	Geotechnical Risk to Proposed Development	Likelihood
Ground Dissolution	Dissolution of carbonaceous geology beneath the site.	Weakening of the rock and generation of voids beneath the site.	Unlikely
Brine Extraction	Areas of brine extraction beneath the site at shallow depths.	Affected areas may leave voids underground that have the potential to settle when new loads are placed above them.	Unlikely

6.2 Discussion

Structures

- 6.2.1 The nature and distribution of geotechnical properties of the near surface strata have not been fully identified within this study, therefore it is not possible at this stage, to give meaningful advice as to the type, nature, and construction of any foundations for the proposed development.
- 6.2.2 A suitable geotechnical site investigation should be carried out at the site to confirm ground conditions, geotechnical parameters, details of the groundwater regime, and other general site details to facilitate suitable foundation and substructure design.

Sustainable Drainage

- 6.2.3 In accordance with National Planning and Policy Framework (NPPF) and Local Planning Guidance, the Local Planning Authority (LPA) will require that surface water drainage from the proposed development complies with current design practices for Sustainable Urban Drainage (SUD's) construction of separate drainage systems for foul and surface water. Surface water shall be required to be attenuated to Greenfield runoff rates or better and attenuation up to the 1 in 100 year storm event plus 40% for climate change will be required on site.
- 6.2.4 Based on the indicative ground conditions encountered it is likely that sustainable drainage would be suitable at the site, however the presence and thickness (if present) of Made Ground at the site may result in sustainable drainage not being practical or feasible. If sustainable drainage is to be considered, it is recommended that soak-away testing is carried out in accordance with BRE 365 at the site to establish the sites suitability for sustainable drainage.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Environmental

- 7.1.1 A review of the preliminary information reveals that future end users of the site are potentially at **moderate** risk of being affected by PCB contamination in soils and / or groundwater beneath this site.
- 7.1.2 Risks to neighbouring residents from the site are considered to be **very low** at this stage.
- 7.1.3 Risks to construction workers from the site are considered to be **very low** at this stage.
- 7.1.4 The risks of hazardous ground gasses affecting the site are considered to be **moderate** at this stage.
- 7.1.5 Radon protection measures are necessary in the construction of new dwellings or extensions.
- 7.1.6 The risks to surface waters are considered to be **very low** at this stage.
- 7.1.7 The risks to drinking water and groundwater are considered to be **very low** at this stage.
- 7.1.8 Risks to plants and native grasses are considered to be **very low** at this stage.

Geotechnical

- 7.1.9 The nature and distribution of geotechnical properties of the near surface strata have not been fully identified within this study, therefore it is not possible at this stage, to give meaningful advice as to the type, nature, and construction of any foundations for the proposed development.
- 7.1.10 Inadequately designed buried concrete may be at risk from potentially elevated sulphates and low pH in the soils and groundwater beneath the site.
- 7.1.11 The site is not considered to be affected shallow coal mining. Therefore, risks from shallow coal mining are considered to be **very low** at this stage.
- 7.1.12 The site is not considered to be affected by brine extraction. Therefore, risks from brine extraction are considered to be **very low** at this stage.
- 7.1.13 Based on the indicative ground conditions encountered it is likely that sustainable drainage would be suitable at the site.

7.2 Recommendations

- 7.2.1 It is recommended that a suitable combined phase II environmental and geotechnical site investigation is carried out at the site to establish the presence of any contamination at the site, and to identify the ground conditions and provide details of their engineering properties in order to facilitate foundation design for the proposed development.
- 7.2.2 A recommended scope of works for the intrusive site investigation would be as follows:
 - ✚ Windowless sample boreholes across the site to a nominal depth of up to 5.00mbgl or refusal to facilitate environmental and geotechnical sampling; and to facilitate the installation of groundwater monitoring wells.
 - ✚ Full supervision of all works by engineering geologist including sampling and detailed geotechnical descriptions to BS5930, EN ISO 14688-1 EN ISO 14688-2 and EN ISO 14689 of all strata types encountered within the exploratory holes.

- ✚ The installation of combined groundwater and gas monitoring standpipes.
- ✚ Subsequent gas monitoring in accordance with CIRIA 665 on six occasions over a three month period, commencing approximately one week after the completion of the ground investigation field work coupled with groundwater monitoring.
- ✚ A suitable suite of chemical testing, for determinants identified within the Preliminary Conceptual Model.
- ✚ A suitable suite of geotechnical testing.
- ✚ Provision of interpretative report to undertake a Generic Quantitative Risk Assessment (GQRA) and to provide details of the engineering properties of the underlying soils and rocks encountered with subsequent recommendations on suitable foundation solutions.

7.2.3 It is recommended that the above conclusions and recommendations are agreed in principle with the Local Planning Authority (LPA) to gain their approval prior to commencement of the development to avoid unnecessary complications or delays at a later stage.

7.3 Other Considerations

Soakaways

- 7.3.1 In accordance with National Planning and Policy Framework (NPPF) and Local Planning Guidance, the LPA will require that surface water drainage from the proposed development complies with current design practices for Sustainable Urban Drainage (SUD's) construction of separate drainage systems for foul and surface water.
- 7.3.2 Soakaway Testing should be considered to determine the suitability for sustainable drainage at the site.

Plastic Water Pipes

- 7.3.3 Any organic contamination present in the soils or groundwater beneath the site would pose a risk of premature failure to below ground services via chemical reaction.
- 7.3.4 Any subsequent Phase II Site Investigation would be primarily concerned with human health risk assessment.
- 7.3.5 Considerations should be given to sampling and chemical analysis of the materials that any plastic water supply pipes will be laid in.
- 7.3.6 It is also likely that the water utilities provider will require their own risk assessment to be completed.

Radon

- 7.3.7 Radon protection measure will be required at this site and it is recommended that further geological assessment is carried out to determine the level of those requirements.

Flood Risk

- 7.3.8 Consideration should be given to commissioning a Flood Risk Assessment if required by the Local Planning Authority.

8.0 REFERENCES

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- ✚ BS 10175: *Code of Practise for the Investigation of Potentially Contaminated Sites*
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- ✚ Environment Agency (EA): *EA Online & What's in my back yard*
- ✚ Environment Agency (EA): *Soil Guideline Values (SGVs)*
- ✚ Land Quality Management (LQM): *Generic Screening Criteria (GACs)*
- ✚ Landmark: *Envirocheck report and Envirocheck analysis online historical mapping tool.*
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