



## **South West Milton Keynes**

### **Phase 1 Geo-Environmental Desk Study**

Environmental Statement Appendix 16.1

Pell Frischmann

OCTOBER 2014

**SOUTH WEST MILTON KEYNES  
 PHASE 1 GEO-ENVIRONMENTAL DESK STUDY  
 R53295/G001B**

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### APPENDICES

**EXECUTIVE SUMMARY**

<b>Site Name</b>	<b>South West Milton Keynes</b>
<b>Location</b>	The subject site is located on located directly to the south west of Milton Keynes. The NGR for the approximate centre of the site is 483517, 4232467.
<b>Redevelopment details</b>	The proposed development is to comprise the construction of approximately 1850 residential properties, employment areas, a primary school, a secondary school, other community facilities and public open space areas.
<b>Site History</b>	The development areas have predominantly been occupied by end uses associated with farming and agriculture from the earliest available map (1882) until the present day. The historical mapping also indicates that the surrounding area has experienced industrial, commercial and residential development and several potentially contaminative land uses have been identified.
<b>Geology</b>	The general geology of the site area is shown on the 1:50,000 geological map of Leighton Buzzard (Sheet 220). The mapping indicates that the site is underlain by Glacial till overlying units of the Oxford Clay Formation.
<b>Hydrogeology</b>	The Environment Agency (EA) classifies the Oxford Clay Non-productive strata. The Glacial Till is also classified as non-productive strata.  The site is not located within a Source Protection Zone.  A single licensed groundwater abstraction is located within 1000m of the site. This licence relates to potable water supply.
<b>Hydrology</b>	Several unnamed streams are shown on the site.
<b>Unexploded Ordnance</b>	The online Zetica bomb map for Buckinghamshire suggests that site is located in an area at low risk from UXO. Further assistance with regard to UXO is not considered necessary.
<b>Environmental Sensitivity</b>	The site is located within a nitrate vulnerable area.
<b>Geotechnical hazards from the desk study</b>	<ul style="list-style-type: none"> <li>• Uncontrolled Made Ground</li> <li>• Attack of buried concrete by aggressive ground conditions;</li> <li>• Low strength, compressible ground;</li> <li>• Shallow groundwater ingress into excavations;</li> <li>• In ground structures from previous development (farm buildings).</li> </ul>
<b>Possible Contaminant linkage of moderate or greater risk level – from desk study</b>	<ul style="list-style-type: none"> <li>• Metals and other inorganics within localised Made Ground – future occupiers, surface waters and construction workers;</li> <li>• Organic contaminants such as petroleum hydrocarbons or PAHs associated with historic on and off-site sources of contamination i.e. possible spills from oil pipeline running across site; and</li> <li>• Asbestos – potentially present in uncontrolled Made Ground.</li> </ul>
<b>Conclusions of Phase 1 Study</b>	Based on historic land uses and its current operational use, the overall risk from land contamination at the site is considered to be <b>low</b> for the current development, and <b>low</b> for a re-developed site, but would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.  It is considered that it is unlikely that the site would be classified as Contaminated Land under Part IIA of the EPA 1995.

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	<p>Based on the available desk study and walk-over information, the following geotechnical issues need to be addressed in exploratory investigation:</p> <ul style="list-style-type: none"><li>• determine the strata and soil strength profile beneath the site; and</li><li>• assess the sulphate concentration with depth.</li></ul>
<b>Further Work Requirements</b>	<p>In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. Based on the current data, this site investigation is proposed to comprise:</p> <ul style="list-style-type: none"><li>• the excavation of trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and “digability”;</li><li>• cable percussive boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils and allow in-situ testing (SPTs) to be undertaken to assess strength and compressibility of the clay beneath the site and to allow foundation design, and allow the installation of gas monitoring wells;</li><li>• TRL Dynamic Cone Penetration / Mexecon tests for pavement design;</li><li>• geotechnical laboratory testing of soils and rock;</li><li>• contamination analyses of soil and groundwater.</li></ul>

## **1. INTRODUCTION**

### **1.1 TERMS OF REFERENCE**

Pell Frischmann Consultants Limited (PF) was commissioned by a consortium of developers (Taylor Wimpey, Hallam Land Management, Connolly Homes, William Davis Homes and Bellcross Homes) to undertake a desk study of land at South West Milton Keynes.

The site covers approximately 144 ha and currently comprises open fields likely used for agricultural purposes.

The proposed development is to comprise the construction of approximately 1850 residential properties, employment areas, a primary school, other community facilities and public open space areas.

A site location plan (Drawing 53295-G001) is presented in Appendix A.

### **1.2 OBJECTIVES**

The objectives of this investigation are to assess the readily available information on the likely ground conditions at the site and produce a preliminary qualitative risk assessment in support of the outline planning application for the proposed development.

### **1.3 SCOPE**

The scope of work for this commission comprises:

- a desk study to determine the nature of the site and its surroundings including current and former land uses, geology, hydrogeology, hydrology and geo-environmental data. A summary of previous investigations carried out at the site is also included;
- production of an initial geotechnical and geo-environmental constraints plan; and
- a Phase 1 Desk Study report on the findings.

A detailed description of the reporting methodology can be provided upon request.

## **2. PRELIMINARY INVESTIGATION (PHASE 1 STUDY)**

A number of desk study sources have been used to assemble the following information, including a proprietary environmental data report which has been obtained for the site (dated 4<sup>th</sup> March 2013) and is presented in Appendix B.

### **2.1 SITE REFERENCING**

The site is located on land to the south west of Milton Keynes occupying approximately 144ha of land between the A421 (Buckingham Road) to the north and the former East West Rail Line (Bletchley to Bicester) to the south. The approximate centre of the site is located at National Grid Reference 483517, 4232467.

A site location plan is presented in Appendix A.

### **2.2 SITE DESCRIPTION**

The site occupies an irregular shaped area of land which is currently occupied by open fields likely used for agricultural purposes. The site is currently split into a number of smaller fields by mature hedgerows and trees. The site can be accessed from the northwest corner.

The site is bound to the north by the A421, to the east by residential properties and golf course associated with Milton Keynes, to the south by a disused railway and to the west by further open land.

A high pressure fuel / oil pipeline runs across the western part of the site from north to south operated by BPA Pipelines. A minimum 15m wayleave is managed for the pipeline.

Industrial land uses are in close proximity to the site, e.g. a gas governor station is located adjacent to the northern carriageway of the A421, and a distribution centre for Suzuki is located just to the north of the A421 as well.

For the most part the land surrounding the site predominantly comprises a mixture of residential properties and open fields with occasional industrial sites located at various distances away from the site to the north.

### **2.3 SITE HISTORY**

Copies of the historic maps from 1890 – 2012 are given in the eMapsite GroundSure report in Appendix B. A summary of the pertinent features of the historical development of the site and the surrounding area is presented in Table 1 below.

**Table 1: Land Use History**

Date/source	Description	
	On-site	Off-site
1882-1890 County Series 1:2,500  County Series 1:10,560	The site is predominantly shown as undeveloped grassland/farmland. Weasel Lane runs through the site in a NE-SW orientation, in part following a historical County and Civil Parish Boundary. Another track branches off this in a northerly direction towards an off-site location. There are several small buildings; most likely these are farm buildings.	The area surrounding the site is predominantly undeveloped grassland/farmland. A track/road is shown to follow the site boundary on the northern and western sides. Bletchley Leys Farm is shown approximately 50m to the SW of the site. To the south of the same boundary is an elevated railway line that is orientated in a NE-SW direction.
1898-1900 County Series 1:2,500  County Series 1:10,560	The site is largely unchanged except for the presence of a footpath located in the eastern area of the site running in a N-S orientation, originating at Weasel Lane.	Manor Farm is located between two tracks/roads that are on an embankment (these tracks have forked 250m west of the farm in NE and SE directions). Brushwood is shown to the far NW of the site that includes a several small buildings. Public footpaths are also indicated towards the west of the Brushwood.
1923-1925 County Series 1:2,500  County Series 1:10,560	No significant changes are shown to the site.	Three small farm buildings have appeared (Railway Farm) to the east of the site, located along a track/road that has branched off Weasel Lane. Brushwood is no longer shown but the small buildings (Windmillhill) are still indicated.
1938 County Series 1:2,500  County Series 1:10,560	No significant changes are shown to the site.	Two small buildings have become apparent immediately outside the northeast corner of the site. No other significant changes are shown to the area surrounding the site.

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Date/source	Description	
	On-site	Off-site
1968-1970 County Series 1:2,500  County Series 1:10,560 1:2,500  National Grid 1:10,560  Provisional 1:10,560	Drains are now indicated where individual field boundaries were indicated previously. There is also a pond indicated towards the north, just inside the on-site boundary. No other significant changes to the site are apparent.	The two small buildings first shown on the map in 1938 have been developed into a series of farm buildings, Dagnall Farm, that straddle the site boundary such that the farm occupies both an on-site and off-site location. A pond is also indicated immediately north of the site. There is also some indication of residential buildings appearing along the northern side of Buckingham Road between both Railway and Dagnall Farms. Immediately to the NW of the site boundary a building identified as a "bottledump" is indicated. 400m NE of Manor Farm is a newly identified sewage works which includes a circular structure and six other buildings within its defined boundary.
1975 National Grid 1:2,500  National Grid 1:10,560	No significant changes to the site are apparent.	A large development of buildings, possibly residential, is indicated immediately north of Railway Farm and along Buckingham Road. A number of new farm buildings (Thick Thorn Farm) are also indicated about 200m SW of Manor Farm. No other significant changes are shown to the area surrounding the site.
1986 -1988 National Grid 1:2,500  National Grid 1:10,560	Electrical transmission lines (ETL) have become apparent, traversing the eastern area of the site in a NE/SW orientation. One pylon is located along the ETL on-site.	A total of four pylons are shown along the ETL. Also a new road network has been installed, branching off Buckingham Road, partly elevated and including a new roundabout. A golf course is shown to the north. Additionally, new residential buildings are indicated on the south side of Buckingham road.
1990-1995 Raster 1:10,000	No significant changes to the site are apparent.	The residential development to the south of Buckingham road has now been extended. The western edge of this development defines the proposed site boundary.
1992-1993 National Grid 1:1,1250	No significant changes to the site are apparent.	An extensive network of roads and a roundabout are indicated to the NW of the site.

Date/source	Description	
	On-site	Off-site
2002 Raster 1:10,000	No significant changes to the site are apparent.	The sewage work buildings are no longer indicated on the maps, although the words “sewage works” are present. Three small buildings are indicated (between 300-400m from the sewage work area) and including a hall and a recreational field area. The road network into the north of the site has been further developed and includes subways (pedestrian) and cycle routes. A factory is shown to the north. Further residential development to the east has replaced Railway Farm. Dagnall Farm also appears to have been replaced by a General Practice Surgery.
2012 National Grid 1:10,000	No significant changes to the site are apparent.	The sewage works are no longer indicated in any way. An additional three large buildings are shown to the north.

It can be seen that the site has undergone relatively little development since the earliest map records and is largely considered to consist mostly of grassland/farmland. The surrounding off-site location has, however, undergone some significant development over the same period of time, as is recorded in the map history. In several places the surrounding land has been developed into a number of residential and commercial (factory buildings etc.) and associated with this has seen an increase in the transport infrastructure (roads, pavements, cycle routes etc.). There are proposals to bring the disused railway line back into use as part of the east west Raillink project.

There are no significant items that have been identified in the site history, as derived from historical and modern maps that would preclude or impede the proposed development on the site.

## **2.4 UNEXPLODED ORDNANCE**

In general accordance with CIRIA report C681 (Stone *et al* 2009) a non-UXO specialist screening exercise has been carried out for the site. This indicates there is no former military use at the site and as such the site is at low risk of UXO contamination. Further detailed is not considered to be required at this stage.

A copy of the map is presented in Appendix C.

## **2.5 GEOLOGY**

The general geology of the site area is shown on the 1:50,000 geological map of Leighton Buzzard (Sheet 220 – an extract of which is presented in the GroundSure Report in Appendix B). The mapping indicates that the site is underlain by Glacial Till deposits predominantly comprising clay with occasional

oversized gravel which in turn are underlain by clays and mudstones of the Oxford Clay Formation.

## 2.6 GROUND STABILITY & MINING / MINERAL EXTRACTION

Table 2 records the natural ground subsidence hazards reported in the GroundSure report.

**Table 2: Natural Ground Subsidence Hazards**

Natural Ground Subsidence Hazard	Hazard rating
Shrink-swell clays	Low to moderate
Landslides	Very Low
Ground Dissolution of Soluble Rocks	Null to Negligible
Compressible Deposits	Negligible
Collapsible Deposits	Very Low
Running Sands	Very Low to Negligible

This indicates that the site is unlikely to experience problems due to natural ground subsidence, with the exception of shrinkage / swelling in clays, which records a low to moderate hazard rating. The GroundSure report records the following notes with respect to shrink/swelling in clay deposits:

*“Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink/swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.”*

The site is not within areas of recorded coal or non-coal mining. The apparent lack of superficial gravel deposits indicates the site is unlikely to be associated with presence of former sand and gravel pits. Whilst the Oxford Clay Formation could provide a potential source of clay for brick manufacture there is no evidence on the historical plans of any brick pits or brick and tile works having existed in the site area or in the vicinity of the site.

## 2.7 HYDROGEOLOGY

The aquifer designations given in the table below are based on the Environment Agency interactive aquifer designation map. Additional information on the hydraulic characteristics of the geological units has been abstracted from Allen *et al* (1997) and Jones *et al* (2000).

**Table 3: Hydraulic Characteristics of Strata**

Stratum	Aquifer Designation	Hydraulic Characteristics
Glacial Till	Non-productive strata	Dominated by low permeability clay. Unlikely to be any significant permeability.
Oxford Clay	Non-productive strata	Dominated by low permeability clay. Unlikely to be any significant permeability.

Reference to the Environment Agency web site shows the no groundwater bodies in the vicinity of the site have been given a current quantitative quality.

The site is not within a Source Protection Zone (SPZ).

There are is a single licensed groundwater abstraction within 1000m of the site. The license is located 634m to the west of the site and allows the abstraction of groundwater for 'general farming and domestic' purposes.

The majority of the site is covered by soils of low leaching potential.

## **2.8 HYDROLOGY & FLOODING**

The surface water features in the vicinity of the site are listed in the table below.

**Table 4: Surface Water Features**

<b>Feature</b>	<b>Location Relative to Site</b>
Unnamed Stream	In northwest corner of the site
Unnamed stream	In southwest corner of site
Unnamed stream	In south of the site
Unnamed secondary River	20m to the north of the site at its nearest point

There are no recorded surface water abstractions within 1000m of the site.

The site is in Flood Zone 1, with low probability of flooding.

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regards to drainage and flooding.

## **2.9 WASTE MANAGEMENT & HAZARDOUS SUBSTANCES**

The following waste management sites are recorded in the vicinity of the site (Table 5).

**Table 5: Waste Management Sites**

<b>Site Name</b>	<b>Details</b>
Environment Agency licensed waste site.	Newton Longville Landfill located 176m southeast of the site (open). The license was issued in 2002 and is currently recorded as modified. The site is a co-disposal landfill site.

There are a number of industrial processes operating in the surrounding area. As long as these have been operated in accordance with any applicable licence, no impact on the site is envisaged.

## **2.10 PREVIOUS EVIDENCE OF KNOWN CONTAMINATION EVENTS**

The GroundSure Report has details of eleven recorded pollution incidents within the vicinity of the site, three of which took place on the site itself. The incidents on site involve the likely fly tipping of inert materials and waste, tyres and other unrecorded pollutants. All three incidents recorded the following impacts, Category 4 (No Impact – water and air) and Category 3 (Minor Impact – land).

The other pollution incidents recorded surrounding the site generally involved the release of sewage materials into local watercourses and also fly tipping of general waste materials.

#### **2.11 BR 211 GUIDANCE ON RADON**

Reference to the Annex A maps in BR 211 (Scivyer 2007), based on the indicative atlas of radon in England and Wales (Miles *et al* 2007) indicates that no radon protection is required for new dwellings at this location in line with current guidance.

### **3. PRELIMINARY RISK ASSESSMENT**

#### **3.1 PRELIMINARY CONCEPTUAL MODEL**

The findings of the Phase 1 investigation indicate that the site is currently occupied by grassland and/or farmland. This has been the dominant land-use since ~1880 (the earliest available maps).

The on-site area largely contains field boundaries (possibly a mixture of fences, hedgerows and trees) and bund drains. Weasely Lane passes in a rough SW-NE direction with a small lane feeding off this towards the north. There are also a number of public footpaths on-site.

Given the presence of superficial drain networks and a minor water course immediately north of the site, there can be considered a direct pathway to off-site surface water receptors. Incidentally, the site is in Flood Zone 1, with low probability of flooding.

Superficial materials on-site are largely Glacial Till deposits predominantly comprising clay with occasional oversized gravel which are in turn underlain by clays and mudstones of the Oxford Clay Formation (solid geology).

Made Ground may be encountered on-site where farm buildings have been identified and also the area occupied by Weasel Lane.

With reference to the EA website, there are no groundwater bodies in the vicinity of the site that have been given current quantitative values demonstrating their quality. The site is not within a SPZ. There is a single licensed groundwater abstraction within 1000m of the site. The license is located 634m to the west of the site and allows the abstraction of groundwater for 'general farming and domestic' purposes. The majority of the site is covered by soils of low leaching potential.

#### **3.2 PRELIMINARY CONCEPTUAL EXPOSURE MODEL**

The **exposure model** is used for geo-environmental hazard identification and for establishing potential contaminant linkages in line with the Statutory Guidance to Part 2A of the Environmental Protection Act 1990, also known as a 'potential pollution linkages' in the Model Procedures of CLR11 (DEFRA and Environment Agency, 2004).

This is based on the contaminant-pathway-receptor linkage approach.

##### **3.2.1 Potential Contaminants of Concern**

For the purpose of this assessment the potential contaminants of concern have been separated according to whether they are likely to have originated from on-site or off-site sources.

#### **Potential on-site contaminants**

- In areas of possible Made Ground - possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons;
- Naturally occurring and potentially elevated levels of metals derived from underlying geological materials;
- Contaminants associated with the farming/agriculture industry (e.g. Cu and Zn accumulations in soil associated with the application of animal manure); and
- Elevated levels of contaminants associated with traffic along Weasel Lane – possibly including metals, metalloids, PAH species and petroleum hydrocarbons.

#### **Potential off-site contaminants**

- In areas of possible Made Ground - possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons;
- Naturally occurring and potentially elevated levels of metals, derived from underlying geological materials;
- Contaminants associated with the farming/agriculture industry;
- General PAH species and petroleum hydrocarbon contamination associated with the railway and extensive road infrastructure surrounding the site;
- Organic contaminants associated with sewage treatment plants; and
- Contamination associated with factories in the north.

#### **3.2.2 Potential Receptors**

- Humans (neighbours, site end users);
- Development end use (buildings, utilities and landscaping);
- Surface waters;
- Ecological receptors; and
- It should be noted that health and safety risks to site preparation and construction workers have not been assessed during these works and will need to be considered separately.

#### **3.2.3 Summary of Potential Contaminant Linkages**

Table 7 lists the plausible contaminant linkages which have been identified. These are considered as potentially unacceptable risks in line with guidelines published in CLR 11 and additional risk assessment is required.

Linkages has been assessed in general accordance with guidance in CIRIA Report C552 (Rudland *et al* 2001) but with the addition of a 'no linkage' category.

It should be noted that whilst the risk assessment process undertaken in this report may identify potential risks to site demolition and redevelopment workers, consideration of occupational health and safety issues is beyond the scope of this report and need to be considered separately in the Construction Phase Health and Safety Plan.

**Table 6 – Risk Matrix basis for guide to Table 7**

		Consequence			
<i>product</i>		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Low risk	Very low risk
	Low Likelihood	Moderate risk	Low risk	Low risk	Very low risk
	Unlikely	Low risk	Very low risk	Very low risk	Very low risk
	No Linkage	No risk			

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**Table 7 – Plausible contaminant linkages**

Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk Level	Comments
Metals, Metalloids and other inorganic contaminants	Ingestion, inhalation or direct contact. Inhalation of fugitive dust. Root uptake. Leaching through unsaturated zone. Surface run-off, base flow from contaminated groundwater.	End users of the site. Neighbours. Ecosystems. Landscape planting. Groundwater and possible abstractors. Aquatic ecosystems. Surface water and possible abstractors.	Low	Medium	Low	Any Made Ground that may be present will be of a small and localised scale and is considered to be of low risk.  Impacts due to farming practices are unlikely to be an issue.  Given the site is not located within a Source Protection Zone, any risks of contamination impact to groundwater are likely to be of low significance.  Construction workers and site neighbours may be at risk from the emission of fugitive dusts particularly during the construction process. These risks can be controlled through appropriate means during the construction.

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Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk Level	Comments
Organic contaminants such as petroleum hydrocarbons and PAHs associated with surrounding historical land uses.	Ingestion, inhalation or direct contact. Inhalation of fugitive dust. Root uptake. Leaching through unsaturated zone. Surface run-off, base flow from contaminated groundwater.	End users of the site. Neighbours. Ecosystems. Landscape planting. Groundwater and possible abstractors. Aquatic ecosystems. Surface water and possible abstractors.	Low	Medium	Low	Any Made Ground that may be present will be of a small and localised scale and is considered to be of low risk. Impacts due to farming practices unlikely to be an issue. Given the site is not located within a Source Protection Zone, any risks of contamination impact to groundwater are likely to be of low significance. Construction workers and site neighbours may be at risk from the emission of fugitive dusts particularly during the construction process. These risks can be controlled through appropriate means during the construction.
Sulfates present in the Made Ground, Glacial Till and Oxford Clay Formation	Direct contact with dissolved sulfates.	Buried concrete.	Low	Medium	Low	Natural strata are not considered to be sulphate bearing and Made Ground, where present, is likely to be on a relatively small scale.
Organic chemicals in the Made Ground,	Direct contact or contact with vapours.	Plastic etc. building products (degradation).	Low	Medium	Low	Any Made Ground is likely to be localised, as such there is unlikely to be significant sources of organic chemicals at the site. Risks are considered to be low.
Asbestos fibres from insulation	Fugitive dust.	End users of the site.	Unlikely	Severe	Low	Whilst unlikely, there exists the possibility that Made ground may be present on the site surrounding the area that houses the existing farm buildings. Given

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Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk Level	Comments
or asbestos-containing materials in the Made Ground		Neighbours.	Unlikely	Severe	Low	the age of the buildings present on the site it is unlikely that Made Ground would have been used within previous building fabrics. As such, any asbestos is likely to be associated with fly tipping of unknown waste materials across the site.
Asbestos fibres from insulation or asbestos-containing materials in the buildings.	Fugitive dust.	End users of the site.	Unlikely	Severe	Low	Given the age of the buildings present on site (i.e. pre 1950's) it is considered unlikely that asbestos will be present within the building fabric.
		Neighbours.	Unlikely	Severe	Low	
Elevated concentrations of ground gases (methane & carbon dioxide) from biodegradable matter in the Made Ground.	Migration through soils or groundwater to indoor air.	End users of new buildings (asphyxiation or explosion).	Unlikely	Medium	Very low risk	Given the scale (if any) of Made Ground present, the probability of ground gases potentially being generated is thought unlikely.
		Users of off-site properties (asphyxiation or explosion).				
		New buildings (damage by explosion).				
		Neighbouring properties (damage by explosion).				
Radon	Migration through soils or groundwater to indoor air.	End users of new buildings.	No linkage	Medium	No risk	BR 211 (2007) radon report indicates no precautions are required.

### **3.3 GEOTECHNICAL HAZARD IDENTIFICATION**

The **ground model** has been used to develop a preliminary list of geotechnical hazards to inform the required scope of intrusive investigation works for managing the identified geotechnical risks. Potential geotechnical hazards are listed below:

- Uncontrolled Made Ground – excessive settlement (creep and inundation settlement or differential settlement of foundations, roads, sports pitches and infrastructure elements.
- Attack of buried concrete by aggressive ground conditions – the development site may contain unknown Made Ground and potentially sulfate bearing soils.
- Shrink / swell of clay – settlement / heave of foundations when located within the influence of trees and vegetation.
- Low strength, compressible ground – excessive settlement of foundations and infrastructure elements is possible.

#### **4. DESK STUDY CONCLUSIONS**

Table 7 is a summary of the geo-environmental risks identified and the overall risk associated with the site has been designated using qualitative judgement.

Based on historic land uses and its current operational use, the overall risk from land contamination at the site is considered to be **low** for the current development, and **low** for a re-developed site, but would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.

It is considered that it is unlikely that the site would be classified as Contaminated Land under Part IIA of the EPA 1990.

## **5. UNCERTAINTIES AND LIMITATIONS**

This report details the findings of work carried out in June 2014. The report has been prepared by Pell Frischmann on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, all potential environmental constraints or liabilities associated with the site may not have been revealed.

The report has been prepared for the exclusive benefit of The Consortium and those parties designated by them for the purpose of providing geotechnical and geo-environmental recommendations for the site. The report contents should only be used in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Information provided by third parties has been used in good faith and is taken at face value; however, Pell Frischmann cannot guarantee its accuracy or completeness.

The work has been carried out in general accordance with recognised best practice as detailed in guidance documents such as the CLR 11 Model Procedures (Environment Agency 2004), BS5930:1999 +A2:2010 and BS10175:2011. Important aspects of the risk assessment process are transparency and justification. The rationale behind the assessments can be provided upon request. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance.

Where the phrase “suitable for use” is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Pell Frischmann.

Unless otherwise stated, the chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required.

The preliminary risk assessment process may identify potential risks to site demolition and redevelopment workers. However, consideration of occupational health and safety issues is beyond the scope of this report.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds such as Japanese knotweed, this report does not constitute a formal survey of these potential hazards.

Any site boundary line depicted on plans does not imply legal ownership of land.

## **6. RECOMMENDATIONS FOR FURTHER WORK**

In order to confirm the actual risks to receptors and to confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. Prior to the proposed development being progressed, based on the current information, this ground investigation is proposed to comprise of:

- Trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and “digability”;
- cable percussive boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils and allow in-situ testing to be undertaken to assess the strength profile of the clay beneath the site, and allow the installation of gas monitoring wells in and around the previous landfill areas;
- TRL Dynamic Cone Penetration tests for pavement design;
- gas monitoring of wells installed during the ground investigation;
- groundwater level monitoring;
- laboratory geotechnical testing of soil samples; and
- contamination analyses of soil samples;

The findings would be used to inform the preparation of a Phase 2 geotechnical and geo-environmental report and to generate engineering design parameters for the proposed development works. Any conditions imposed by the planning authority could be accounted for by the works set out above.

As a result of the size of the site, and the varying end-uses, phasing of the ground investigation work and subsequent risk assessment may be appropriate.