LANCASHIRE COUNTY COUNCIL

ISAAC CENTRE
HARROGATE CRESCENT, BURNLEY  BB10 2NX

PRELIMINARY DESK STUDY REPORT

Contract: 42367-1(00)

Date: September 2019
PRELIMINARY DESK STUDY REPORT

carried out at

ISAAC CENTRE

HARROGATE CRESCENT, BURNLEY BB10 2NX

Prepared for

LANCASHIRE COUNTY COUNCIL
PO Box 78
County Hall
Fishergate
Preston
Lancashire
PR1 8XJ

Contract: 42367-1(00)

Date: September 2019
EXECUTIVE SUMMARY

On the instructions of Lancashire County Council, a Preliminary Investigation in the form of a desk study and site reconnaissance has been carried out in order to assess the potential hazards on and adjacent to the site and prepare a risk assessment for further consideration. It is understood that it is proposed to develop the site for low-rise housing with private gardens.

The site is situated at south of Harrogate Crescent, north west of Minehead Avenue, south of Briercliffe Road, north east Burnley and may be located by Grid Reference SD 856 348.

At the time of the walkover survey, the northern quarter of the site was occupied by a single and two storey school building of masonry and frame construction. The school appeared to have been partially ‘cut into’ the slope as there were embankments to the north east and east of the buildings.

An asphalt covered car park and playgrounds were located in the west of the site and playing fields were present in the south and western half of the site. A number of trees were located around the perimeter of the site and additional trees were present to the south east north east and west of the school buildings.

The site appears to have been open fields with a drainage ditch running across the site up until between 1960 and 1967 when the existing school was built. The area around the site was developed for housing between the late 1930’s and the late 1960’s.

The 1:50000 British Geological Maps indicate that the site is underlain by Glacial Till overlying Pennine Lower Coal Measures Formation. The Glacial Till can consist of Boulder Clay or sand and gravel and the Pennine Lower Coal Measures can consist of mudstone and sandstone.

The Coal Authority Report for the site is included in Appendix 5. The report indicates that the site is underlain by two seams at 120m and 420m below ground level last worked in 1956. The report says any movement in the ground associated with these workings should have stopped by now.

The geological map indicates that the site is underlain by Glacial Till which may include Boulder Clay. Conventional foundations may be satisfactory for low rise structures but deeper foundations may be required within the zone of influence of trees.

There is the potential for the migration of explosive gases from the nearby landfill site and the backfilled drainage ditch on the site, the risk is considered to be high.

There is the potential for the made ground on the site to be pose and risk to site workers and end users. The risk to end-users is considered to be moderate.
The following scope of works is suggested in order to collect the required data:

- The sinking of boreholes for the recovery of samples for geotechnical and chemical contamination analysis
- The installation and monitoring of gas and groundwater monitoring standpipes
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1.0 INTRODUCTION

1.1 General

1.1.1 On the instructions of Lancashire County Council, a Preliminary Investigation in the form of a desk study and site reconnaissance has been carried out in order to assess the potential hazards on and adjacent to the site and prepare a risk assessment for further consideration.

1.1.2 It is understood that it is proposed to develop the site for low-rise housing with private gardens.

1.1.3 This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.

1.1.4 It is recommended that a copy of this report be submitted to the relevant authorities to enable them to carry out their own site assessment and provide any comments.

1.1.5 The comments given in this report and the opinions expressed herein are based on the information obtained from the desk study and site reconnaissance. No intrusive investigation has been carried out to confirm the actual ground or environmental conditions.

1.1.6 Any risks identified in this report are perceived risks based on information reviewed. Actual risks can only be assessed following a physical investigation of the site.

1.1.7 This report has been based, in part, on information supplied by others. The report has been prepared on the basis of that information being accurate.

1.1.8 The conclusions presented in this report are based on the guidance available at the time of preparation of the report. No liability can be accepted for the retrospective effects of any changes or amendments to legislation or guidance.

1.1.9 This Preliminary Investigation has been conducted in general accordance with CLR 3, ref. 8.1, CLR 11, ref 8.2, BS 10175, ref 8.3, and GPLC 1, ref 8.4.
2.0 SITE

2.1 Site Location

2.1.1 The site is situated at south of Harrogate Crescent, north west of Minehead Avenue, south of Briercliffe Road, north east Burnley and may be located by Grid Reference SD 856 348.

2.1.2 A site location plan is included in Appendix 1, Figures A1.1.

2.2 Site Walkover and Description

2.2.1 A walkover survey of the site was conducted on 27th August 2019. The walkover was carried out in general accordance with CLR 2, ref. 8.5.

2.2.2 The site is approximately 1.47 Hectares in area and slopes gently down to the south west.

2.2.3 At the time of the walkover survey, the northern quarter of the site was occupied by a single and two storey school building of masonry and frame construction. The school appeared to have been partially ‘cut into’ the slope as there were embankments to the north east and east of the buildings.

2.2.4 An asphalt covered car park and playgrounds were located in the west of the site and playing fields were present in the south and western half of the site. A number of trees were located around the perimeter of the site and additional trees were present to the south east north east and west of the school buildings.

2.2.5 Photographs from the walkover survey are included within Appendix 2, Figure A2.1. A site plan is included in Appendix 1, Figure A1.3.
## 2.3 Historical Maps

2.3.1 A review of the history of the site has been conducted based on readily available historical maps. Details of the findings are provided in the table below. All maps are provided in Appendix 4.

<table>
<thead>
<tr>
<th>Map, Date and Scale</th>
<th>Site Description</th>
<th>Regional Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lancashire and Furness</td>
<td>The site was part of the number of open fields. Field boundaries crossed the site.</td>
<td>The area around the site was generally open fields with Briercliffe Road located 100m north west of the site. A hamlet called Burnley Lane Head was located 120m north of the site and Lane Head (sandstone) Quarry was present north of the hamlet.</td>
</tr>
<tr>
<td>1848</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>1:10560</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>The site was part of the number of open fields with a drainage ditch trending north and then east in the middle of the site. Field boundaries and a track also crossed the site.</td>
<td>No significant change</td>
</tr>
<tr>
<td>1893</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>1:2500</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant change. Terraces of houses were present on the north western side of Briercliffe Road 100m west of the site. The quarry to the north was not named.</td>
<td>No significant change. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1895</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>1:10560</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant change. Terraces of houses were present on the north western side of Briercliffe Road 100m west of the site. The quarry to the north was not named.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1912</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>1:2500</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant changes. Tram lines were located along Briercliffe Road and houses were located on the north western and northern sides of the road. Oak Bank Cotton Mill was present 120m west of the site.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1913</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>1:10560</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>The houses to the north west and south west of the site had been constructed or were under construction but the area to the east and south remained farmland. Lane Head Quarry 150m north of the site was indicated to be disused.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1929</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1:10560</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant changes. No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1931</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1:2500</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant changes. No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1938</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1:10560</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>Lancashire and Furness</td>
<td>No significant changes. No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1955</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>1:10000</td>
<td></td>
<td>No significant changes. Burnley Union Workhouse located 250m west of the site.</td>
</tr>
<tr>
<td>Map, Date and Scale</td>
<td>Site Description</td>
<td>Regional Setting</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Ordnance Survey Map 1960 1:2500 and 1:1250</td>
<td>The site was vacant and the field boundaries and drainage ditches appeared to have been removed.</td>
<td>No significant changes</td>
</tr>
<tr>
<td>Ordnance Survey Map 1967 1:1250</td>
<td>The school was present on the site and was designated Brunlea Special School</td>
<td>The houses to the north and east of the site had been built</td>
</tr>
<tr>
<td>Lancashire and Furness 1968 1:10000</td>
<td>No significant changes.</td>
<td>No significant changes.</td>
</tr>
<tr>
<td>Unpublished Ordnance Survey Map 1973 1:1250</td>
<td>No significant changes</td>
<td>The area to the east of the site had been developed for housing. A works was located 100m south of the site. A primary school was present 100m east of the site.</td>
</tr>
<tr>
<td>Ordnance Survey Map 1974 1:1250</td>
<td>No significant changes</td>
<td>The works 100m to the south was indicated to be an Engineering Works.</td>
</tr>
<tr>
<td>Lancashire and Furness 1978 1:10000</td>
<td>No significant changes.</td>
<td>No significant changes.</td>
</tr>
<tr>
<td>Large Scale Nation Grid Data 1993 1:1250</td>
<td>No significant changes although the school was designated Primrose Hill School and Educational Resource Centre</td>
<td>Heasandford Industrial Estate was located 100m south of the site and electricity sub stations were located within the industrial estate 150m south of the site</td>
</tr>
<tr>
<td>Aerial Photograph 1999</td>
<td>The school was located in the north western quarter of the site with the remaining area being playing field or asphalt playground and car parks.</td>
<td>The cotton mill structure was still located 120m north west of the site and industrial units were located 100m to the south. The primary school was present 100m east of the site.</td>
</tr>
<tr>
<td>10k Raster Mapping 2001 1:10000</td>
<td>No significant changes.</td>
<td>No significant changes.</td>
</tr>
<tr>
<td>10k Raster Mapping 2006 1:10000</td>
<td>No significant changes.</td>
<td>No significant changes.</td>
</tr>
</tbody>
</table>
2.4 Summary

2.4.1 The site appears to have been open fields with a drainage ditch running across the site up until between 1960 and 1967 when the existing school was built. The area around the site was developed for housing between the late 1930’s and the late 1960’s.
3.0 SITE SETTING

3.1 Geological Setting

3.1.1 The 1:50000 British Geological Maps indicate that the site is underlain by Glacial Till overlying Pennine Lower Coal Measures Formation. The Glacial Till can consist of Boulder Clay or sand and gravel and the Pennine Lower Coal Measures can consist of mudstone and sandstone.

3.1.2 The Coal Authority Report for the site is included in Appendix 5. The report indicates that the site is underlain by two seams at 120m and 420m below ground level last worked in 1956. The report says any movement in the ground associated with these workings should have stopped by now.

3.1.3 No recorded mine entries are located within or within 20m of the site.

3.2 Hydrogeological Setting

3.2.1 The hydrogeological records, provided by the Environment Agency, indicate that the site is situated on a Secondary A Aquifer, relating to the bedrock and a Secondary Undifferentiated Aquifer relation to the Glacial Till.

3.2.2 The Environment Agency has assigned the term Secondary Undifferentiated to aquifers where it has not been possible to attribute category A or B due to variable characteristics of the rock type.

3.2.3 The Environment Agency defines Secondary A aquifers 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'.

3.2.4 The Envirocheck vulnerability map indicates the soil to be of low vulnerability.

3.2.5 Soils of low leaching potential are soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contributes to groundwater recharge elsewhere in the catchment.

3.2.6 The site is not located within a groundwater source protection zone.

3.2.7 There is one groundwater abstraction wells within 1km of the site which is 896m east of the site at the Michelin Tyre works which is used for cooling and industrial purposes.

3.3 Hydrological Setting

3.3.1 The nearest surface watercourse is the a small drainage ditch which flows south, located approximately 157m to the south east of the site at its closest point.

3.3.2 The site is not situated within an area defined by the Environment Agency as being at risk of flooding from rivers.
3.3.3 There is no available river quality classification data for the nearest watercourse.

3.3.4 There is one surface water abstraction within 1km of the site which is 737m north of the site at Little Toms Farm which is used for farming and domestic purposes.

3.4 Radon

3.4.1 The British Geological Survey, in conjunction with the Radiation Protection Division of the Health Protection Agency, ref. 8.6, indicates the site to lie within an area where there is a probability of <1% of present or future homes being above the action level of 200Bq/m³. As such, the site is not classified as a Radon Affected Area.

3.4.2 As such, no radon protective measures are deemed necessary for the proposed development. This is confirmed by the Building Research Establishment, Report BR211, ref 8.7.
4.0 ASSESSMENT OF GEOTECHNICAL RISK

4.1 Geological Constraints

4.1.1 The following are brief findings relating to factors identified during the research from the Envirocheck data that may have a potential impact upon the engineering of the proposed development.

<table>
<thead>
<tr>
<th>Potential Hazard</th>
<th>Assessed Risk</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGS Recorded Mineral Sites</td>
<td>Moderate</td>
<td>Nearest is Lane Head Sandstone Quarry 208m north of the site. Hagg Gate Colliery located 582m east of the site.</td>
</tr>
<tr>
<td>Coal Mining / Mining Instability</td>
<td>Very low</td>
<td>Coal Authority Report included in Appendix 5</td>
</tr>
<tr>
<td>Other shallow mine workings</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Man-Made or Natural Cavities</td>
<td>Very Low</td>
<td></td>
</tr>
<tr>
<td>Collapsible Ground</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Compressible Ground</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Ground Dissolution</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Landslide</td>
<td>Low</td>
<td>Some landscaped slopes on site moderate if altered.</td>
</tr>
<tr>
<td>Running Sand</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Shrinking or Swelling Clay</td>
<td>Moderate</td>
<td>Some deeper foundations may be required near trees</td>
</tr>
<tr>
<td>Buried structures</td>
<td>Moderate in north west quarter</td>
<td>Foundations and services form existing school building</td>
</tr>
</tbody>
</table>

4.2 Geotechnical Risk Assessment

4.2.1 An assessment of the main hazards associated with the site is detailed below. Unless stated otherwise, the presence of such hazards are based on information from the research or reconnaissance and have not been confirmed by an intrusive investigation.

- **Soil Conditions**

  The geological map indicates that the site is underlain by Glacial Till which may include Boulder Clay. Conventional foundations may be satisfactory for low rise structures but deeper foundations may be required within the zone of influence of trees.

- **Topography**

  The Envirocheck data provided indicates only a low risk of landslip subsidence. However, if the existing slopes on the site are altered these will need to be Engineer designed.
• Previous Use

Historical mapping indicates previous development in the north west of the site. Therefore, the presence of buried structures such as services, basements and old foundations is a potential risk.

4.3 Conclusions of Geotechnical Risk Assessment

4.3.1 The research has identified evidence of potential hazards associated with underlying ground conditions, either natural or man-made, and therefore it is recommended that further work be carried out to confirm the presence, nature or extent of those hazards anticipated to impact on the site.
5.0 ENVIRONMENTAL SEARCHES

5.1 Potential Sources of Contamination

5.1.1 A search was made of records held by the various regulatory authorities and other statutory bodies to determine the presence or otherwise of past and current activities on or within 500m of the site which have the potential to give rise to the presence on site of contaminants. The findings are given in the table below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>On Site</th>
<th>Off Site (distance / direction)</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated Land Register Entries</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Discharge Consents</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Integrated and Local Authority Pollution Prevention and Controls</td>
<td>None</td>
<td>One at 112m south of the site</td>
<td>Relates to combustion plant.</td>
</tr>
<tr>
<td>Pollution Incidents to Controlled Waters</td>
<td>None</td>
<td>One at 492m south west</td>
<td>Minor incident of rubbish in a stream</td>
</tr>
<tr>
<td>Prosecutions Relating to Authorised Processes or Controlled Waters</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Registered Radioactive Substances</td>
<td>None</td>
<td>One at 450m west</td>
<td>Relates to Burnley General Hospital</td>
</tr>
<tr>
<td>Substantiated Pollution Incident Register</td>
<td>None</td>
<td>One at 473m east</td>
<td>Relates to significant incident of smoke air pollution in 2011</td>
</tr>
<tr>
<td>BGS Recorded Landfill Sites</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Historical Landfill Sites</td>
<td>None</td>
<td>One at 176m north west, one at 282m north</td>
<td>Closest was unknown waste deposits at Casterton Avenue at unknown date.</td>
</tr>
<tr>
<td>Licenced Waste Management Facilities</td>
<td>None</td>
<td>One within 500m</td>
<td>Plaster and gypsum recycling at 426m south east of the site.</td>
</tr>
<tr>
<td>Local Authority Recorded Landfill Sites</td>
<td>None</td>
<td>Three within 250m</td>
<td>Nearest 172m north of the site no details. No details on the two next nearest.</td>
</tr>
<tr>
<td>Registered Landfill Sites</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Registered Waste Transfer Sites</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Registered Waste Treatment or Disposal Sites</td>
<td>None</td>
<td>One at 433m west</td>
<td>Relates to Burnley General Hospital</td>
</tr>
<tr>
<td>Hazardous Substances</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Explosive Sites</td>
<td>None</td>
<td>None within 500m</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>On Site</td>
<td>Off Site (distance / direction)</td>
<td>Detail</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------</td>
<td>---------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Contemporary Trade Entries</td>
<td>None</td>
<td>Twenty within 250m, forty one at 250-500m</td>
<td>Closest is a mechanical engineer at 96m north of the site but inactive. Nearest active is ironing services 96m south west. Others include laundry services, engineers, printers and textile services but many inactive.</td>
</tr>
<tr>
<td>Fuel Station Entries</td>
<td>None</td>
<td>One at 324m west of the site.</td>
<td>Burnley Express Esso Station.</td>
</tr>
</tbody>
</table>

5.2 Green Belt Areas

5.2.1 There are no designated areas or as yet un-adopted areas of Green Belt land within 900m of the site.

5.3 Designated Sites

5.3.1 The enquiries indicated there are no Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) or Local Nature Reserves (LNR) within 1km of the site.

5.4 Nitrate Vulnerable Zone

5.4.1 The site is located within an area designated as a nitrate vulnerable zone.

5.4.2 The Nitrates Directive defines a nitrate vulnerable zone as:

   a) Surface freshwater which contains or could contain, if preventative action is not taken, nitrate concentrations greater than 50mg/l.

   b) Groundwater which contains or could contain, if preventative action is not taken, nitrate concentrations greater than 50mg/l.

   c) Natural freshwater lakes or other freshwater bodies, estuaries, coastal waters and marine waters, which are eutrophic or may become so in the near future if protective action is not taken.
6.0 ASSESSMENT OF GEOENVIRONMENTAL RISK

6.1 General

6.1.1 The definition of ‘contaminated land’, along with the relevant details on legislation and guidance is set out in Appendix 3.

6.1.2 The assessment of potential risk has been based on the guidelines given in CIRIA report C552, ref 8.8. These guidelines are summarised in Appendix 3.

6.1.3 The assessment of environmental risk is aimed at identifying the possible risk, if any, arising from substances used or deposited on the site, or from any other sources of land contamination, based on the principles of the pollutant linkage.

6.1.4 The assessment is based on the proposed development end use, taking account of present and previous use. It is based only on a review of historical maps, desk based data and site reconnaissance; therefore it contains some elements of conjecture based on professional judgement. A comprehensive risk assessment can only be made following an intrusive investigation and testing regime.

6.1.5 The proposed development comprises of low rise housing with private gardens.

6.2 Potential Sources of Contamination Identified

6.2.1 The research has identified the following potential sources of contamination which may form part of a pollutant linkage:

- Contamination associated with existing school on the site. Given the age of the school asbestos may be present within the structure.
- Potential gas associated with historical landfill situated 176m north west of the site and local authority recorded landfill site 172m north of the site.
- Potential gas associated with backfilled drainage ditch on the site.

6.3 Potential Pathways Identified

6.3.1 The research has identified a number of potential pathways which are relevant to the potential sources of contamination identified above and may form part of a pollutant linkage.

6.3.2 Those identified are detailed within the Conceptual Site Model, along with the receptors relevant to the development on a site specific basis.

6.4 Hazard Identification

6.4.1 The research has identified a number of potential sources and pathways which are considered ‘likely’ to be present which, taking into account the potential receptors identified, form potential pollutant linkages and have been used in the formulation of the Conceptual Site Model.
6.5 Hazard Assessment

6.5.1 An assessment of the main sources of contamination and the potential for unacceptable risk to receptors is detailed below. Unless stated otherwise, it is considered ‘likely’ that a potential source is present at this stage, in order to provide a preliminary estimation of the risk and therefore determine the need for further work.

- Human Health

  There is the potential for the migration of explosive gases from the nearby landfill site and the backfilled drainage ditch on the site, the risk is considered to be high.

  There is the potential for the made ground on the site to be pose and risk to site workers and end users. The risk to end-users is considered to be moderate.

- Construction Material

  There is considered to be a low risk due to chemical attack on construction materials emplaced within the Made Ground.

- Controlled Waters

  The site is located on Secondary Aquifers and as such, which will be a target for mobile contamination on the site. However, the site is not located within a source protection zone and given the previous use of the site the risk is considered to be low.
6.6 Conceptual Site Model

6.6.1 The research has therefore identified the following pollutant linkages that require further consideration and have been used to formulate the Conceptual Site Model.

<table>
<thead>
<tr>
<th>Potential Contamination Sources</th>
<th>Potential Contaminants of Concern</th>
<th>Potential Pathways</th>
<th>Receptor Group</th>
</tr>
</thead>
</table>
| Possible contamination associated with made ground | Inorganic Compounds  
  • Metals  
  • Cyanide | • Soil ingestion  
  • Vegetable uptake  
  • Dermal contact  
  • Inhalation of contaminated dust  
  • Vapour inhalation | Human Health  
  • Site occupants  
  • Site users  
  • Construction workers  
  • Maintenance workers  
  • Neighbouring site users/general public |
| | Organic Compounds  
  • TPH  
  • PAH | • Plant uptake and accumulation of contaminants | Ecology  
  • Landscaped areas |
| | Others  
  • Asbestos  
  • Organic materials | • Lateral migration  
  • Surface run-off  
  • Infiltration | Controlled Waters  
  • Surface waters  
  • Groundwater |
| | Carbon dioxide  
  • Methane  
  • Carbon monoxide  
  • Hydrogen sulphide | • Direct contact of contaminants with building materials | Building Materials or Services  
  • Concrete  
  • Plastic pipes and services  
  • Structural iron & steel work |
| Made Ground/ Nearby Landfill | Carbon dioxide  
  • Methane  
  • Carbon monoxide  
  • Hydrogen sulphide | • Inhalation  
  • Explosion | Human Health  
  • Property |

6.7 Conclusions of Geoenvironmental Risk Assessment

6.7.1 The research has identified evidence of potential sources of contamination on or which may impact on the site, with plausible pathways to the likely receptors, and therefore potential pollutant linkages have been suggested.
6.7.2 It is recommended that further work be carried out to confirm the presence, nature or extent of any contamination which is anticipated to impact on the site.

6.8 Consultation

6.8.1 During development, consultation may be required for a number of reasons with a number of regulatory Authorities. The following provides an indication as to the most likely Authorities with which consultation may be required:

- **Local Authority.** There may be a planning condition regarding contamination and consultation will be required with a designated Contaminated Land Officer within the Environmental Health Department. The Local Authority is generally concerned with human health risks.

- **Environment Agency.** Where a site is within a groundwater protection zone or has been designated as a special site, the Environment Agency is likely to be involved to ensure that controlled waters are protected.

- **National House Building Council, NHBC.** Section 4.1 of the NHBC Standards, ref 8.9, requires land management to be addressed. For a new housing development to be approved by the NHBC, any contamination will require remediation accompanied by a validation report.

6.8.2 Based on the results of any consultation, there may be specific investigation and/or remediation requirements imposed by one or more of the Authorities.
7.0 RECOMMENDATIONS

7.1 Further Work

7.1.1 An intrusive investigation should be undertaken to address the issues raised in Chapter 4.0 and Chapter 6.0.

7.1.2 The following scope of works is suggested in order to collect the required data:

- The sinking of boreholes for the recovery of samples for geotechnical and chemical contamination analysis.
- The installation and monitoring of gas and groundwater monitoring standpipes.

7.2 Other Considerations

7.2.1 There are several other areas of research which are beyond the scope of this report. All or none of the following may be applicable to the site, either on the outcome of consultation with a regulatory body or as a result of the research for this Preliminary Investigation. They include:

- **Archaeology.** Should the site be situated on or within an area of archaeological sensitivity, the advisor to the relevant local authority should be consulted. The requirement for an archaeological report may be identified within a planning condition, if appropriate, for the site.

- **Ecology.** There may be a requirement for a detailed ecological report, dependant on the type or size of the development, or due to evidence identified during the site reconnaissance or desk study. This requirement may be identified within a planning condition, or recommended within Section 7.0.
8.0 REFERENCES

8.1 CLR 3, ‘Documentary research on industrial sites’, Report by RPS Consultants Ltd, DoE, 1994


8.7 BR211, ‘Radon: Protective measures for new dwellings’. BRE, 2007


8.9 Standards, ‘Land Quality – Managing Ground Conditions’, Chapter 4, NHBC, 2010

8.10 The Environmental Protection Act, Part IIA, Section 78, 1990

8.11 Environment Act 1995, Section 57, DoE, 1995

8.12 Water Environment and Water Services (Scotland) Act, 2003

8.13 Planning Policy Statement 23: Planning and Pollution Control, ODPM, 2004


For and on behalf of Ian Farmer Associates (1998) Limited

Victoria Tickner
Principal Geoenvironmental Engineer
BSc(Hons.) MSc PIEMA

William H Sell
Regional Manager
BSc(Hons.) FGS