



BELLWAY HOMES LTD.

Land Off Dodworth Road, Barnsley

Phase I and II Environmental Assessment

September 2011

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**BELLWAY HOMES LTD**

**Land Off Dodworth Road, Barnsley**

**Phase I and II Environmental Assessment**

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ENERGY AND CLIMATE CHANGE  
ENVIRONMENT AND SUSTAINABILITY  
INFRASTRUCTURE AND UTILITIES  
LAND AND PROPERTY  
MINING, QUARRYING AND MINERAL ESTATES  
WASTE RESOURCE MANAGEMENT

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## DRAWINGS

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| SH10753-001 | Site Location Plan | 1:50,000 |
| SH10753-002 | Site Plan          | 1:500    |

## **1 INTRODUCTION**

### **1.1 Instructions**

- 1.1.1 This report is prepared in accordance with instructions from Mr M Bray of Bellway Homes Limited, Yorkshire, dated 5 October 2010 and in accordance with our standard terms and conditions as attached at Appendix I.

### **1.2 Site Location**

- 1.2.1 The site is Polar Ford, Dodworth near Barnsley on Dodworth Road, and is located as shown on the site location plan, Drawing No. SH10753-001 (1:50,000 scale) and more detailed site plan SH10753-002 (1:500 scale). The site comprises a bungalow and a small, light industrial unit. The site is bound by residential land use to the south, light industrial land use to the east, a former car dealership to the west and a railway line to the north. The site is located on Dodworth Road, the main road into Barnsley from junction 37 of the M1 motorway.

### **1.3 Purpose and Basis of Report**

- 1.3.1 The purpose of this report is to identify and examine in broad terms the potential stability and contamination constraints and liabilities that may arise in connection with the proposed use of the site for residential development. The desk study section of the report is designed generally in accordance with the first incremental stage of a Land Quality Statement as set out by the Royal Institution of Chartered Surveyors (RICS) in their publication "Contamination and Environmental Matters" dated November 2003. The background to government guidance on contamination and the purpose and use of Land Quality Statements in assessing the risk of contamination at a site is described at Appendix II. In this instance the report also includes the results of site investigations for contamination and shallow mining purposes along with the results of investigation and stabilisation works at the site.
- 1.3.2 This also follows extensive researches, site investigations and remediation on land to the west of this site during the latter part of 2010 and 2011 to date.

#### 1.4 Proposed Use

1.4.1 It is proposed that the site is redeveloped for residential land use.

## 2 SITE HISTORY AND PRESENT LAND USE

### 2.1 Data Sources

2.1.1 The history of the site and its immediate vicinity has been investigated by consultation with a range of archive sources and statutory bodies. The topographical and environmental data is primarily based on a Landmark Envirocheck report dated 29 September 2010. In addition the following report has been provided for information and review:

- *Former Polar Ford Garage, Dodworth Road, Barnsley – Additional Site Investigation Works, Sirius Geotechnical & Environmental Ltd, 12<sup>th</sup> August 2010.*

2.1.2 Further additional information from the site to the west has also been used in deriving risks and ground conditions.

2.1.3 Additional archives and statutory bodies contacted are given in Appendix III.

### 2.2 Site History

2.2.1 The site history has been primarily researched to identify previous land uses, including any significant potentially contaminative uses. Where other features that may have an effect on development of the site have been identified, they are described.

2.2.2 Table I summarises the history of the site and its immediate vicinity over the period from about 1855 to the present day.

| TABLE I<br>SUMMARY OF LAND USE |                                                                                                                       |                                                                                                              |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Date                           | Site Land Use                                                                                                         | Adjacent Land Use                                                                                            |
| 1855                           | The site is identified as greenfield.                                                                                 | The site is surrounded by greenfield land with a railway line adjacent to the northern boundary of the site. |
| 1893-<br>1894                  | The east of the site is shown as greenfield. A clay pit related to the brickworks is present on the west of the site. | A large Brick Works is located 250m west of the site.                                                        |

**TABLE I**  
**SUMMARY OF LAND USE**

| Date      | Site Land Use                                                                                                                                                                            | Adjacent Land Use                                                                                                                                                                                                                                                                                             |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1906-1907 | The clay pit is no longer identified on site. An embankment separates the majority of the site from a small area to the east.                                                            | An Old Shaft is located on the adjacent site to the west. The brickworks to the west has expanded. Summer Lane Brickworks is identified to the north of the site on the opposite side of the railway line.                                                                                                    |
| 1931-1933 | Tipping from the brickworks is located on site.                                                                                                                                          | The brickworks to the west of the site have expanded further. Old Shafts are shown to the south of the site. A refuse destructor is identified to the north on the no longer identified Summer Lane Brickworks site across the railway line. Residential development has taken place to the east of the site. |
| 1948      | No significant change.                                                                                                                                                                   | Residential development has taken place to the south of the site.                                                                                                                                                                                                                                             |
| 1956      | Less brickworks activity is identified on site.                                                                                                                                          | No significant change.                                                                                                                                                                                                                                                                                        |
| 1960      | A small building of unknown use occupies the west of the site, a number of small buildings unknown use occupy the north east of the site and two dwellings occupy the south of the site. | No significant change.                                                                                                                                                                                                                                                                                        |
| 1966-1983 | The building to the west of the site is identified as a Depot. The small buildings to the north east of the site are no longer present.                                                  | The brickworks are no longer identified. Residential development has taken place around the site.                                                                                                                                                                                                             |
| 1993      | No significant change.                                                                                                                                                                   | A model railway is shown to the west on the site of the old brickworks and a factory has been developed in an old clay pit to the south of the site.                                                                                                                                                          |
| 2000-2009 | No significant change.                                                                                                                                                                   | Development associated with Polar Ford has taken place adjacent to the site to the west.                                                                                                                                                                                                                      |

| TABLE 1<br>SUMMARY OF LAND USE |                                                                                                       |                        |
|--------------------------------|-------------------------------------------------------------------------------------------------------|------------------------|
| Date                           | Site Land Use                                                                                         | Adjacent Land Use      |
| Present day                    | The site is currently a vacant plot of land comprising a small, light industrial unit and a bungalow. | No significant change. |

## 2.3 Present Site Use

- 2.3.1 The site is currently a vacant plot of land comprising a small, light industrial unit and a bungalow.

### **3 REVIEW OF PAST WORK**

#### **3.1 Introduction**

3.1.1 One previous report entitled, Former Polar Ford Garage, Dodworth Road, Barnsley – Additional Site Investigation Works has been reviewed. This report primarily focused on the adjacent site to the west and was completed by Sirius Geotechnical & Environmental Ltd. and is dated 12 August 2010.

##### ***Scope of Works***

3.1.2 The site investigation works located within this site consisted of two trial pits to a maximum depth of 3.6m below ground level (bgl) and one rotary open-hole borehole to a maximum depth of 34.0mbgl.

##### ***Ground Conditions***

3.1.3 Made ground was encountered in all investigation locations and consisted of a sandy gravel with the gravel fraction consisting predominantly of ash and clinker or a sandy, gravelly clay with the gravel fraction consisting of brick, concrete and timber. The made ground ranged in thickness from 3.1m to 7.0m.

3.1.4 The natural materials on site consisted of a stiff, sandy, gravelly clay which was interpreted as weathered coal.

3.1.5 Coal measures bedrock was encountered and consisted of mudstone, sandstone and coal. Old workings were also encountered during the site investigation works in the rotary borehole at a depth of 30.2m-33.0mbgl.

##### ***Contamination***

3.1.6 No contamination testing was carried out on soil and groundwater samples from the site, however, given the ashy nature of the made ground it was considered likely that polycyclic aromatic hydrocarbon (PAH) contamination may be present.

### ***Foundations***

- 3.1.7 Due to the thickness of the made ground encountered across the site strip foundations were considered unsuitable for the proposed residential development. Ground improvement using vibro-stone ground improvement techniques were considered suitable to achieve the necessary bearing capacities.

### ***Ground Gas***

- 3.1.8 Preliminary ground gas results for the adjacent site characterise the site as 'Amber 1' with regard the risk posed to the proposed residential development, however, further gas monitoring specific to this site is recommended prior to a full assessment.

### ***Recommendations***

- 3.1.9 The report made recommendations for test drilling to confirm the need for drill and grout stabilisation works in the area of rotary borehole RO8.
- 3.1.10 The report can be found at Appendix IV.

## 4 ENVIRONMENTAL SETTING AND CONSULTATIONS

### 4.1 Statutory Sources

4.1.1 Information from various statutory sources has been summarised utilising the information received from the Landmark Information Group Ltd. This is summarised at Appendix V. The site sensitivity map and full copy of the Envirocheck data is available on request.

### 4.2 Contaminated Land Register Entries and Notices

4.2.1 No contaminated land entries or notices are identified within 1km of the site.

### 4.3 Waste Management

4.3.1 Information supplied has indicated the presence of the following landfills or waste management sites within potential influencing distance of the site boundary (250m).

| TABLE II                                                                                                                                                |                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BGS Recorded Landfill Sites                                                                                                                             |                                                                                                                                                                                                                      |
| Location                                                                                                                                                | Details                                                                                                                                                                                                              |
| <b>Licenced Waste Management Facility:</b><br>Dodworth Road, Barnsley, Yorkshire<br><b>Grid Ref:</b> 432910 406274<br><b>Distance from Site:</b> 91m SW | <b>Site Name:</b> Disused Quarry<br><b>Authority:</b> British Geological Survey, National Geoscience Information Service<br><b>Geology:</b> n/a<br><b>Boundary Accuracy:</b> Derived                                 |
| Historical Landfill Sites                                                                                                                               |                                                                                                                                                                                                                      |
| Location                                                                                                                                                | Details                                                                                                                                                                                                              |
| <b>Name:</b> Land North of Dodworth Road<br><b>Grid Ref:</b> 433041 406422<br><b>Distance from Site:</b> Adjacent to W                                  | <b>Licence Holder:</b> Polar Motors<br><b>Provider Reference:</b> EAHLD04327<br><b>First Input Date:</b> 1 <sup>st</sup> February 1992<br><b>Specified Waste Type:</b> Not Supplied                                  |
| <b>Name:</b> West Road<br><b>Grid Ref:</b> 433134 406457<br><b>Distance from Site:</b> 31m NE                                                           | <b>Licence Holder:</b> A F Budge<br><b>Provider Reference:</b> EAHLD04328<br><b>First Input Date:</b> 15 <sup>th</sup> July 1987<br><b>Specified Waste Type:</b> Deposited Waste included Inert and Commercial Waste |

| TABLE II                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name:</b> Recreation Ground<br><b>Grid Ref:</b> 432858 406460<br><b>Distance from Site:</b> 35m NW                                                                                                | <b>Licence Holder:</b> Not Supplied<br><b>Provider Reference:</b> EAHLD04325<br><b>First Input Date:</b> Not Supplied<br><b>Specified Waste Type:</b> Not Supplied                                                                                                         |
| <b>Name:</b> Land West of Summer Lane Dairy<br><b>Grid Ref:</b> 433170 406455<br><b>Distance from Site:</b> 50m E                                                                                    | <b>Licence Holder:</b> Co-op Retail Services Limited, Yorkshire Region<br><b>Provider Reference:</b> EAHLD04329<br><b>First Input Date:</b> 30 <sup>th</sup> November 1982<br><b>Specified Waste Type:</b> Deposited Waste included Inert, Industrial and Commercial Waste |
| <b>Name:</b> Quarry at Higher Spring Head Farm<br><b>Grid Ref:</b> 432815 406376<br><b>Distance from Site:</b> 68m W                                                                                 | <b>Licence Holder:</b> Mr J Clayton<br><b>Provider Reference:</b> EAHLD04324<br><b>First Input Date:</b> Not Supplied<br><b>Specified Waste Type:</b> Deposited Waste included Inert and Commercial Waste                                                                  |
| <b>Name:</b> Allotment Gardens<br><b>Grid Ref:</b> 433083 406568<br><b>Distance from Site:</b> 126m NE                                                                                               | <b>Licence Holder:</b> Not Supplied<br><b>Provider Reference:</b> EAHLD04330<br><b>First Input Date:</b> Not Supplied<br><b>Specified Waste Type:</b> Not Supplied                                                                                                         |
| <b>Name:</b> S.R. Gents<br><b>Grid Ref:</b> 432980 406204<br><b>Distance from Site:</b> 137m S                                                                                                       | <b>Licence Holder:</b> Barnsley Metropolitan Borough Council<br><b>Provider Reference:</b> EAHLD04326<br><b>First Input Date:</b> Not Supplied<br><b>Specified Waste Type:</b> Not Supplied                                                                                |
| <b>Name:</b> Disused Quarry<br><b>Grid Ref:</b> 432968 406119<br><b>Distance from Site:</b> 221m S                                                                                                   | <b>Licence Holder:</b> Not Supplied<br><b>Provider Reference:</b> EAHLD31670<br><b>First Input Date:</b> 31 <sup>st</sup> December 1968<br><b>Specified Waste Type:</b> Not Supplied                                                                                       |
| Licensed Waste Management Facilities (Locations)                                                                                                                                                     |                                                                                                                                                                                                                                                                            |
| Location                                                                                                                                                                                             | Details                                                                                                                                                                                                                                                                    |
| <b>Licensed Waste Management Facility:</b><br>Haulage Yard, Off West Road,<br>Pogmoor, Barnsley, South Yorkshire,<br>S75 2DH<br><b>Grid Ref:</b> 433077 406535<br><b>Distance from Site:</b> 103m NE | <b>Licence Number:</b> 60564<br><b>Authority:</b> Environment Agency – North East Region, Yorkshire Area<br><b>Site Category:</b> Household, Commercial And Industrial Transfer Stations<br><b>Licence Status:</b> Issued                                                  |

| TABLE II                                                                                              |                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local Authority Recorded Landfill Sites                                                               |                                                                                                                                                                                                             |
| Location                                                                                              | Details                                                                                                                                                                                                     |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 433012 406425<br><b>Distance from Site:</b> On Site | <b>Reference:</b> 57<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown  |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 433103 406455<br><b>Distance from Site:</b> 26m NE  | <b>Reference:</b> 61<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown  |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 432859 406370<br><b>Distance from Site:</b> 28m W   | <b>Reference:</b> 130<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 432927 406466<br><b>Distance from Site:</b> 31m NW  | <b>Reference:</b> 134<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 433200 406500<br><b>Distance from Site:</b> 102m NE | <b>Reference:</b> 139<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 432997 406219<br><b>Distance from Site:</b> 117m S  | <b>Reference:</b> 131<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown |
| <b>Location:</b> Not Supplied<br><b>Grid Ref:</b> 433109 406567<br><b>Distance from Site:</b> 136m NE | <b>Reference:</b> 44<br><b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Types of Waste:</b> Not Supplied<br><b>Last Reported Status:</b> Unknown  |

| TABLE II                                                                                                                                                          |                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Registered Landfill Sites                                                                                                                                         |                                                                                                                                                                                                                                                           |
| Location                                                                                                                                                          | Details                                                                                                                                                                                                                                                   |
| <b>Site Location:</b> West Road, Pogmoor,<br>Barnsley, South Yorkshire<br><b>Grid Ref:</b> 433200 406500<br><b>Distance from Site:</b> 102m NE                    | <b>Licence Reference:</b> WD20 B 572 (WD2 B19)<br><b>Authority:</b> Environment Agency – North East Region,<br>Ridings Area<br><b>Site Category:</b> Landfill<br><b>Status:</b> Licence lapsed/cancelled/defunct/not applicable<br>/surrendered Cancelled |
| <b>Site Location:</b> West Road, Pogmoor,<br>Barnsley, South Yorkshire<br><b>Grid Ref:</b> 433200 406500<br><b>Distance from Site:</b> 102m NE                    | <b>Licence Reference:</b> WD2 B19<br><b>Authority:</b> Environment Agency – North East Region,<br>Ridings Area<br><b>Site Category:</b> Landfill<br><b>Status:</b> Licence lapsed/cancelled/defunct/not applicable<br>/surrendered Cancelled              |
| <b>Site Location:</b> Summer Lane Dairy,<br>Stocks Lane, Barnsley South Yorkshire<br><b>Grid Ref:</b> 433300 406500<br><b>Distance from Site:</b> 187m E          | <b>Licence Reference:</b> WD20 B 38<br><b>Authority:</b> Environment Agency – North East Region,<br>Ridings Area<br><b>Site Category:</b> Landfill<br><b>Status:</b> Licence lapsed/cancelled/defunct/not applicable<br>/surrendered Cancelled            |
| Registered Waste Transfer Sites                                                                                                                                   |                                                                                                                                                                                                                                                           |
| Location                                                                                                                                                          | Details                                                                                                                                                                                                                                                   |
| <b>Site Location:</b> Haulage Yard Off West<br>Road, Pogmoor, Barnsley, South<br>Yorkshire<br><b>Grid Ref:</b> 433100 406450<br><b>Distance from Site:</b> 22m NE | <b>Licence Reference:</b> WD20 B 554 MOD 3<br><b>Authority:</b> Environment Agency – North East Region,<br>Ridings Area<br><b>Site Category:</b> Transfer<br><b>Licence Status:</b> Operational as far as is known<br>Operational                         |

4.3.2 In addition to the recorded/licensed landfilling activities in the vicinity of the site, the possibility of there being unrecorded landfilling activities within influencing distance of the site cannot be discounted. If at some time in the future, the presence of such an unrecorded landfill is revealed then its potential influence on the site may need to be investigated and dealt with as necessary.

#### **4.4 Radon**

4.4.1 Radon can accumulate in enclosed spaces within buildings and this has been identified as a risk to human health for many years. The Health Protection Agency and British Geological Survey document "Indicative Atlas of Radon in England and Wales" (2007) provides a summary of the number of homes in a given area above the Action Level for radon. Although the radon atlas relates directly to measurements taken from homes or dwellings, it is also relevant to employers assessing risks for underground and groundfloor work places.

4.4.2 The BRE document "Radon: guidance on protective measures for new dwellings" (2007) provides guidance for reducing the concentration of radon in new dwellings and a two stage procedure using accompanying maps needed to determine the level of protection for a given site.

4.4.3 These documents have been consulted and the site is shown to lie in an area where consideration should be given to geological data and whether basic protection against radon may be needed should development of residential dwellings or new structures of similar form of construction and compartmentation occur.

4.4.4 A site specific radon protective measures report has been obtained from the British Geological Survey (BGS) to confirm the appropriate level. The BGS report for the site confirms that no radon protective measures are required for the site. The report is attached at Appendix VI.

#### **4.5 Environmental Issues**

4.5.1 As a result of research mainly via the Landmark Envirocheck report, there are no records of pollution incidents, discharge consents, prosecutions or enforcements relating to authorised processes.

### ***Integrated Pollution Controls***

4.5.2 The Environment Agency data via the Landmark report records the following current or past IPC permissions at or in the vicinity of the site.

| <b>TABLE III</b>                                                                                           |                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Operator</b>                                                                                            | <b>Details</b>                                                                                                                                                                                                                                                             |
| <b>Operator:</b> Royston Lead Ltd.<br><b>Grid Ref:</b> 433294 406573<br><b>Distance from Site:</b> 221m NE | <b>Permit Reference:</b> Bi5710<br><b>Dated:</b> 30 <sup>th</sup> May 2009<br><b>Description:</b> 2.2 A (E) Non-ferrous Metal processes within the metal industry<br><b>Status:</b> Revoked – now IPPC                                                                     |
| <b>Operator:</b> Royston Lead Ltd.<br><b>Grid Ref:</b> 433299 406568<br><b>Distance from Site:</b> 221m NE | <b>Permit Reference:</b> BB9539<br><b>Dated:</b> 30 <sup>th</sup> October 1998<br><b>Description:</b> 2.2 A (E) Non-ferrous Metal processes within the metal industry<br><b>Status:</b> Authorisation superseded by a substantial or non substantial variation Superseded  |
| <b>Operator:</b> Royston Lead<br><b>Grid Ref:</b> 433294 406573<br><b>Distance from Site:</b> 221m NE      | <b>Permit Reference:</b> AN6671<br><b>Dated:</b> 27 <sup>th</sup> June 1994<br><b>Description:</b> 4.1 A (B) Petrochemical processes within the Chemical Industry<br><b>Status:</b> Application since found to be exempt from IPC Exempt                                   |
| <b>Operator:</b> Royston Lead Ltd.<br><b>Grid Ref:</b> 433299 406573<br><b>Distance from Site:</b> 224m NE | <b>Permit Reference:</b> BE6064<br><b>Dated:</b> 24 <sup>th</sup> November 1998<br><b>Description:</b> 2.2 A (E) Non-ferrous Metal processes within the metal industry<br><b>Status:</b> Authorisation superseded by a substantial or non substantial variation Superseded |

### ***Integrated Pollution Prevention and Controls***

4.5.3 The Environment Agency data via the Landmark report records the following current or past IPC permissions at or in the vicinity of the site.

| TABLE IV                                                                                                      |                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operator                                                                                                      | Details                                                                                                                                                                                                                                         |
| <b>Operator:</b> Royston Lead Limited<br><b>Grid Ref:</b> 433294 406573<br><b>Distance from Site:</b> 224m NE | <b>Permit Reference:</b> Bk6408ig<br><b>Effective Date:</b> 21 <sup>st</sup> September 1999<br><b>Primary Activity Description:</b> Non-Ferrous Metals; Producing Etc Lead And Alloys With Release To Air<br><b>Status:</b> Effective           |
| <b>Operator:</b> Royston Lead Limited<br><b>Grid Ref:</b> 433294 406573<br><b>Distance from Site:</b> 224m NE | <b>Permit Reference:</b> Bk6408ig<br><b>Effective Date:</b> 28 <sup>th</sup> March 2002<br><b>Primary Activity Description:</b> Non-Ferrous Metals; Producing Etc Lead And Alloys With Release To Air<br><b>Status:</b> Superseded by Variation |

#### ***Local Authority Pollution Prevention and Controls***

- 4.5.4 The Environment Agency data via the Landmark report records the following current or past Local Authority Pollution Prevention Controls at or in the vicinity of the site.

| TABLE V                                                                                                 |                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operator and Location                                                                                   | Details                                                                                                                                                                                                                                                                                                     |
| <b>Name:</b> Polar Motor Co Ltd<br><b>Grid Ref:</b> 433107 406389<br><b>Distance from Site:</b> On Site | <b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Permit Reference:</b> Ppc/B/37<br><b>Dated:</b> 28 <sup>th</sup> September 1993<br><b>Description:</b> PG6/34 Respraying of road vehicles<br><b>Status:</b> Permitted                             |
| <b>Name:</b> S J Autowelding<br><b>Grid Ref:</b> 433063 406548<br><b>Distance from Site:</b> 114m N     | <b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Permit Reference:</b> Ppc/B/09<br><b>Dated:</b> 3 <sup>rd</sup> November 1997<br><b>Description:</b> PG1/1 Waste oil burners, less than 0.4MW net rated thermal input<br><b>Status:</b> Permitted |

| TABLE V                                                                                                      |                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operator and Location                                                                                        | Details                                                                                                                                                                                                                                                                                                    |
| <b>Name:</b> Shell Barnsley Motorway<br><b>Grid Ref:</b> 432853 406229<br><b>Distance from Site:</b> 141m SW | <b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Permit Reference:</b> PPC/B/99<br><b>Dated:</b> 17 <sup>th</sup> June 1999<br><b>Description:</b> PG1/14 Petrol filling station<br><b>Status:</b> Permitted                                      |
| <b>Name:</b> Intake 1 Service Station<br><b>Grid Ref:</b> 432897 406670<br><b>Distance from Site:</b> 240m N | <b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Permit Reference:</b> PPC/B/65<br><b>Dated:</b> 24 <sup>th</sup> May 1999<br><b>Description:</b> PG1/14 Petrol filling station<br><b>Status:</b> Permitted                                       |
| <b>Name:</b> Crows Garage<br><b>Grid Ref:</b> 432896 406672<br><b>Distance from Site:</b> 241m N             | <b>Authority:</b> Barnsley Metropolitan Borough Council, Environmental Health and Trading Standards<br><b>Permit Reference:</b> Ppc/B/06<br><b>Dated:</b> 6 <sup>th</sup> October 1994<br><b>Description:</b> PG1/1 Waste oil burners, less than 0.4MW net rated thermal input<br><b>Status:</b> Permitted |

#### 4.6 Ecology

- 4.6.1 There are a number of legal or planning constraints relating to wildlife habitats and protected plant and animal species. Wildlife habitats and protected species can occur on or adjacent to a site. They can also be linked via surface or groundwater and can be affected by activities on the site such as noise, dust or pollution.
- 4.6.2 Reference to the Landmark Envirocheck report indicates no National Nature Reserves, Marine Nature Reserves or Sites of Special Scientific Interest within 1km of the site.
- 4.6.3 Although a site visit was not carried out observations made during works on the adjacent site visit did not identify any sensitive ecological features in the vicinity of either site.

***Japanese Knotweed, Himalayan Balsam and Giant Hogweed***

4.6.4 Many foreign plants were introduced to Britain in the 19<sup>th</sup> Century, mainly for ornamental reasons. A few have become aggressively dominant, creating serious problems in some areas. Three such invasive plants are Japanese knotweed, Himalayan balsam and Giant hogweed. Their spread is primarily the result of human activities, which aid their dispersal along linear corridors such as railway tracks, rivers and road verges. By forming dense stands they can displace native species and reduce wildlife interest.

4.6.5 These three invasive plants are a problem because they:

- Grow extremely densely and shade out native plants.
- Provide poor habitats for insects, birds and mammals
- Devalue the natural landscape.
- Increase the risk of river bank erosion when they die back in the autumn
- Create a potential flood hazard if dead stems fall into and clog up watercourses

4.6.6 In addition, Giant hogweed poses a serious health hazard and Japanese knotweed can cause physical damage to pavements and structures.

4.6.7 Japanese knotweed has been identified on the adjacent site and as such may be present in vegetation to the east of the site. In, 1981, the Wildlife and Countryside Act made it illegal to plant Knotweed or cause it to spread. In order to avoid liability under the Act, it is necessary to demonstrate that all reasonable steps are being taken to avoid the spread of Knotweed. Any excavated soil from areas where Knotweed has established must be disposed of at a licensed landfill site and not reused in further construction or landscaping. When disposing of infested soil, it is essential that the landfill operator is made aware of the presence of Knotweed and that the soil is not used for landscaping or restoration works at the tip site. To ensure safe disposal, contaminated soils must be buried to at least a depth of 5 metres. The Environmental Protection Act 1990, identifies Japanese knotweed as a 'controlled waste' and places a duty of care on all waste producers to ensure that any wastes (knotweed itself, or soil infested with rhizomes [root

fragments)) are disposed of safely and that a written description of the wastes and any harmful properties, is provided to the site operator.

4.6.8 Indian balsam (Himalayan balsam) has not been identified as a species present on site.

4.6.9 Giant hogweed has not been identified as a species present on site. This species has been identified as a health hazard. The Wildlife and Countryside Act 1981 makes it an offence to plant Giant hogweed or cause it to spread. The hollow stems are attractive to children who use them as "pea shooters" and "telescopes". However, the stems, edges and undersides of the leaves bear small hairs which are coated with poisonous sap and even the slightest touch can cause painful blistering and severe irritation. This reaction can occur up to 48 hours after contact and in some cases results in recurrent dermatitis. As the hairs can penetrate light fabrics, protective clothing should be worn to safeguard against contact with the sap.

#### ***Control***

4.6.10 As Japanese knotweed may be present on site there are two methods of control which may be considered; non-chemical control and chemical control.

#### ***Non-Chemical Control***

4.6.11 The control of these plants by non-chemical methods including excavation and disposal, cutting or mowing, pulling and grazing should always be considered as the first option. However, this form of management is often labour and plant intensive and consequently expensive and time consuming. Also, methods which do not fully remove the roots will not be effective in the long term. A decision on non-chemical or chemical control will depend on the site conditions, notably the area covered and how well established the invasive plant has become. Before control is carried out on sites of high conservation interest, the relevant competent authority (Natural England or Countryside Council for Wales for Sites of Special Scientific Interest, Wildlife Trust, Local Authority etc.) must be fully satisfied that the proposed management action is appropriate.

#### ***Chemical Control***

4.6.12 Chemical control should be considered only after non-chemical control has been evaluated and has proved impracticable. Properly used, herbicides can

provide effective control for Japanese knotweed, Himalayan balsam and Giant hogweed, often leading to complete eradication in the long term. The prior agreement of the Environment Agency must be obtained before herbicides are applied in or near water.

4.6.13 It is recommended that further information on Japanese Knotweed is obtained.

#### **4.7 Environmental Management**

4.7.1 The operations at the site have ceased and it is believed no issues relating to environmental management exist at the site.

#### **4.8 Asbestos**

4.8.1 The Health and Safety at Work Act requires that Employers provide safe places of work for their employees. The Control of Asbestos at Work Regulations (CAWR) place very heavy specific duties on those who commission and carry out work on asbestos containing materials. Construction work that is likely to involve exposure of workers to hazards associated with asbestos in existing buildings will be subject to the Construction (Design and Management) Regulations which impose duties upon Clients, Designers and the Contractors carrying out the work. Other health and safety and welfare regulations place duties on Employers to undertake risk assessments and prepare hazard management plans which, in the case of a building likely to contain asbestos, could involve the commissioning of surveys, hazardous materials location registers and proposals for remedial work.

4.8.2 Given the age of the small industrial unit on site it is considered that asbestos may be present and should be investigated and if necessary controlled during any demolition works. Guidance on the need for asbestos surveys and the method of carrying them out are given in HSE Publication HSG264.

#### **4.9 Archaeology**

4.9.1 Examination of historical maps indicates no features of significant archaeological interest in the general vicinity of the site.

#### 4.10 **Unexploded Ordnance**

4.10.1 From a review of historical plans, the area around the site is not known to have had previous military use and does not appear to have been subject to heavy enemy bombing during WWII. The risk of unexploded ordnance at the site can be considered to be very low. Should new evidence indicate that unexploded ordnance may be an issue, this assessment will have to be revised and some site clearance prior to redevelopment of the site may be required.

## 5 GEOLOGICAL AND HYDROGEOLOGICAL SETTING

### 5.1 Geology

5.1.1 The assessment of the geology of the site is based on the published geological mapping sheet (Sheet SE30NW) supplemented by the geological memoir, topographical plans, the results of limited site investigation works and site visit. A typical conjectured section of strata is provided in Table VI below along with other geological data.

| TABLE VI               |                                                                                                                                                                                                    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strata                 | Description                                                                                                                                                                                        |
| Made ground.           | There is extensive made ground at the site associated with past brickworks and colliery activity.<br>This is further described at Section 3 in the review of the Sirius Site Investigation Report. |
| Natural superfcials.   | Firm-Stiff, sandy clay; weathered coal measures.                                                                                                                                                   |
| Solid strata.          | Coal measures; mudstones, sandstones and coal (Barnsley Seam).                                                                                                                                     |
| Dip and dip direction. | Variable within the site.                                                                                                                                                                          |
| Evidence of faulting.  | Faulting present (see Drawing SH10753-002).                                                                                                                                                        |

### 5.2 Hydrogeology

5.2.1 Hydrogeological information from the Environment Agency changed in April 2010 in order to comply with the Water Framework Directive. Where possible, this report considers both the old and new information obtained from:

- a Landmark Envirocheck report;
- Groundwater Protection Policy and Groundwater Vulnerability maps published by the Environment Agency;
- Hydrogeological maps published by the British Geological Survey; and
- Groundwater Protection: Policy and Practice (Environment Agency, 2006).

- 5.2.2 This information indicates the site to be underlain by Carboniferous Coal Measures which are classified as a Minor or Secondary A Aquifer.
- 5.2.3 Minor or Secondary A aquifers are generally fractured or potentially fractured formations and do not have a high primary permeability. Although not producing large quantities of water for abstraction, they are important for local supplies and may supply base flow to rivers.
- 5.2.4 There are three active groundwater abstraction licences within a 2km radius of the site. The closest is 638m south east (NGR: 433700 406060) and is operated by Sheldale Developments Ltd which is licensed to abstract an unspecified amount of groundwater per year for 'Food and Drink: Water Bottling' purposes. A further two groundwater abstraction licences listed within 2km of the site but have been revoked.
- 5.2.5 The site does not lie within a source protection zone.

### 5.3 Soil Vulnerability Classification – Leaching Potential

- 5.3.1 The soil vulnerability classification groups the many different soil types of England and Wales into three soil vulnerability classes and six sub-classes. Each is based on the physical and chemical properties of the soil, which affect the downward passage of water and contaminants. This classification is not applied to soil above non-aquifers. Soil information for urban areas is based on fewer observations than elsewhere. A worst case vulnerability is therefore assumed until proved otherwise.
- 5.3.2 The soil has a High Leaching potential (HU) due to the site's urban location.

### 5.4 Hydrology

- 5.4.1 There are no graded surface watercourses within 2km of the site. A surface water culvert runs beneath the adjacent site, to the west, and drains into a small pond located adjacent to the north west of the site and a small stream is located adjacent to the site to the north.
- 5.4.2 The Environment Agency completed a national flood risk assessment in 2004, which used ground levels, predicted flood levels, information on flood defences, and local knowledge. The assessment predicts the likelihood of flooding in an area as low medium or high based on zones identified in Planning Policy Statement 25 Development and Floodrisk (2006).

- 5.4.3 The site is within Zone I and has a low probability of flooding. The chance of flooding each year is less than 0.1% (1 in 1,000).
- 5.4.4 There is one surface water abstraction licences within 2km of the site. This is 2km north east (NGR: 434800 407500) and is operated by Yorkshire Water plc, which is licensed to abstract 2,273m<sup>3</sup> of surface water per year for 'Unclassified (Other)' purposes.

## **6 MINING AND QUARRYING**

### **6.1 General**

6.1.1 Research of the mining setting is based on examination of the published topographical and geological information as described in Section 2 and 4 of this report along with other mining archive information. A Coal Authority report for the site has been obtained, dated 15 December 2010 and is attached at Appendix VII. In addition we have obtained a report from the South Yorkshire Mining Advisory Service (SYMAS) and have visited the Coal Authority Abandoned Mines Record Office at Mansfield. We have also utilised the results of extensive stabilisation works at the adjacent site to the west for assistance in interpretation.

6.1.2 Copies of relevant reports and plans are attached at Appendix VIII.

### **6.2 Surface Workings**

6.2.1 Research of topographical, geological and other archive mining records has indicated evidence of extensive brickworks activity on and adjacent to the site.

### **6.3 Shallow Underground Workings**

6.3.1 From the enquiries made and examination of the geological information there is evidence of recorded workings in the Barnsley Coal seam beneath the site. Details of the recorded extent are shown on Drawing No. SH10753-002.

6.3.2 There are recorded workings in the Barnsley seam. It did not become a statutory requirement to maintain and preserve plans of abandoned mines until the 1 January 1873 when the Coal Mines Regulation Act of 1872 was enacted. Mineworkings are known to have been carried out in the Barnsley seam to prior to this date, particularly at shallow depth. Therefore, the possibility that unrecorded mineworkings may be present beneath the site cannot be discounted and have been located by earlier exploratory drilling and adjacent works.

### **6.4 Potential Surface Instability**

6.4.1 Most of the ancient and frequently unrecorded mining activity of the nineteenth and earlier centuries was carried out by the room and pillar

system. The problems of potential surface instability over such old mine workings arises when the process of upward collapse under gravity penetrates through the solid strata, either to the surface sub-soil, to superficial deposits and/or tipped material above.

6.4.2 The height above the working to which the collapse process can take place before total choke-filling occurs, is generally governed by the volume of the original tunnel or roadway, and by the change in volume of the collapsed material. The greater the volume of the tunnel or void (ie, the greater its height and width), or the smaller the change in volume of the collapsed material, the higher the process of collapse is likely to take place. The change in volume of the collapsed materials may be as little as 10% and as much as 50%. Therefore, the ultimate height of collapse through solid strata is not likely to be less than twice or more than ten times the thickness of the seam mined.

6.4.3 The above leads directly to a definition of "shallow" old mine workings and to the delineation of problem areas. Research of existing records, an appreciation of the caving or collapse, and the characteristics of the solid strata overlying such old workings, allows the evaluation of problems and appropriate action.

## 6.5 Deep Mining

6.5.1 The Coal Authority report indicates evidence of deep underground mining activity in eight seams of coal from shallow depths to 370m below ground. The last date of working was 1978.

6.5.2 Deep mining is generally defined as that mining undertaken at depths greater than about 30m below rockhead.

6.5.3 Whilst ground movements would have occurred due to the mining of any deeper seams, surface subsidence effects should have been largely contemporaneous with the mining. The site is considered stable in respect of any past deep mining.

6.5.4 There are no current mining activities affecting the site and the site does not lie within influencing distance of any presently known planned future workings.

## 6.6 Mine Entries

6.6.1 The Coal Authority report, examination of abandoned mine plans and information from SYMAS has indicated that there are no recorded mine entries on the site.

## 6.7 Coal Mine Gas

6.7.1 Examination of the mining and geological information and adjacent site investigation works indicates that it is possible that gases migrating from now abandoned coal mine workings may affect the site.

## 7 CONCEPTUAL SITE MODEL

### 7.1 Environmental Issues

7.1.1 Conclusions are drawn from the preceding information in terms of potential sources of contamination, possible receptors that may be affected by any sources of contamination and the pathways that exist between source and receptor. This basic risk assessment allows identification of the suitability of the site for its current and future use and evaluation of any potential environmental liability that may attach to the site. A description of past or existing uses and their chemicals of potential concern is attached at Appendix IX. The issues can be broadly addressed as follows: land contamination, groundwater contamination, surface water contamination, ground gases and air pollution.

7.1.2 The land use history has identified the following potentially significant sources of contamination both on the site and adjacent to the site.

#### ***Potentially Significant Contamination Source On Site:***

1. Made ground present across the site.
2. Potential asbestos containing material.
3. Invasive species (Japanese knotweed)
4. Coal seams (ground gas - radon)
5. Historic landfill.

#### ***Potentially Significant Contamination Source Off Site:***

6. Surrounding commercial and industrial properties including brickworks and railway line.
7. Historic landfill.

7.1.3 As a result of the land use history presented in previous sections of this report the site may have a number of sources of contamination. For land or groundwater to be designated as polluted a linkage must exist between:

- a source of contamination capable of causing significant harm;
- human or environmental receptors; and
- a pathway by which the contamination can reach the receptor.

7.1.4 The conceptual site model presented in Table VII details an initial assessment of all potential pollutant linkages.

| TABLE VII                                                                     |                                                                                                                                                                         |                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOURCE<br>(CONTAMINANT)                                                       | PATHWAY                                                                                                                                                                 | RECEPTOR                                                                                                                                                                                                |
| 1.<br>Made ground present across the site (heavy and phytotoxic metals, PAH). | 1. Inhalation.<br>2. Dermal contact.<br>3. Ingestion.<br>4. Surface runoff.<br>5. Groundwater migration.<br>6. Direct contact (aggressive attack).<br>7. Gas migration. | 1. Current occupiers.<br>2. Future occupiers.<br>3. Construction workers.<br>4. Groundwater.<br>5. Surface water.<br>6. Subsurface building materials and plastic service pipes.<br>7. Flora and Fauna. |
| 2.<br>Possible historic building material within made ground (asbestos).      | 1. Disturbance and inhalation.                                                                                                                                          | 1. Current occupiers.<br>2. Future occupiers.<br>3. Construction workers.                                                                                                                               |
| 3.<br>Invasive species (Japanese knotweed).                                   | 8. Habitat degradation                                                                                                                                                  | 6. Subsurface building materials<br>7. Flora and Fauna.                                                                                                                                                 |
| 4.<br>Coal seams (ground gas).                                                | 1. Inhalation.<br>7. Gas migration.                                                                                                                                     | 1. Current occupiers.<br>2. Future occupiers.                                                                                                                                                           |
| 5.<br>Historic landfill (leachate and gas).                                   | 1. Inhalation.<br>2. Dermal contact.<br>3. Ingestion.<br>4. Surface runoff.<br>5. Groundwater migration.<br>6. Direct contact (aggressive attack).<br>7. Gas migration. | 1. Current occupiers.<br>2. Future occupiers.<br>3. Construction workers.<br>4. Groundwater.<br>5. Surface water.<br>6. Subsurface building materials and plastic service pipes.<br>7. Flora and Fauna. |

| TABLE VII                                                                                                                             |                                                                                                                                                                               |                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOURCE<br>(CONTAMINANT)                                                                                                               | PATHWAY                                                                                                                                                                       | RECEPTOR                                                                                                                                                                                                   |
| 6.<br>Surrounding historical<br>industry including<br>brickworks and railway<br>line (hydrocarbons,<br>solvents, metals,<br>phenols). | 1. Inhalation.<br>2. Dermal contact.<br>3. Ingestion.<br>4. Surface runoff.<br>5. Groundwater<br>migration.<br>6. Direct contact<br>(aggressive attack).<br>7. Gas migration. | 1. Current occupiers.<br>2. Future occupiers.<br>3. Construction workers.<br>4. Groundwater.<br>5. Surface water.<br>6. Subsurface building materials and<br>plastic service pipes.<br>7. Flora and Fauna. |
| 7.<br>Historic adjacent Landfill<br>(leachate and gas).                                                                               | 1. Inhalation.<br>2. Dermal contact.<br>3. Ingestion.<br>4. Surface runoff.<br>5. Groundwater<br>migration.<br>6. Direct contact<br>(aggressive attack).<br>7. Gas migration. | 1. Current occupiers.<br>2. Future occupiers.<br>3. Construction workers.<br>4. Groundwater.<br>5. Surface water.<br>6. Subsurface building materials and<br>plastic service pipes.<br>7. Flora and Fauna. |

## 8 SITE INVESTIGATION

### 8.1 Introduction

8.1.1 The current investigation was designed around the preliminary conceptual site model that identified all potential sources, pathways and receptors. This allowed a targeted sampling approach to be undertaken and provide general coverage of the site. Results of the investigation are used to revise the conceptual site model, establish whether linkages identified are plausible and establish the level of risk associated with the site.

8.1.2 The preliminary conceptual site model is shown as Table VII.

8.1.3 The investigation including sampling techniques was carried out in accordance with BS10175:2001 Investigation of potentially contaminated sites – code of practice.

8.1.4 A physical site investigation has been carried out to assess the geotechnical nature of the ground. The site investigation comprised of 6 trial pits (to approximately 3.5m bgl depth) and 2 shell and auger boreholes to a nominal depth of 10m bgl were completed across the site area. Locations were positioned to provide complete coverage of the site. Site investigation locations are shown on Drawing SH10753-002.

### 8.2 Scope

8.2.1 The investigation was designed as a series of tasks that are summarised below in Table VIII.

| TABLE VIII – Summary of Tasks |                                                                                                                                                                  |                  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Task                          | Summary                                                                                                                                                          | Date(s)          |
| Preparatory Work              | Setting up site investigation contract, including services enquiries, contractor health & safety document and site meeting with contractor/client.               | July-August 2011 |
| Intrusive site investigation  | 2 Cable percussion boreholes to a nominal depth of 10m and 6 trial pits to a nominal depth of 3.5m. Installation of one monitoring well for groundwater and gas. | 4-5 August 2011  |
| Laboratory analysis           | Chemical / geotechnical testing in accredited laboratory – 21 soil samples.                                                                                      | 5-25 August 2011 |

| TABLE VIII – Summary of Tasks |                                 |                  |
|-------------------------------|---------------------------------|------------------|
| Task                          | Summary                         | Date(s)          |
| Monitoring                    | Gas and water level monitoring. | 5 August-ongoing |

8.2.2 The investigation was completed in accordance with Construction (Design and Management) (CDM) Regulations 2007 and a site specific Health & Safety plan. Contractors used during this project include; JB Site Investigations (drillers), Bellway Homes (trial pits), ALcontrol Laboratories (geochemical analysis) and Professional Soils Laboratories (geotechnical analysis). Drilling was completed using a variety of methods and these are discussed in more detail below.

### 8.3 Cable Percussion Boreholes

8.3.1 Cable percussion drilling was completed under the part-time supervision of a Wardell Armstrong engineer. Two cable percussion boreholes (BH1-BH2) were drilled to 9.5m below ground level (bgl). Locations (see Drawing No. SH10753-002) were positioned to provide widespread coverage of the site.

8.3.2 Cable percussion drilling borehole logs are attached at Appendix X.

### 8.4 Trial Pit Excavations

8.4.1 Trial pit excavations were completed under the full-time supervision of a Wardell Armstrong engineer. Six trial pits (TP301-TP306) were excavated to depths of between 2.1m and 3.2m below ground level (bgl) using a Zaxis 30 hydraulic excavator. Excavations beyond these depths were not possible due to obstructions. Locations (see Drawing No. SH10753-002) were positioned to provide widespread coverage of the site.

8.4.2 Trial pit logs are included at Appendix XI.

### 8.5 Ground Gas and Groundwater Monitoring Standpipes

8.5.1 One gas and groundwater monitoring standpipe was installed by the cable percussion drilling contractor at borehole BH1.

8.5.2 The standpipes were completed with 50mm diameter screen and casing to 8.5mbgl, with the screened section extended from the base to 1.00mbgl. A filter pack of 4-6 mm washed gravel was placed in each well annulus to just above the screened section. Thereafter the annulus was sealed to the surface with bentonite. Installations were completed with concreted headworks to protect the inner casing and gas valves. All installations were supervised by a Wardell Armstrong engineer on a part-time basis.

8.5.3 Newly installed monitoring boreholes were left for 24hrs to allow gas levels to equilibrate. Data for methane, carbon dioxide, oxygen and flow rate was collected using a portable infrared gas analyser. Atmospheric pressure was recorded at the time of monitoring. Soil gases were analysed and assessed following guidance from:

- NHBC Report No. 4, Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present (March, 2007);
- BS 8485, Code of practice for the characterization and remediation of ground gas in brownfield developments (October 2007); and
- CIRIA C665, Assessing Risks Posed by Hazardous Ground Gases to Buildings (2007).

## 8.6 Sampling and Testing

### *Sampling and Chemical Analysis of Soils*

8.6.1 Nine disturbed samples of material from beneath the site were collected for laboratory analysis. Samples were taken at regular depths, changes in strata and any discrete horizons with a high potential to retain contaminants and logged in general accordance with BS14686:2002. Samples were obtained using a fresh pair of nitrile gloves.

8.6.2 Samples scheduled for analysis of organic contaminants were placed in amber bottles with a minimum of headspace. The bottles were immediately sealed with polytetrafluoroethylene (PTFE) lined caps and labelled. The remaining small disturbed samples were placed in polypropylene tubs with a minimum of headspace, sealed with airtight polypropylene 'snap-on' lids and labelled. The labels detailed individual sample number, location, depth and sampler identity.

- 8.6.3 Collected samples were stored away from sunlight in temperature controlled conditions and transported by courier to ALcontrol Laboratories. Chain of custody forms were completed for all samples sent to the laboratory. The forms detailed individual bottle identification number and sample location. The forms were signed on release by the Wardell Armstrong field engineer and upon receipt by the laboratory.
- 8.6.4 The laboratory analyses scheduled were selected to establish the type, level and distribution of the possible harmful contaminants that may be present on the site given its past and current uses. In order to provide cost effective analysis, solid samples were analysed for a number of determinands depending on depth, matrix and a visual assessment of ground conditions. The analysis scheduled is presented in Table IX.

| TABLE IX – Summary of Sample Analysis                                                                                                                                                                                                                                                                                   |                  |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|
| Substance                                                                                                                                                                                                                                                                                                               | No. Soil Samples | No. Leachate Samples |
| A standard suite of industrial pollutants including common metals (arsenic, water-soluble boron, cadmium, chromium, chromium <sup>VI</sup> , copper, lead, mercury, nickel, selenium, and zinc), pH, total Polycyclic Aromatic Hydrocarbons (PAH), sulphate, sulphide, sulphur, thiocyanate, total cyanide and phenols. | 8                | 2                    |
| Petroleum hydrocarbons (C <sub>5</sub> – C <sub>40</sub> with aliphatic/aromatic class separation and carbon banding), BTEX, MTBE and speciated PAH (USEPA 16).                                                                                                                                                         | 4                |                      |
| Total Petroleum Hydrocarbons (TPH).                                                                                                                                                                                                                                                                                     | 4                |                      |
| Volatile Organic Compounds (VOCs).                                                                                                                                                                                                                                                                                      | 4                |                      |
| Semi-Volatile Organic Compounds (SVOCs).                                                                                                                                                                                                                                                                                | 6                |                      |
| Poly-chlorinated Biphenyl (PCBs).                                                                                                                                                                                                                                                                                       | 1                |                      |
| Soluble Sulphate (2:1).                                                                                                                                                                                                                                                                                                 | 4                |                      |
| Total Organic Carbon (TOC).                                                                                                                                                                                                                                                                                             | 4                |                      |
| Asbestos.                                                                                                                                                                                                                                                                                                               | 4                |                      |

- 8.6.5 The results of the chemical analyses are attached at Appendix XII.

## **8.7 Quality Assurance and Quality Control**

8.7.1 The soil samples were collected, transferred to the laboratory under chain of custody and analysed to ensure traceability and reliability of analytical results. Based on the laboratory QA data the analytical results are considered acceptable for interpretative use.

## **8.8 Limitations of Site Investigation**

8.8.1 It should be noted that the interpretation of the results of the physical site investigation is based on a limited number of investigation points. The locations and numbers of the investigation locations were governed by the physical state of the site and the location of known services at the time of the investigation. Although reasonable inferences have been made during the interpretation, it is possible that variances in the thickness, distribution and physical/chemical characteristics of the strata present will exist.

## 9 RESULTS OF SITE INVESTIGATION

### 9.1 Ground Conditions

#### *Made Ground*

9.1.1 Made Ground was present in all borehole and trial pit locations on the site. The made ground consisted of two main horizons and the proven thickness varied from 4.4m in BH1 to 6.4m in BH2. The first horizon of made ground was described as loose, black, very sandy gravel or very gravelly sand. The gravel fraction in this horizon consisted of a number of constituents including brick, limestone aggregate, ceramic and bottle fragments, shale, animal bone, ash and clinker. The second horizon of made ground was described as firm to stiff, greyish brown or brownish grey, slightly sandy, slightly cobbly, gravelly clay. The gravel fraction in this horizon consisted of brick and sandstone.

9.1.2 Areas of hardstanding were, in general, surfaced with rolled tarmac, underlain immediately at the associated borehole locations by a sub-base of limestone aggregate which was in turn underlain by the made ground described above.

9.1.3 The thickness of the made ground was unproven in all trial pit locations due to the thickness of the underlying made ground.

#### *Natural Strata*

9.1.4 The natural materials encountered during the intrusive investigation comprised a 1.6m thickness of firm to stiff, orange-brown mottled grey, locally slightly gravelly clay. The gravel fraction consisted of mudstone and coal.

9.1.5 Rockhead was encountered at all borehole locations during the intrusive investigation and consisted of a weathered, grey/brown mudstone that became increasingly strong with depth. All natural strata were interpreted as the weathering profile of the Lower Coal Measures geology.

9.1.6 A summary of the strata beneath the site is shown in Table X.

| Table X – Summary of strata beneath the site |      |       |                          |                      |
|----------------------------------------------|------|-------|--------------------------|----------------------|
| Depth to base of strata<br>(mbgl)            |      |       | Mean<br>Thickness<br>(m) | Typical Description  |
| Max.                                         | Min. | Mean  |                          |                      |
| 0.2                                          | 0.2  | 0.2   | 0.2                      | Tarmac               |
| 6.4                                          | 2.1* | 3.45* | 3.4*                     | Made Ground          |
| 7.6                                          | 6.4  | 7.0   | 1.6                      | Superficial Deposits |
| *                                            | *    | *     | *                        | Rockhead/Bedrock     |
| * Base of strata not always proven.          |      |       |                          |                      |

## 9.2 Groundwater

9.2.1 Groundwater was not encountered during the intrusive investigation works.

## 9.3 Ground Gas

9.3.1 There are several regulatory authorities that require the assessment of ground gas on potentially contaminated sites. The main stakeholders are Building Control, Local Authority Planning and Environmental Health (Contaminated Land Officers). CIRIA have published guidance (C665, 2007) on risk assessment for new buildings and existing structures on ground with potentially hazardous gassing regimes. This guidance indicates that a semi-quantitative risk assessment for ground gas can be completed using Gas Screening Values (GSV) and consideration of the conceptual site model.

9.3.2 Three gas monitoring rounds have been completed to date. Three further rounds will be carried out over the coming weeks. All three visits made were carried out at low and/or falling atmospheric pressure.

## 9.4 Observations of contamination

9.4.1 Observations of soil contamination noted during the site investigation are presented on the borehole and trial pit logs (Appendix X and XI). These can be summarised as follows:

- Ash and clinker were observed in all Trial Pit locations within the made ground.

## **10 GUIDANCE ON CONTAMINATION RISK ASSESSMENT**

### **10.1 Introduction**

10.1.1 The following section aims to assess the magnitude and significance of potential risks to human health, surface water, groundwater, ecosystems and buildings from contaminated soil and groundwater. The assessment provides information that is fit for purpose given the regulatory context and completed in accordance with UK best practice. A summary of the risk assessment process is presented below. More detailed information on risk assessments is contained in various reports published by the Environment Agency and DEFRA including:

- Contaminated Land Science Reports (SR2 to 4); and
- Model Procedures for the Management of Land Contamination (CLR 11). General Soil Contamination Guidance.

### **10.2 General Soil Contamination Guidance**

10.2.1 The Environment Agency (EA) has a statutory duty to ensure the protection of the environment and the remediation of contaminated land and groundwater. In order to achieve this, the EA employs the principle of risk assessment - the risk of a contaminant source causing harm or pollution via a given pathway to an identified receptor. If one of the source-pathway-receptor linkages is not considered to be present then there is deemed to be no risk. However, if a contaminant source is present and there is a pathway for that contaminant to reach a receptor then there is a potential risk of significant harm to the receptor. Therefore, if the source-pathway-receptor linkages are complete, there is a requirement to undertake a risk assessment related to the receptor of concern, be it human health, surface water, groundwater, buildings or other property or ecological issues.

- 10.2.2 The first stage in the assessment of a site is development of a conceptual model. This includes consideration of all possible sources of contamination on the site, the potential receptors and whether there is a plausible pathway between the two. This allows evaluation of whether further more complicated risk assessment for an identified receptor is necessary. A site-specific conceptual model is presented in Section 7 of this report and is revised here in Section 12 based on the findings of the site investigations.
- 10.2.3 In March 2002 the Environment Agency and the Department of Environment, Food and Rural Affairs (DEFRA) released a package of guidance to assess the health risks posed by contaminated land as part of the statutory framework for contaminated land. The Contaminated Land Exposure Assessment (CLEA) model is a framework for estimating the likely exposure to contaminants in soil as part of the wider approach of the UK's assessment of risk and suitability for use. The methodology adopted for CLEA builds upon the source-pathway-receptor model for the assessment of risk. Following the CLEA model, generic Soil Guideline Values (SGVs) were developed to act as triggers for intervention in a number of end-use scenarios. The Environment Agency commenced a programme looking at 55 contaminants. The CLEA methodology has been updated and the SGVs were withdrawn from use in August 2008. New SGVs have been published by the EA since March 2009 and further SGVs are expected to be published as part of an on-going programme. For the purposes of risk assessment in this report and in the absence of more appropriate screening criteria we have continued to use the pre-2009 SGV for lead as a measure of significance for contamination as no replacement SGV has been published.
- 10.2.4 The CLEA SGVs are derived using specific parameters, which may not be relevant to each site. The CLEA software allows parameters to be changed and site specific assessment criteria (SSAC) can be developed. The CLEA methodology also uses a statistical evaluation of all the data collected in order to give an overall impression of the site and therefore the exposure to a modelled receptor rather than using individual contaminant values, which may vary dramatically across the site. The statistical tests calculate a normalised upper bound value for the site as a whole and also give an indication of whether a particular data value is a statistical outlier (potential hotspot) or whether it is part of the whole population of samples.

10.2.5 The Soil Guideline Values derived from the CLEA model are intended for use in assessing the risk to long term human users of the site. There is also a requirement to consider the potential for harm from short-term exposure to contaminants at the site, e.g. to construction workers who may be exposed to risk via inhalation of dust or dermal contact with the contaminated material.

10.2.6 In the absence of SGVs published under the new CLEA methodology, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) published generic assessment criteria (GAC) for over seventy inorganic and organic substances in July 2009. In addition, GAC values for 30 separate organic compounds were published in December 2009 by the Environmental Industries Commission (EIC), the Association of Geotechnical and Geoenvironmental Specialists (AGS) and CL:AIRE. These GAC values have been derived in the same vein as SGVs and are intended to be used in the same manner. Additionally, the GAC values have been produced for varying soil organic matter content (i.e. 1%, 2.5% and 6%).

### 10.3 Statistical analysis

10.3.1 Statistical analysis has been completed to identify if the data set for each substance tested contains outliers, has as normal or non-normal distribution and if there is significant evidence that the mean concentration, as defined by the 95% upper confidence level (UCL), is less than the adopted screening value. This process follows the CL:AIRE/CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008. Results from this statistical testing can be used to inform decisions on whether land is suitable for use under the land use planning system without mitigation to break identified pollutant linkages.

### 10.4 General Water Contamination Guidance

10.4.1 Concentrations of contaminants detected in groundwater have been compared to the UK Drinking Water Standards (UKDWS) encompassing the Water Supply (Water Quality) Regulations 1989 and Water Supply (Water Quality) Regulations 2000 where drinking water is the receptor. Where surface water is the receptor the Environment Agency Environmental Quality Standards (EQS) have also been used.

10.4.2 Where the UKDWS and EQS do not encompass contaminants of concern to human health, reference is made to other appropriate guidance. This includes the European Union Council Directives 98/83/EC and 75/440/EEC on the quality of water intended for human consumption and the quality required of surface water intended for the abstraction of drinking water respectively. Additional screening values are derived from the World Health Organisation (WHO) Guidelines for Drinking-water Quality (1984) and the Dutch Target and Intervention Values for Soil Remediation.

## 11 GENERIC QUANTITATIVE RISK ASSESSMENT

### 11.1 Soil Contamination Results

11.1.1 Soil samples taken from the site have been tested for potential chemicals of concern appropriate to the former land uses. As the proposed redevelopment is for residential housing with gardens, the most appropriate end use for assessment is that of residential with plant uptake. Results from the chemical testing have been evaluated with reference to each of the plausible receptors identified in the conceptual model. The results are evaluated differently for each receptor.

### 11.2 Human Health - occupiers

11.2.1 As the receptor is human health, the most relevant risk assessment model is the CLEA model. The model estimates child and adult exposures to soil contaminants for those potentially living, working and/or playing on contaminated sites over long time periods and has been used to produce the SGVs for the United Kingdom.

11.2.2 The principal pathways of concern for human health are dermal contact, ingestion, and inhalation. Generally, in the assessment of risk to site users, only samples taken in the top 1m are considered as contact with deeper samples is unlikely.

11.2.3 The geometric mean soil organic matter content at the site is 4.3%. Therefore GAC values derived using 2.5% SOM have been selected in this assessment. The pH of the soil ranged from 7.48 in TP305-0.4m to 8.73 in TP302-1.3m.

#### **Metals**

11.2.4 The mean concentration (95% UCL) for cadmium, chromium, copper, mercury, nickel, selenium, vanadium and zinc were below their respective GAC. Therefore, it may be considered that the concentrations of these substances in soil on site do not present a significant risk to long-term human health.

11.2.5 The upper bound values for arsenic at 133mg/kg and lead at 796mg/kg exceeded the relevant SGV or GAC of 32mg/kg and 450mg/kg. This would indicate that arsenic and lead within the soils on site may present a

significant risk to long-term human health and no statistical outlier concentrations were identified. Therefore lead and arsenic contamination may present a significant risk to long term human health without some form of mitigation.

11.2.6 Statistical analysis of the laboratory results is attached at Appendix XIII.

***Volatile Petroleum Hydrocarbons (VPH)***

11.2.7 Volatile Petroleum Hydrocarbons range (VPH) testing represents the short-chain length petroleum hydrocarbons detected within the carbon band range C5 to C10 and concentrations were recorded for both aliphatic and aromatic fractions.

11.2.8 All samples recorded low concentrations of petroleum hydrocarbons and no visual and olfactory evidence of petroleum hydrocarbons was noted.

11.2.9 The concentrations of short chain-length petroleum hydrocarbon fractions (C6-C10) were less than LOD or the adopted GAC. Therefore, the concentrations of volatile petroleum hydrocarbons are not considered to present a risk to long term human health.

***Extractable Petroleum Hydrocarbons (EPH)***

11.2.10 Extractable Petroleum Hydrocarbons (EPH) range testing represent the medium to long chain length petroleum hydrocarbons detected within the carbon band range C10 to C44 and concentrations were recorded for both aliphatic and aromatic fractions.

11.2.11 The site investigation identified no visual or olfactory evidence of petroleum hydrocarbons. The concentrations of medium to long chain-length petroleum hydrocarbon fractions (C10-C44) ranged from 354mg/kg to 2150mg/kg in TP305-0.4m and TP.303-0.2m. All recorded concentrations were at or less than the adopted GAC. Therefore, TPH contamination is considered unlikely to present a significant risk to long term human health at the site.

***Semi-Volatile Organic Compounds (SVOC) and Polycyclic Aromatic Hydrocarbons (PAH)***

11.2.12 The mean concentrations (95% UCL) for most PAH compounds analysed (naphthalene, acenaphthylene, acenaphthene, fluorene,

phenanthrene, anthracene, fluoranthene, pyrene, and benzo(ghi)perylene) were below their respective GAC. Therefore, these PAHs are unlikely to present a significant risk to long term human health.

11.2.13 The mean concentrations (95% UCL) for the PAH compounds benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene indeno(123cd)pyrene and dibenz(ah)anthracene were above their respective GAC. These elevated PAH concentrations were recorded in TP301-1.8m, TP302-0.7m, TP303-0.2m, TP305-0.4m and TP306-0.6m.

11.2.14 The elevated concentrations are not assumed to be localised hotspots and may present a potential significant risk to long-term human health at the site without some form of mitigation.

11.2.15 PAH compounds are typically formed as a result of pyrolytic processes, especially the incomplete combustion of organic materials. The origin of the elevated concentrations of PAH is thought to be ash and clinker observed in parts of the made ground underlying the majority of the site. As such, the highest PAH concentrations were reported in trial pits where traces of ash and clinker were identified.

| Table XI – PAH Soil Exceedances |                                         |                                                   |                                     |
|---------------------------------|-----------------------------------------|---------------------------------------------------|-------------------------------------|
| Substance                       | Number of Individual Sample Exceedances | Mean Concentration (95% Confidence Level) (mg/kg) | Generic Assessment Criteria (mg/kg) |
| Acenaphthene                    | 0                                       | 0.261                                             | 480                                 |
| Acenaphthylene                  | 0                                       | 1.026                                             | 400                                 |
| Anthracene                      | 0                                       | 1.892                                             | 4900                                |
| Benzo(a)anthracene              | 3                                       | 15.059                                            | 4.7                                 |
| Benzo(a)pyrene                  | 5                                       | 15.496                                            | 0.94                                |
| Benzo(b)fluoranthene            | 2                                       | 7.482                                             | 6.5                                 |
| Benzo(ghi)perylene              | 0                                       | 5.070                                             | 46                                  |
| Benzo(k)fluoranthene            | 1                                       | 10.586                                            | 9.6                                 |
| Chrysene                        | 1                                       | 13.051                                            | 8                                   |

| Table XI – PAH Soil Exceedances |                                         |                                                   |                                     |
|---------------------------------|-----------------------------------------|---------------------------------------------------|-------------------------------------|
| Substance                       | Number of Individual Sample Exceedances | Mean Concentration (95% Confidence Level) (mg/kg) | Generic Assessment Criteria (mg/kg) |
| Dibenzo(ah)anthracene           | 3                                       | 1.15                                              | 0.86                                |
| Fluoranthene                    | 0                                       | 16.475                                            | 460                                 |
| Fluorene                        | 0                                       | 0.423                                             | 380                                 |
| Indeno(123cd)pyrene             | 2                                       | 4.903                                             | 3.9                                 |
| Naphthalene                     | 0                                       | 1.482                                             | 3.7                                 |
| Phenanthrene                    | 0                                       | 6.037                                             | 200                                 |
| Pyrene                          | 0                                       | 14.443                                            | 1000                                |

11.2.16 Statistical analysis of the laboratory results is attached at Appendix XIII.

#### ***Volatile Organic Compounds (VOC)***

11.2.17 The recorded concentrations of VOC were all below their respective limits of detection (LOD) or screening value. Therefore, these compounds are unlikely to present a significant risk to long term human health.

#### ***Polychlorinated Biphenyls (PCB)***

11.2.18 Concentrations of PCB (ICES 7) have been compared to their respective screening values. None of the samples tested contained concentrations of PCB above their limit of detection or screening value. Therefore, these compounds are unlikely to present a significant risk to long term human health.

#### ***Other Substances***

11.2.19 Statistical analysis for monohydric phenol, total cyanide and sulphide was carried out to identify the 95% confidence limits of the measured mean and to compare the upper 95th percentile with the respective screening criteria.

11.2.20 The upper bound values (US95) for phenol, cyanide and sulphide were below their respective screening values. Therefore, it may be considered that the concentrations of these substances in soil on site do not present a significant risk to long-term human health.

11.2.21 Statistical analysis of the laboratory results is attached at Appendix XIII.

### **Asbestos**

11.2.22 Guidance on the need for asbestos surveys and the method of carrying them out are given in HSE Publication HSG264.

11.2.23 Three samples were screened for asbestos and no fibres were detected. In addition, no visual evidence of asbestos was recorded during site investigation works. However, in a forth sample Chrysotile fibres were detected (TP301-0.5m). Therefore, asbestos contamination may pose a risk to future site occupiers or construction workers in the area of TP301 without some form of mitigation. Asbestos containing material within made ground in the vicinity of the TP301 should be remediated if groundworks are proposed in this area.

## **11.3 Human Health – Construction Workers**

11.3.1 The CLEA Soil Guideline Values only apply to the protection of health for long term chronic exposure. Construction workers are more likely to be at risk from a high single exposure, i.e. an acute dose, which can result in contaminant poisoning. Suggested values for acute lethal doses of arsenic, cadmium, chromium, inorganic mercury, nickel and selenium is outlined in the Environment Agency R&D SGV reports from 2002.

11.3.2 None of the samples contained concentrations of cadmium, chromium, inorganic mercury, nickel or selenium that are elevated with respects to an acute lethal dose.

11.3.3 No acute lethal dose value was given for lead in its now withdrawn SGV report. The concentration of lead (1380mg/kg) in TP305-0.4m could be significant with respect to an acute lethal dose. Appropriate Personal Protective Equipment (PPE) to minimise soil ingestion should be employed when working in this area and in general across the site.

#### 11.4 Ecology – Future Landscaped Areas

11.4.1 Ecological Soil Screening Levels (Eco-SSL) have been published by the USEPA for a range of metals. The Eco-SSLs present indicative values for assessing potential risk to plants and other ecological receptors. As no relevant UK guidance exists for assessing risk to ecology, the recorded metal concentrations have been compared on an individual basis to Eco-SSLs.

11.4.2 The mean concentration (95% UCL) for cadmium was below the Eco-SSLs for plants. Therefore, it may be considered that the concentration of cadmium in soil on site do not present a risk to sensitive plants.

11.4.3 The mean concentrations (95% UCL) for arsenic, copper, lead, nickel, selenium and zinc were above the Eco-SSLs for plants. Therefore, it may be considered that the concentrations of these elements may pose a risk to sensitive plant growth in future garden or landscaped areas.

#### 11.5 Groundwater Contamination Results

11.5.1 Groundwater was not sampled as the installed wells were dry. Therefore, our assessment of the risk to controlled waters can only be guided by the measured soil contamination and the analysis of soil samples submitted for leachate preparation. While leachate preparation is considered to be more aggressive than natural processes in the unsaturated zone, the results give a broadly representative estimate of the leachability of contaminants.

11.5.2 Elevated soil concentrations of arsenic, lead and PAHs in TP301-1.8m, TP305-0.4 and TP306-0.6m suggests that groundwater contamination by arsenic, lead and PAHs may be a potential risk to the environment.

11.5.3 Leachate samples were obtained from two soil samples (TP305-0.4m and TP306-0.6m) containing abundant ash and high concentrations of potential contaminants. The leachate samples were analysed for metals and PAH compounds to aid the assessment of potential risk to groundwater.

11.5.4 As surface water is considered the principal receptor for metal and PAH contamination, reference has been made to UK and EU Environmental Standards or UKDWS where no Environmental Standards are available.

#### ***Metals, Semi-Metals and Metalloids***

11.5.5 Most of the recorded leachate concentrations for metals were either below their LOD or their Environmental Standard values (based on moderate water hardness). Therefore, the majority of the recorded metal concentrations are not considered to pose a significant risk to groundwater.

11.5.6 However, elevated concentrations of total chromium and hexavalent chromium were recorded in one leachate sample from TP306-0.6m at 35.7µg/l and 46µg/l respectively. The recorded concentrations may present a potential risk to controlled waters but the site is considered to have a low environmental sensitivity and the overall risk is therefore considered to be low.

#### ***Polycyclic Aromatic Hydrocarbons (PAH)***

11.5.7 For the purposes of this risk assessment, benzo(a)pyrene and dibenzo(a,h)anthracene are considered to be the most carcinogenic PAH compound and naphthalene is considered to be the most mobile PAH. These compounds have been used as surrogates to assess the degree of risk posed by PAH compounds to groundwater and surface water.

11.5.8 The leachable concentrations of benzo(a)pyrene ranged from <0.009µg/l in TP306-0.6m to 0.0161µg/l in TP305-0.4m and are below the EQS of 0.05µg/l.

11.5.9 The leachable concentrations of dibenzo(a,h)anthracene was below the limit of detection at <0.16µg/l.

11.5.10 The leachable concentrations of naphthalene was below the limit of detection at <0.1µg/l and below the EQS of 2.4µg/l.

11.5.11 Therefore, the recorded concentrations of PAHs in the leachate samples are not considered to present a significant risk to controlled waters.

11.5.12 The concentrations of PAHs in soil samples and two leachate sample are not considered to present a risk to controlled waters given the site is considered to have a low environmental sensitivity and the overall risk is considered to be low.

#### **11.6 Ground Gas**

11.6.1 The ground gas assessment has been undertaken using both the NHBC Traffic light assessment for low rise housing constructed with a ventilated

underfloor void (CIRIA 665 Situation B) as well as the Wilson and Card classification for all other development types (CIRIA 665 Situation A).

11.6.2 The NHBC 'Traffic Lights' ground gas assessment is a risk-based approach that is designed to allow quick and easy design of gas protection for a low-rise housing development by comparing the measured gas emission rates to generic Traffic Lights. The Traffic Lights include 'Typical Maximum Concentrations' and risk-based Gas Screening Values (GSVs) that can be compared with measured data and calculated GSVs (See Table IX below).

11.6.3 The GSVs are also used in the Wilson and Card classification and equate to the borehole gas volume flow rate, as defined by Wilson and Card as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered. The calculations are applicable to both methane and carbon dioxide and a worst case maximum flow rate and maximum concentration is used to calculate the GSV.

| Table XII – NHBC Traffic Light Gas Assessment |                                      |                            |                                      |                            |
|-----------------------------------------------|--------------------------------------|----------------------------|--------------------------------------|----------------------------|
| Traffic Light Classification                  | Methane                              |                            | Carbon Dioxide                       |                            |
|                                               | Typical Maximum Concentration (%v/v) | Gas Screening Value (l/hr) | Typical Maximum Concentration (%v/v) | Gas Screening Value (l/hr) |
| Green                                         |                                      |                            |                                      |                            |
|                                               | 1                                    | 0.16                       | 5                                    | 0.78                       |
| Amber 1                                       |                                      |                            |                                      |                            |
|                                               | 5                                    | 0.63                       | 10                                   | 1.56                       |
| Amber 2                                       |                                      |                            |                                      |                            |
|                                               | 20                                   | 1.56                       | 30                                   | 3.10                       |
| Red                                           |                                      |                            |                                      |                            |
|                                               |                                      |                            |                                      |                            |

11.6.4 Three gas monitoring visits have been carried out to date. No methane was detected on any of these visits. Carbon dioxide was detected to a maximum concentration of 2.4%. Flow rates for the borehole ranged between 0.0 and 0.1 l/hr. Barometric pressures ranged from 977mb to 997mb.

11.6.5 Using the Wilson and Card classification system (CIRIA 665 Situation A) and based on the current monitoring results, a GSV of 0.0024 l/hr has been calculated. This corresponds to a Characteristic Situation 1. This assessment is subject to confirmation following the results of the remaining monitoring visits.

#### ***Ground Gas Protection Measures***

11.6.6 The conceptual site model and gas monitoring data indicates the ground conditions are classified as Characteristic Situation 1. Therefore, no special precautions are required. This assessment is subject to confirmation once the remaining gas monitoring visits have been carried out.

11.6.7 Full gas monitoring results are included at Appendix XIV and a summary of this data is included below in Table XIII.

| Table XIII |                      |           |                     |                     |             |                      |
|------------|----------------------|-----------|---------------------|---------------------|-------------|----------------------|
| Bore-hole  | Response Zone/Strata | No. Tests | CO <sub>2</sub> (%) | CH <sub>4</sub> (%) | Flow (l/hr) | Atmospheric Pressure |
| BH01       | MG                   | 3         | 0-2.4               | 0                   | 0.0-0.1     | 977-997              |

#### **11.7 Building Materials**

##### ***Concrete***

11.7.1 Chemical attack of concrete is influenced by several factors including the concentration and solubility of the substance, the groundwater Table and the pH of the groundwater.

11.7.2 Concrete is in particular at risk from acidic groundwater and elevated concentrations of sulphates and chlorides in soil and groundwater. Sulphate reacts with the minerals (e.g. calcium hydroxide) within the cement which causes a breakdown in the structure of the concrete. Chloride attack tends to be significant with regards the corrosion of reinforcing steel leading to deterioration of the concrete.

11.7.3 Concentrations of total sulphate were measured in order to indicate the potential for concrete attack. Concentrations on site ranged between 0.0223% and 0.291% indicating that there is potential for concrete attack on site.

11.7.4 Results from sulphate (2:1 extract) for materials on site ranged between 0.0532g/l and 0.651g/l. These results indicate that a design sulphate class of DS-2 and Aggressive Chemical for Concrete (ACEC) class of AC-1 may be appropriate for the site. Relevant guidelines are given in BRE Special Digest 1: Concrete in Aggressive Ground.

#### ***Water Supply Pipes***

11.7.5 Permeation and accelerated deterioration of pipe material can occur due to chemical reactions between the pipe and contaminants in the ground in which it is laid. This can lead to premature failures resulting in leakage and loss of water quality.

11.7.6 The Water Supply (Water Quality) Regulations in England and Wales, the Byelaws in Scotland and the Northern Ireland Water Regulations include a requirement to use only suitable materials when laying water pipes and the laying of unprotected water supply pipes through contaminated land is not permitted.

11.7.7 A Table of threshold values for various contaminants has been produced by UKWIR in their report *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (ref: 10/WM/03/21). These threshold values allow an assessor to select an appropriate pipe material where the contaminant concentrations are below the threshold values.

11.7.8 The selection of an appropriate pipe material based on the worst case (maximum) contaminant concentrations at the site is presented below in Table XIII. Based on the available chemical test results, it is recommended that barrier pipe is used for water supply to the site. Further information regarding the selection of materials for water supply pipes is given in the *UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites*.

| TABLE XIV – UKWIR Pipe Material and Threshold Value (mg/kg) |                           |      |       |                         |               |                      |        |
|-------------------------------------------------------------|---------------------------|------|-------|-------------------------|---------------|----------------------|--------|
| Contaminant                                                 | Max / Range Concentration | PE   | PVC   | Barrier Pipe (PE-AL-PE) | Wrapped Steel | Wrapped Ductile Iron | Copper |
| VOC's                                                       | 0.073 mg/kg               | 0.5  | 0.125 | Pass                    | Pass          | Pass                 | Pass   |
| BTEX +MTBE                                                  | 1.29 mg/kg                | 0.1  | 0.03  | Pass                    | Pass          | Pass                 | Pass   |
| SVOC's including aliphatic and aromatic fraction C5-C10)    | 177 mg/kg                 | 2    | 1.4   | Pass                    | Pass          | Pass                 | Pass   |
| Phenols                                                     | <0.035 mg/kg              | 2    | 0.4   | Pass                    | Pass          | Pass                 | Pass   |
| Mineral Oil C11-C20                                         | 788 mg/kg                 | 10   | Pass  | Pass                    | Pass          | Pass                 | Pass   |
| Mineral Oil C21-C40                                         | 1215.6 mg/kg              | 500  | Pass  | Pass                    | Pass          | Pass                 | Pass   |
| Corrosive (conductivity, redox and pH)                      | 7.48 ~ 8.84 pH range      | Pass | Pass  | Pass                    | Pass          | Pass                 | Fail   |
| Nitrobenzene                                                | <0.1                      | 0.5  | 0.4   | Pass                    | Pass          | Pass                 | Pass   |
| Preferred Pipe Type                                         |                           | -    | -     | ✓                       | ✓             | ✓                    | -      |

## 12 GEOTECHNICAL RESULTS

12.1.1 Site investigation works have identified a significant thickness (up to 6.4m) of made ground across the extension area investigated. This is underlain by natural deposits of weathered coal measures.

12.1.2 In total, 12 samples of made ground and natural superficial material were collected from various depths and tested for range of geotechnical parameters including:

- Moisture content;
- Particle Size Distribution; and
- Atterberg Limits.

12.1.3 All tests were performed in accredited geotechnical laboratory and in accordance with the appropriate British Standard. Geotechnical Laboratory results are attached at Appendix XV.

### 12.2 Made Ground

12.2.1 The made ground encountered on site consisted of two main horizons. The first horizon was described as loose, black, very sandy gravel or very gravelly sand. The gravel fraction in this horizon consisted of a number of constituents including brick, limestone aggregate, ceramic and bottle fragments, shale, animal bone, ash and clinker. The second horizon was described as firm to stiff, greyish brown or brownish grey, slightly sandy, slightly cobbly, gravelly clay. The gravel fraction in this horizon consisted of brick and sandstone.

12.2.2 The first of these horizons was present in all locations in variable thicknesses (0.15m to 6.0m). The second horizon was present in a number of locations underlying the first. However, in TP303 these units were interbedded with horizon one reoccurring beneath horizon two.

12.2.3 6 No. samples of made ground were sent to the laboratory for analysis. Four samples were from horizon one and comprised either dark grey very sandy very silty gravel or dark brown slightly gravelly sand. Two samples were from horizon two and were described by the laboratory as brown mottled grey very gravelly very sandy clay.

### ***Cohesive material***

#### ***Particle Size Distribution Test***

12.2.4 A Particle Size Distribution test was performed on one of the samples from the clayey made ground. The results are shown in table XV.

| Table XV: PSD Clayey Made Ground |                  |
|----------------------------------|------------------|
| Soil Fraction                    | Total Percentage |
| Cobbles                          | 0                |
| Gravel                           | 33               |
| Sand                             | 18               |
| Silt/Clay                        | 49               |

#### ***Moisture Content***

12.2.5 Two samples were tested for natural moisture content and the results showed consistent values of 20% (TP302, 1.4m) and 22% (TP304, 1.0m).

#### ***Atterberg Limits***

12.2.6 Both samples determined intermediate plasticity with a plasticity index (PI) of 18% (TP302, 1.4m) and 22% (TP304, 1.0m).

### ***Granular Layers***

#### ***Particle Size Distribution Test***

12.2.7 Particle Size Distribution tests were performed on two samples from the gravelly made ground. The range in quantities of each soil fraction is shown in Table XVI.

| Table XVI: PSD Sandy Made Ground |                  |
|----------------------------------|------------------|
| Soil Fraction                    | Total Percentage |
| Cobbles                          | 0                |
| Gravel                           | 46 - 48          |
| Sand                             | 30 - 35          |
| Silt/Clay                        | 19 - 22          |

### *Moisture Content*

12.2.8 Moisture content was tested in three samples of the gravelly made ground. Results ranged from 21% (BH1, 0.5-1.2m) to 26% (BH2, 1.0 – 2.0m).

### **12.3 Natural Deposits**

12.3.1 The natural materials encountered during the intrusive investigation comprised a 1.6m thickness of firm to stiff, orange-brown mottled grey, locally slightly gravelly clay. The gravel fraction consisted of mudstone and coal.

12.3.2 3 No. samples representing the natural deposits were sent to the geotechnical laboratory. The natural deposits were described as brown mottled grey gravelly clay, grey mottled brown gravelly slightly sandy very silty clay and brown sandy clay.

### *PSD results*

12.3.3 A Particle Size Distribution test was performed on one of the samples (BH1, 4.8 – 5.8m). The results are shown in Table XVII.

| Table XVII: PSD Weathered Ironstone |                  |
|-------------------------------------|------------------|
| Soil Fraction                       | Total Percentage |
| Cobbles                             | 0                |
| Gravel                              | 15               |
| Sand                                | 6                |
| Silt/Clay                           | 79               |

#### *Moisture content*

12.3.4 Moisture content was tested in three samples and results of 19% (BH1, 4.4m), 24% (BH1, 4.8-5.8m) and 33% (BH2, 6.4m) were obtained.

#### *Atterberg Limits*

12.3.5 Three samples from the natural strata were tested for determination of Atterberg limits. Two samples were determined as high plasticity with a plasticity index of 32% (BH1, 4.8-5.8m) and 27% (BH2, 6.4m). One sample was determined as an intermediate plasticity material with a plasticity index (PI) of 22% (BH1, 4.4m).

### **12.4 Rockhead**

12.4.1 Rockhead was encountered at both borehole locations during the intrusive investigation and consisted of a weathered, grey/brown mudstone that became increasingly strong with depth. This unit was interpreted as the weathering profile of the Lower Coal Measures geology.

12.4.2 Three samples representing the weathered solid strata were collected.

#### *Moisture content*

12.4.3 Moisture content was tested in three samples and results of 9.7% (BH2, 7.6m), 9.5% (BH2, 8.3m) and 6.4% (BH2, 9.2m) were obtained.

#### *Atterberg Limits*

12.4.4 One sample was scheduled for Atterberg limits. However, the sample (BH2, 7.6m) was found to be non plastic.

### **12.5 Standard Penetration Testing**

12.5.1 In addition to laboratory geotechnical testing, in situ standard penetration tests were carried out during the site investigation and the results are summarised in the Table XVIII.

| Table XVIII: Results for Standard Penetration Tests |         |      |         |      |
|-----------------------------------------------------|---------|------|---------|------|
| Depth                                               | BH1     |      | BH2     |      |
|                                                     | N-value | Geol | N-value | Geol |
| 0.5                                                 | 12      | MG   | 9       | MG   |
| 1.5                                                 | 9       | MG   | 9       | MG   |
| 2.5                                                 | 15      | MG   | 6       | MG   |
| 3.5                                                 | 50      | MG   | 12      | MG   |
| 4.5                                                 |         |      | 9       | MG   |
| 4.8                                                 | 43      | C    |         |      |
| 5.5                                                 |         |      | 14      | MG   |
| 5.8                                                 | 50      | C    |         |      |
| 6.5                                                 | 37      | CM   |         |      |
| 6.7                                                 |         |      | 24      | C    |
| 7.7                                                 |         |      | 46      | C    |
| 8.5                                                 | 50      | CM   | 50      | CM   |
| 9.2                                                 |         |      | 50      | CM   |

KEY: MG – Made ground, C – Clay, CM – Coal Measures

12.5.2 The table shows that the majority of N-values within the made ground are low, ranging between 9 and 15. Refusal (N=50) was obtained during one test. However this is likely to be due to cobbles present in the ground. The drillers logs indicate sandstone to be present within the material at this depth. As the majority of N-values in the made ground are low this material can be considered to be generally poorly consolidated and weak.

12.5.3 The natural clays and weathered coal measures have considerably higher N-values which range between 24 and 50.

### 13 REVISED CONCEPTUAL SITE MODEL

13.1.1 A preliminary conceptual site model was presented in section 7. This outlined potential sources, pathways and receptors and was based on information provided by statutory sources and observations during the site visit. As the conceptual model was largely based on desk study information a number of uncertainties in the conceptual model existed. These have been revised and an updated CSM is presented below in Table XIX.

| TABLE XIX                                 |                                                               |                                                  |                 |
|-------------------------------------------|---------------------------------------------------------------|--------------------------------------------------|-----------------|
| Source                                    | Pathway                                                       | Receptor                                         | Risk            |
| Leachable chromium in soil                | Infiltration                                                  | Minor Aquifer and Open Watercourse               | Low             |
|                                           | Lateral migration                                             |                                                  |                 |
| Arsenic, lead, PAHs in soil               | Ingestion of soil                                             | Construction workers and Future occupiers        | Low to Moderate |
|                                           | Dermal contact with soil and inhalation of soil derived dusts | Construction workers and Future occupiers        | Low to Moderate |
| Asbestos containing material in soil      | Disturbance and Inhalation.                                   | Construction workers                             | Low to Moderate |
| Ground gases (carbon dioxide and methane) | Lateral and vertical migration of gases and inhalation        | Construction workers and Future occupiers        | Low to Moderate |
| Invasive species (Japanese knotweed)      | Habitat degradation                                           | Subsurface building materials<br>Flora and Fauna | Low to Moderate |

## **14 ASSESSMENT OF REMEDIAL OPTIONS**

### **14.1 Introduction**

14.1.1 The following sections presents a summary of potential remediation options for contaminated ground beneath the site. Each option is briefly evaluated and only those considered appropriate are carried forward to the outline remediation strategy.

14.1.2 Potential remediation options for the contamination hotspot include:

- Bulk excavation of soil contaminated with asbestos fibres and burial at <1m bgl depth (but above the saturated zone) in areas of hardstanding;
- Bulk excavation and disposal to landfill of contaminated material or otherwise unsuitable material for retention on site;
- Use of a cover system; and
- Excavation and ex-situ on-site treatment by chemical, physical or thermal methods.

14.1.3 Remediation option 1 involving bulk excavation and burial of material at a depth of <1m bgl could be utilised to deal with the presence of asbestos which precludes most remediation methods.

14.1.4 Remediation option 2 involving bulk the adoption of a 'dig and dump' approach could address contamination issued concerning material that is not treatable (asbestos) or is not suitable for retention on site.

14.1.5 Remediation option 3 involving a cover system could be utilised in order to create a physical barrier between the contamination and the surface. In particular this would significantly prevent direct contact with relatively immobile metal and PAH contamination. Given the relatively low concentrations and low mobility of the identified contamination a 'break' layer or 'no dig' layer is not considered necessary.

14.1.6 Based on the maximum recorded contamination and guidance provided by BR465 (Cover systems for land regeneration, 2004) less than 600mm of cover would be required to protect residential land users. See Appendix XVI for the calculation worksheet.

14.1.7 Remediation option 4 involving chemical, physical or thermal treatments are not viable due to the relatively small volume of contaminated material and the presence of asbestos containing material.

## 14.2 Groundwater Treatment

14.2.1 Given the nature of the aquifer, the lack of groundwater abstractions in close proximity to the site and following the remedial treatment of the unsaturated zone the risk to groundwater from slightly elevated leachable chromium is considered to be low. Remediation of groundwater is not considered further.

## 14.3 Summary

14.3.1 The remediation approach is expected to; a) maximise the benefit of remediation using best practice and robust methods not entailing excessive cost, and b) minimise the negative environmental impacts of the remediation itself.

### *Gardens*

14.3.2 It is considered that the adoption of a simple 600mm thick cover system in areas of residential gardens will address the minor risk to human health from relatively low metal and PAH concentrations in made ground at the site.

### *Soil Asbestos Hotspot*

14.3.3 In addition to the above it is considered that excavation of soil containing asbestos fibres and either off-site disposal to landfill or burial of the material at a depth of <1mbgl is required.

## **15 OUTLINE REMEDIATION STRATEGY**

### **15.1 Outline of Proposed Remediation Strategy**

15.1.1 Whilst the risk assessment was completed in accordance with standard practices and Environment Agency guidelines, the models used are conservative and professional judgement is required to determine remedial requirements. Therefore, it is recommended that prior to redevelopment, a 'reasonable' approach for remediation is agreed with the regulatory authorities.

15.1.2 This remediation outline proposal is for discussion only and does not include any site development issues including those issues associated with temporary or permanent site drainage, building or geotechnical requirements. On the basis of consideration of the issues highlighted in this report the following outline remediation scheme is proposed:

1. Agree the final scheme with the regulators. Determine phasing and programming with respect to the issues of practicalities, cost and technical issues.
2. Off-site disposal or burial at a depth of <1m of material not required to maintain site levels or is not treatable. It would be prudent to dispose of unsuitable materials preferentially to a licensed facility. Certain materials may require pre-treatment prior to disposal.
3. If necessary, importation and validation of inert fill to form a base beneath buildings, roads and parking areas to compensate for material removed from site.
4. Importation and validation of inert fill and topsoil to form a cover layer 600mm thick beneath areas of gardens.

### **15.2 Unidentified Contamination**

15.2.1 In the event of significant unexpected contamination being encountered, the works should be halted until:

- A suitably qualified person is able to assess the situation;
- The regulatory authorities are consulted; and
- An agreed plan is put in place to deal with the contamination.

### 15.3 Monitoring and Validation

15.3.1 The proposed strategy for monitoring and validation is discussed below and summarised in Table XX. All monitoring, sampling and reporting should be undertaken by experienced and suitably qualified consultant.

| Table XX - Outline of Proposed Monitoring and Validation |                      |                                                                                                              |                                                           |
|----------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Material                                                 |                      | No. Samples                                                                                                  | Rationale                                                 |
| Imported Material                                        | Prior to remediation | -                                                                                                            | To validate the imported material prior to redevelopment. |
|                                                          | Post remediation     | 1 sample per 250m <sup>3</sup> if homogenous or 1 sample per 100m <sup>3</sup> if relatively inhomogeneous   |                                                           |
| Excavations                                              | Prior to remediation | Previously constrained                                                                                       | To validate the material prior to redevelopment           |
|                                                          | During remediation   | Validation sample every 15m along the edge of the excavation and on a 15m grid on the base of the excavation |                                                           |
| Excavated Material deposited <1m bgl                     | Prior to remediation | Previously constrained                                                                                       | To validate the material prior to reuse.                  |
|                                                          | Post remediation     | 1 sample per 500m <sup>3</sup> if homogenous or 1 sample per 250m <sup>3</sup> if relatively inhomogeneous   |                                                           |

#### **15.4 Validation of Excavated Material**

15.4.1 Validation sampling should be undertaken on the base and sides of the excavation and on the excavated material destined for burial at a depth <1mbgl. Any material destined for off-site disposal should be classified as waste under Duty of Care requirements and Landfill Regulations where appropriate.

#### **15.5 Validation of Imported Material**

15.5.1 Clean fill and topsoil will need to be imported on to the site as part of a cover system in areas of gardens and landscaping. The origins and characteristics of the material should be documented in the validation report.

#### **15.6 Validation Report**

15.6.1 A validation report detailing the results of the remediation work should be prepared on the completion of the site works. The report will include the description of the works and the extent of the excavations. Results of the imported material should demonstrate that groundwater quality has not deteriorated.

15.6.2 The validation report should be submitted to the relevant authorities.

## **16 CONCLUSIONS AND RECOMMENDATIONS**

### **16.1 General**

16.1.1 The site history, summarised from Section 2 indicates that the site was had a clay pit associated with an adjacent brick works which was later infilled with waste and developed for light industrial use/depot in the 1960s'.

16.1.2 A total of 6 trial pits (to approximately 3.5m bgl depth) and 2 shell and auger boreholes to a nominal depth of 10m bgl were completed. Eight soil samples from across the site were tested for a suite of potential chemicals of concern comprising: aliphatic, aromatic and polyaromatic hydrocarbons; metals and other inorganic elements.

### **16.2 Human Health**

16.2.1 Analytical results were analysed using CLEA methodology to assess the risk to human health in a residential scenario. The results for arsenic, lead and PAHs indicate that these compounds present a potential risk to future occupiers and/or construction workers.

16.2.2 Asbestos fibres and lead concentrations were detected at levels that were significantly elevated with respect to appropriate screening values. Where possible the groundworks on site should be designed and planned to minimise the exposure of workers to contaminated soil. This should be taken into account in the Health and Safety plan under the CDM regulations. Where risks cannot be removed entirely at this planning stage, mitigation measures should include the use of personal protective clothing (PPE) including gloves and respiratory facemasks. Dust suppression measures should also be incorporated into the works to reduce ingestion and inhalation of contaminated dust. Decontamination facilities should be provided during the site works.

### **16.3 Surface Water and Groundwater**

16.3.1 The risk to surface and groundwater is considered to be low, given the nature of the aquifer, the lack of groundwater abstractions in close proximity to the site and following the remedial treatment of the unsaturated zone.

### **16.4 Buildings and Property**

16.4.1 Results from sulphate (2:1 extract) testing indicate that a design sulphate class of DS-2 and Aggressive Chemical for Concrete (ACEC) class of AC-1 may be appropriate for the site.

16.4.2 Gas monitoring to date has indicated the presence of low concentrations of carbon dioxide (max 2.4% v/v). No methane was detected on the site during the three visits conducted thus far. Based on these results the site can be considered as Characteristic Situation 1 and no gas protection measures are required. This assessment will be subject to confirmation following completion of the gas monitoring.

16.4.3 The phytotoxic metals arsenic, copper, nickel, lead and zinc are present at elevated concentrations that present a potential risk to sensitive plants.

## 16.5 Geotechnical

16.5.1 The results of the geotechnical testing suggest that the made ground is loose over the majority of the site with large cobbles within the made ground at random locations. The majority of the made ground has a significant granular content bound with a silty clay matrix. Moisture contents are moderate and the materials are of low to intermediate plasticity.

16.5.2 In its current condition the made ground is unsuitable as a founding stratum for housing or other forms of development which are sensitive to either total or differential settlement. However, the nature of the made ground suggests that it will be suitable for ground improvement using vibro-stone columns as has been done on other areas of the site. It is clear from other areas of the site that the use of this technique significantly improves the quality of the made ground and allows the use of conventional strip footings for house construction. Specialist contractors should be consulted to ensure that the ground improvement is carried out correctly and that the appropriate testing regime is in place to confirm the suitability of the improved ground for foundation construction.

16.5.3 The made ground would also be suitable for excavation and recompaction where necessary.

16.5.4 Where construction loads greater than conventional housing are required to be supported it may be necessary to use a piled foundation solution. Piles should be carried to the underlying Mudstone strata. The design of the piles will depend on the nature of the loading and the requirements of the proposed structure.

## 16.6 Coal Mining

16.6.1 Shallow coal workings have been identified on site at 30.2-33.0m bgl (Previous investigation by Sirius – Appendix IV) and therefore the site will need further investigation and potentially stabilisation. This can be carried out as an extension of the previous works to the west and can use the same methodology of an investigation grid followed by stabilisation as necessary.

16.6.2 There are no recorded mine shafts at the site.

## 16.7 Outline Remediation Strategy

16.7.1 The following outline remediation scheme is proposed:

1. Burial at a depth of <1mbgl or off-site disposal of unsuitable material or that is not treatable;
2. Importation and validation of inert fill and topsoil to form a cover layer 600mm thick beneath areas of gardens.
3. If required, importation and validation of inert fill to form a base beneath buildings, roads and parking areas to compensate for material removed from site.

16.7.2 Any material that is destined for importation or for off-site disposal should be classified as waste under Duty of Care requirements and Landfill Regulations.

## **APPENDIX I**

### **Standard Terms and Conditions and Limitations to Reports**

#### **STANDARD TERMS AND CONDITIONS AND LIMITATIONS TO REPORTS**

This report is provided for the stated purpose and for the sole use of the client. It is confidential to the client and his professional advisors and cannot be shown to any other party without prior written consent. Wardell Armstrong LLP accepts no responsibility whatsoever to any person other than the client.

The findings of this report are based upon information relating to the property supplied by the client or their agents. The information has been accepted and used in good faith and unless otherwise stated, no attempt has been made to verify the information supplied. Should any of these factors or information change then the conclusions of the report may need to be amended.

The findings and recommendations are considered to be valid and appropriate at the time of preparation and for the specific purpose or purposes intended. Wardell Armstrong LLP will not be liable if any findings are used by third parties, without the written agreement of the company, or if an interpretation is made and action taken without further consultation.

## **APPENDIX II**

### **Guidance on Contamination and Land Quality Statements**

## **CONTAMINATION**

### **Background**

In 1990 the Government published the Environmental Protection Act which amongst other matters introduced the concept of a public register of contaminated land. The relevant section (section 143) of the Act met with a great deal of criticism and concern and was not implemented. The possibility of such a register did however create and heighten concerns and awareness of contaminated land issues that remain to date.

In the following five years there was a great deal of discussion on this issue and in particular the Government issued a consultative paper entitled "Paying for the Past" in March 1994. The Government's conclusions from this exercise were published in November 1994 under the title "Framework for Contaminated Land". This document set out the Government's proposals for a machinery for dealing with contaminated land and liabilities. Many of the main elements of this proposal remain in the present strategy for assessing and solving contaminated land problems.

A number of important points were raised:

- there is a commitment to sustainable development and to the "polluter pays" principle.
- there is a commitment to the 'suitable for use' approach to the control and treatment of existing contamination. This approach identifies that remedial action should only be required where:
- the contamination poses unacceptable actual or potential risks to health or the environment; and
- there are appropriate and cost effective means available to do so, taking into account the actual or intended use of the site.

### **ENVIRONMENT AGENCY**

In order to regulate and offer guidance on issues of contaminated land the Government established the "Environment Agency". The Agency took over all the functions of the former National Rivers Authority (NRA), the Waste Regulation Authorities and Her Majesty's Inspectorate of Pollution as well as some of the functions of the Secretary of State for the Environment. It is part of the role of the Environment Agency to provide technical research and guidance in matters concerning contaminated land.

Although the need for a public register of contaminated land as set out in section 143 of the EPA 1990 has been repealed there remains within the now enacted Environment Act 1995 a role for Borough and District Councils in identifying and acting on land contamination. This has now been further defined and is outlined in the following guidance notes:

## **Summary Guidance Notes on the Implementation of Part IIA of the Environmental Protection Act 1990 – Contaminated Land**

### ***Introduction***

The following is intended as a general guide outlining the main issues that land and property owners and developers will have to consider with regards to the contaminated land regime, which came into force on 1 April 2000.

This is the first time that contaminated land issues in England have been brought under an integrated legislative framework. In addition to the Act it is also expected during the next few years to have clarification of such issues as specific guideline values for various contaminants along with mechanisms for quantitative risk assessment. The assessment techniques are likely to develop more clearly towards a health based risk assessment utilising the significance of toxicological and ecotoxicological parameters.

### ***Government Policy and Objectives of New Regime***

There are a number of important government policies and priorities underlying the Act. The first priority is to prevent the creation of new contamination by use of this Act and other controls such as Integrated Pollution Prevention and Control and Waste Management licensing. The second is to identify and remove unacceptable risks to human health and the environment. In addition there is a desire to bring contaminated land back into beneficial use whilst seeking to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable. These policy objectives are also underlain by the "suitable for use" approach to the remediation of contaminated land, which the Government considers is the most appropriate approach to achieving sustainable development. In essence the approach is not aiming at a "Garden of Eden" but a removal of unacceptable risks and a long term goal of reduction and progressive improvement in land quality.

The main objective underlying the introduction of the Part IIA Contaminated Land regime is to provide an improved system for the identification and remediation of land

where contamination is causing unacceptable risks to human health or the wider environment, assessed in the context of the current use and circumstances of the land.

The new regime broadly reflects the approaches already in place under the statutory nuisance regime and Part VII of the Water Resources Act 1991. The Government's primary objectives for introducing the new regime are:

1. to improve the focus and transparency of the controls, ensuring authorities take a strategic approach to problems of land contamination;
2. to enable all problems resulting from contamination to be handled as part of the same process; previously separate regulatory action was needed to protect human health and to protect the water environment;
3. to increase the consistency of approach taken by different authorities; and
4. to provide a more tailored regulatory mechanism, including liability rules, better able to reflect the complexity and range of circumstances found on individual sites.

In addition to providing a more secure basis for direct regulatory action, the Government considers that the improved clarity and consistency of the new regime, in comparison with its predecessors, is also likely to encourage voluntary remediation. This forms an important secondary objective for implementation of the Part IIA regime.

Companies who may be responsible for contamination, for example on land they currently own or on former production sites, will be able to assess the likely requirements of regulators acting under Part IIA. They will then be able to plan their own investment programmes to carry out remediation in advance of actual regulatory intervention.

Similarly, the Part IIA regime will assist in the recycling of previously developed land. The new regime cannot be used directly to require the redevelopment of land, only its remediation. However, the Government considers that implementation of the regime will assist developers by reducing uncertainties about so-called "residual liabilities", in particular the perceived risk of further regulatory intervention. In particular it will:

1. reinforce the "suitable for use" approach, enabling developers to design and implement appropriate and cost-effective remediation schemes as part of their redevelopment projects;

2. clarify the circumstances in which future regulatory intervention might be necessary (for example, if the initial remediation scheme proved not to be effective in the long term); and
3. set out the framework for statutory liabilities to pay for any further remediation, should that be necessary.

### ***"Suitable for Use" Approach***

This approach to dealing with contaminated land recognises that the risks presented by any given level of contamination will vary greatly on a site by site basis. The approach considers 3 elements:

1. ensuring that land is suitable for current use
2. (i.e. identifying unacceptable risks)
3. ensuring that land is made suitable for any new use, as planning permission is given for that new use (i.e. identify unacceptable risks to new use).

Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to current use or future use of the land for which planning permission is being sought (i.e. identify risk to specific uses)

### ***Main Feature of Regime***

There are two main players in the new regime with differing but complementary roles as set out in Table I below.

| TABLE I                                                                                                |                                                                                              |                                                                                                                    |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Local Authority Role                                                                                   | Environment Agency Role                                                                      | Remarks                                                                                                            |
| Enforcing Authorities for all contaminated land not designated as Special Sites.                       | Enforcing Authority for Special Sites.                                                       | Special Sites are to be designated by Local Authority Environment Agency based on descriptions in the regulations. |
| Identification and inspection of contaminated land.                                                    | Assist in identification of contaminated land particularly where water pollution is involved | A written strategy should have been published by July 2001 by each Local Authority.                                |
| Establish who should bear responsibility for remediation (appropriate person and proportion of costs). | Provide specific guidance e.g. toxicological data and assistance to Local Authorities        | This is likely to be complex in some situations of multiple pollutants and multiple substances.                    |

| TABLE I - continued                               |                                                |         |
|---------------------------------------------------|------------------------------------------------|---------|
| Local Authority Role                              | Environment Agency Role                        | Remarks |
| Issue remediation notices for contaminated sites. | Issue remediation notices for special sites.   |         |
| Hold a register of information.                   | Technical research.                            |         |
|                                                   | Publish periodic reports on contaminated land. |         |

This definition is: A strategic approach is designed to enable a Local Authority to identify, in a rational, ordered and efficient manner, the land which merits detailed individual inspection, identifying the most pressing and serious problems first and concentrating resources on the areas where contaminated land is most likely to be found. In developing a strategy many factors will apply such as the history of the area and the geological and hydrogeological aspects of the area. The strategic approach has been likened to a "land MOT" picking up those features of most importance.

#### **Definition of Contaminated Land/Risk Assessment**

Contaminated land has been defined for the first time under Part 11A EPA 1990. This definition is: Contaminated land is land which appears to the local authority to be in such a condition, by reason of substances in, or under the land, that significant harm is being caused, or there is a significant possibility of such harm being caused, or that pollution of controlled waters is being, or is likely to be, caused.

The definition of contaminated land is based upon the principles of risk assessment. Risk is defined as the probability of frequency of occurrence of a defined hazard and the magnitude of the consequences.

The statutory guidance uses the concept of a POLLUTANT LINKAGE – that is a linkage between a CONTAMINANT (source) and a RECEPTOR, by means of a PATHWAY. Detailed definitions and guidance are given with regard to types of receptor and significance of harm. A Local Authority in assessing and identifying contaminated land must therefore identify A SIGNIFICANT POLLUTANT LINKAGE.

A contaminant is a substance which is in, on or under the land and which has the potential to cause harm to a receptor or to cause pollution of controlled waters. A

receptor is a living organism, a group of living organisms, an ecological system, a piece of property or controlled water. A pathway is one or more routes or means by, or through, which a receptor is being or could be exposed to or affected by a contaminant.

A Local Authority will need to satisfy itself that both a pollutant linkage exists and that it is resulting in significant harm or there is significant possibility of significant harm to a receptor or pollution to controlled water is occurring or pollution may result. In assessing significance the Local Authority will look at the nature and degree of harm, susceptibility of the receptor and timescale associated with use.

A detailed definition of significant harm is provided which includes such areas as death, disease, birth defects, genetic mutation or serious injury to humans (Number of people, effect, intake and exposure to contaminant) irreversible adverse change to ecological systems (ecotoxicological properties), harm to species of special interest, crop damage, death and disease of livestock and pets, structural failure or substantial damage.

#### **Provision for Payment**

In general the responsibility for paying for remediation will, where feasible, follow the "polluter pays" principle. In the first instance, any person who caused or knowingly permitted the contaminating substance to be in, or under the land will be the appropriate person(s) to undertake the remediation and meet its costs. If it is not possible to find such a person, responsibility will pass to the current owner or occupier of the land (excluding water pollution sec 1.10).

#### **Appropriate Person**

Part 11A EPA defines two different categories (Class A and B) of Appropriate Person and sets out the circumstances in which persons may be responsible for remediation. The designation of the 'appropriate person' is classified as "any person, or any of the persons, who caused or knowingly permitted the substances, or any of the substances, by reason of which the contaminated land in question is such land to be in, on or under the land is an appropriate person. This person is a Class A person and as such the Polluter Pays. Where a Class A person cannot be found after reasonable enquiry then the owner or the occupier of the land (for the time being) becomes the appropriate person and is a Class B person.

### **Caused or Knowingly Permitted**

The test of 'causing' will require that the person concerned was involved in some active operation, or series of operations, to which the presence of the pollutant is attributable. Such involvement may also take the form of a failure to act in certain circumstances. The meaning of the term "knowingly permit" is likely to require both knowledge that the substances in question were in, on or under the land and the possession of the power to prevent such a substance being there. In the Government's view, the test would be met only where the person had the ability to take steps to prevent or remove that presence and had a reasonable opportunity to do so. This situation is likely to become particularly complex in some instances with multiple past polluters, owners and substances perhaps with varying significance of harm.

### **Planning**

Land contamination, or the possibility of it is a material consideration for the purposes of town and country planning. This means that the planning authority has to consider the potential implications of contamination both when it is developing structure or local plans and when it is considering individual applications for planning permission. Under the suitable for use approach, risks should be assessed and remediation requirements set, on the basis of both the current use and circumstances of the land and its proposed new use. It is intended, by DETR, to prepare further guidance on land contamination, which will amplify the guidance in PPG 23, explain the interface with Part IIA EPA from a planning perspective, and provide planning authorities with technical and practical advice on land contamination.

### **Water Resources Act 1991**

Whilst not part of the EPA Part IIA this Act should not be forgotten. This allows an enforcement mechanism by way of a works notice served under section 161A. This is served on any person who has "caused or knowingly permitted" the potential pollutants to be in place from which it is likely to enter controlled water, or to have caused or knowingly permitted a pollutant to enter controlled waters. This is particularly appropriate for historic pollution of groundwater where the Part 11A regime does not apply. The first successful prosecution under section 161A has already occurred.

### **Other Matters**

The importance of contamination and other environmental issues and liabilities may also need to be addressed with regard to such areas as Accountancy rules (FRS 12) which

deals with provisions for contingent liabilities and also the regulations that will apply to Integrated Pollution Prevention and Control (IPPC) which will mean that baseline information regarding the status of land will be required with each permit application. Permit holders will not be able to pollute the land whilst the permit is in operation and will have to clean up to the state the land was in prior to the IPPC permit on cessation of works.

## LAND QUALITY STATEMENTS

In February 1995 and in recognition of the growing need for some form of land assessment the RICS published guidance notes for Chartered Surveyors in dealing with land contamination. This guidance was further enhanced and widened with publication of "Contamination and its implications for Chartered Surveyors" in September 1997.

The RICS promoted the concept of Land Quality Statement (LQS) as the written output of an environmental risk assessment. Originally the LQS was used to identify the environmental characteristics of a site which was the subject of a planning application but its use has now expanded into a more generic role. The LQS is now routinely used by developers, purchasers, funding institutions and other professional advisers.

Wardell Armstrong produce the LQS as the first stage in the process of identifying the environmental and technical constraints affecting a site according to the proposed future use.

The LQS should generally fulfil the following:

- categorise the site according to its environmental risk;
- reassure potential purchasers about the environmental risk of a site;
- assist a vendor by removing or confirming concerns about the quality of land and its impact on sale;
- provide insurance companies with the information that is required to underwrite environmental risk;
- reassure lenders or investors about the environmental quality of land used for security or investment;
- assess the impact of environmental factors on development proposals; and
- where necessary, define the scope of a site investigation and risk assessment for the current or intended future use of the land.

The Wardell Armstrong LQS will typically assess the following:

- the current and former uses of the site and its environs in order to identify contaminative uses;
- the geological conditions pertaining to the site;
- the mining context of the site and standard Coal Authority Mining report (where applicable);

- natural cavities database search (where appropriate);
- the hydrogeological setting of the site;
- site walkover survey;
- enquiries to the Environment Agency concerning recorded landfills and water pollution incidents; and
- any other readily accessible information relevant to the context of the site.

The majority of site contamination has been caused since the beginning of the industrial revolution. A schedule of past uses which may have caused contamination is attached to the report as applicable.

## APPENDIX III

### Sources of Information

The following principal sources of information have been consulted in the preparation of this report:

- Landmark Envirocheck report 29 September 2010 (*a review of information provided by Landmark Information Group Ltd who were commissioned to provide an "Envirocheck" report consisting of published historical plans, environmental data sheets and environmental sensitivity plans;*
- Ordnance Survey County and National Grid Series Plans;
- British Geological Survey published maps and memoirs;
- Environment Agency/NRA Groundwater Vulnerability Map Series;
- Coal Authority.

## APPENDIX IV

### Sirius Report



Sirius Geotechnical & Environmental Ltd  
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Mark Bray  
Bellway Homes  
2 Deighton Close  
Wetherby  
LS22 7GZ

Date: 12<sup>th</sup> August 2010  
Our Ref: C3934/4139/DCB

Dear Mark,

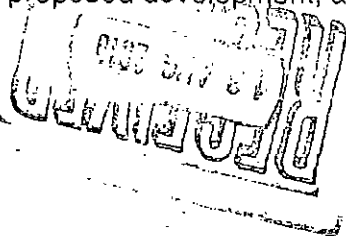
**C3934 – Former Polar Ford Garage, Dodworth Road, Barnsley –  
Additional Site Investigation Works**

### 1.0 Introduction

This report has been prepared for the use of Bellway Homes and their representatives. No other third party may rely upon or reproduce the contents of this report without the written approval of Sirius. If any unauthorised third party comes into possession of this report they rely on it at their own risk and the authors do not owe them any Duty of Care or Skill.

It is understood that it is proposed to develop the site with a residential housing development to incorporate two to three storey housing, access roads and associated landscaping. Detailed proposals for the redevelopment are not yet available.

Sirius Geotechnical and Environmental Ltd (Sirius) has undertaken a preliminary phase of ground investigation at the site in support of the proposed development, and the findings are discussed below.



Also at:  
4245 Park Approach,  
Thorpe Park,  
Leeds, LS15 8GB  
t: 0113 264 9960  
f: 0113 264 9962

Strelley Hall,  
Nottingham,  
NG8 6PE  
t: 0115 906 1334  
f: 0115 906 1251



INVESTOR IN PEOPLE

## **2.0 Site Description**

Table 2.1 - Site Description

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Location:</b>                           | <i>Approximately 2km west of Barnsley town centre, located to the north of Dodworth Road.</i><br><br>The National Grid Reference for the site is SE 331 064.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Topography:</b>                         | The majority of the site is generally level, lying at an elevation of approximately 125m AOD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Surface Cover / Existing Buildings:</b> | <i>At the time of this phase of works the site was predominantly occupied by tarmac and concrete hardstanding. A large concrete floor slab from the previous garage services building was located within the eastern part of the site. The western area of the site comprises a large fenced compound with level rough hardcore surface.</i><br><br>An existing commercial building of portal frame and steel clad construction was present within the central part of the site. No access to this area was available during the investigation works.<br><br>The development site also includes an industrial compound of approximately 1Ha in area located to the east of the main site boundary. This area comprised a medium sized portal framed commercial building with surrounding hardcore surfaced storage yard. |
| <b>Fuels Storage Tanks:</b>                | Former underground fuel storage tanks known to be located on the site resulting from historic use as a petrol filling station.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Adjacent Land Uses:</b>                 | North: Railway land and cutting<br>East: Residential houses and gardens<br>West: Residential properties with gardens<br>South: Dodworth Road and further residential properties                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## **3.0 Fieldwork**

Fieldwork was undertaken between 30<sup>th</sup> June and 2<sup>nd</sup> July 2010 and comprised:

- Mechanical excavation of 11 No. Trial pits to a maximum depth of 3.8m bgl.
- Drilling of 8 No. Rotary openhole boreholes using compressed air water mist flush to a maximum depth of 34.5m bgl.
- Installation of 6 No. gas monitoring wells in rotary boreholes.

Trial pits were backfilled with arisings on completion.

Rotary boreholes without installations were backfilled with arisings and sealed at rockhead with bentonite cement.

An exploratory hole location plan showing the positions of trial pits and boreholes is appended to this letter.

#### 4.0 Ground Conditions

A complete record of all the strata encountered in each exploratory hole is provided on the exploratory hole logs appended. The following is intended to summarise the ground conditions present.

##### 4.1 Strata summary

Table 4.1: Summary of Strata Profile

| Strata                         | Depth Range (Thickness Range) (m) | Description and Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Made Ground                    | Ground Level (3.1 to 8.5m)        | Encountered at all exploratory hole locations. Made ground was predominantly found to be granular comprising sandy gravel of ash and clinker with varying proportions of concrete, brick, tiles ceramic and glass. Occasionally fragments of plastic, metal and timber waste were recorded (TP7, 8 and 9 towards the western part of the site). A low to high brick cobble content was noted locally.<br><br>TP11, located within the yard area to the east of the main site encountered cohesive made ground comprising sandy gravelly clay with brick cobbles and rare timber to a depth of 3.1m bgl. |
| Clay (weathered coal measures) | 3.1 – 10.5m (>0.1 to 3.5m)        | Firm and stiff, sandy clay – Completely weathered coal measures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Bedrock                        | 3.0 to 10.50m                     | Carboniferous Coal Measures mudstone, sandstone and coal. Old workings encountered as                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Strata | Depth<br>Range<br>(Thickness<br>Range) (m) | Description and Comments |
|--------|--------------------------------------------|--------------------------|
|        | (>27m)                                     | detailed below.          |

NR - not recorded

#### 4.2 Bedrock and Shallow Mining

Strata encountered within the eight rotary openhole boreholes advanced are summarised in Table 4.2 below.

Table 4.2 – Summary of Bedrock Geology Encountered

| Hole Reference | Approximate GL (mAOD) | Drilled depth (mBGL) | Rockhead (mBGL) | Rockhead (mAOD) | Evidence of workings / coal (mBGL) | Evidence of workings / coal (mAOD) | Sandstone Strata Encountered (mBGL)    | Notes *                                                                                                                                      |
|----------------|-----------------------|----------------------|-----------------|-----------------|------------------------------------|------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| RO1            | 134.4                 | 32.0                 | 5.9             | 128.5           | 18.1 – 18.3 Coal (0.3m)            | 116.3 – 116.1 Coal (0.3m)          | -                                      | Thin Coal – Stratigraphically below Barnsley Thick Coal                                                                                      |
| RO2            | 133.2                 | 34.0                 | 8.5             | 124.7           | -                                  | -                                  | 10.2 – 12.8m (2.6m)                    | Fractured mudstones encountered between 12.8 and 18.3m possible associated with local faulting.                                              |
| RO3            | 133.4                 | 34.5                 | 8.5             | 124.9           | -                                  | -                                  | 9.1 – 11.9 (2.8m)                      | No evidence of coal/workings encountered                                                                                                     |
| RO4            | 134.1                 | 15.0                 | 10.5            | 123.6           | -                                  | -                                  | -                                      | No evidence of coal/workings encountered                                                                                                     |
| RO5            | 135.8                 | 32.0                 | 4.5             | 131.3           | 20.3 – 22.1 Coal (1.8m)            | 115.3 – 113.7 Coal (1.8m)          | 4.5 – 17.8 (13.3m)                     | Barnsley Thick Seam overlain by Barnsley Rock Sandstone – Intact coal encountered. (Ratio of 6.1 times rock cover to seam thickness)         |
| RO6            | 136.6                 | 13.0                 | 3.0             | 133.6           | 9.0 – 11.0 BG (2.0m)               | 127.6 – 125.6 BG (2.0m)            | 3.0 – 9.0 (6.0m)                       | Old workings in Barnsley Thick Seam overlain by Barnsley Rock Sandstone. (Ratio of 2.3 times rock cover to seam thickness)                   |
| RO7            | 133.3                 | 33.5                 | 7.5             | 125.8           | 18.0 – 20.6 Coal (2.6m)            | 115.3 – 112.7 Coal (2.6m)          | 7.5 – 10.3 (2.8m) & 12.5 – 14.1 (1.6m) | Barnsley Thick Seam – Overlain by Barnsley rock sandstone interleaved with mudstones and siltstones.                                         |
| RO8            | 133.0                 | 34.0                 | 7.0             | 126.0           | 30.2 – 33.0 BG (2.8m)              | 102.8 – 100.0 BG (2.8m)            | 7.0 – 11.6 (4.6m)                      | Old workings in Barnsley Thick Seam – Some overlying sandstone possibly the Barnsley Rock. (Ratio of 8.9 times rock cover to seam thickness) |

\*Ratio of rock cover to seam thickness based on maximum recorded seam thickness of 2.6m (RO7 and CA abandonment plan.)

BG – Broken Ground representative of old collapsed workings

#### 4.3 Groundwater

No significant groundwater flows were encountered during the intrusive fieldwork. Rotary boreholes were advanced using water mist flush which obscures natural groundwater strikes on drilling, therefore accurate observations of groundwater levels within rotary boreholes could not be made.

#### 4.4 Visual and Olfactory Evidence of Contamination

Made ground encountered within all of the trial pits excavated was noted to contain high proportions of ash and clinker which are commonly associated with elevated concentrations of heavy metals and polyaromatic hydrocarbons (PAHs). Made ground was locally noted to include refuse type materials such as timber and plastic which indicate the potential for a source of hazardous ground gas to be present.

No visual or olfactory evidence of hydrocarbon contamination was encountered.

#### 4.5 Ground Gas

Ground gas monitoring has been carried out on two occasions to date, both at barometric pressures of below 1000mb. Noteworthy results are summarised in Table 4.3 below. Full details of ground gas monitoring results available at the time of writing are appended.

Table 4.3 Summary of Gas Monitoring Results – (2 visits to date)

| Well | Methane<br>%v/v (max) | Carbon<br>Dioxide<br>%v/v (max) | Oxygen<br>%v/v (min) | Volatiles<br>ppm (max) | Flow (range)<br>l/hr |
|------|-----------------------|---------------------------------|----------------------|------------------------|----------------------|
| RO1  | ND                    | 8.2                             | 10.7                 | ND                     | ND                   |
| RO2  | ND                    | 0.4                             | 20.0                 | ND                     | 0.1 – 0.5            |
| RO4* | ND                    | 0.3                             | 19.8                 | ND                     | -1.1                 |
| RO5* | ND                    | 7.4                             | 11.0                 | 2.7                    | ND                   |
| RO6* | ND                    | 0.8                             | 19.6                 | 1.5                    | -0.2                 |
| RO7  | ND                    | 0.6                             | 19.0                 | ND                     | -0.2 – 0.6           |

\* 1 visit only completed to date

The proposed monitoring programme includes 24 visits over a 12 month period. On completion of the monitoring, a full set of results will be issued in an addendum letter.

## 5.0 Assessment of Preliminary Findings

### 5.1 Contamination

Constraints due to contamination can not be fully determined without an appropriate programme of chemical testing. However, based on the ashy nature of the made ground observed at the site it is considered likely that elevated concentrations of heavy metals and PAHs will be present. In addition localised ground contamination in the vicinity of the former underground fuel storage tanks within the southern part of the site should be anticipated.

Soils observed are visually and texturally unsuitable for use in gardens and landscaped areas.

It is understood that a further phase of ground investigation including chemical analysis of soils is to be undertaken prior to development.

### 5.2 Foundations

Due to the thickness of granular made ground present across the whole site area traditional strip foundations will be unsuitable for development on this site. Piles or improvement of the ground via vibro-flotation methods will be required for the proposed development. During the recent site investigation works specialist ground improvement contractors from IGI, Balfour Beatty and Keller visited the site to observe the nature of the made ground. All of the contractors have indicated that vibro-stone ground improvement techniques would be viable to achieve the necessary bearing characteristics for a standard residential type development on the site.

### Floor Slabs

Due to the necessity for piling or ground improvement to achieve required bearing capacities, suspended ground floor slabs will be required for any proposed development.

### 5.3 Excavations and Dewatering

Based on the nature of the overlying made ground, it is considered that excavations through cohesive soils will be unstable. Therefore allowance for either battering back to a safe angle or temporary support measures should be incorporated into the design of excavations, particularly if man entry into excavations is envisaged.

Reference to CIRIA Report 97 'Trenching Practice' should be made to establish suitable methods of ground support or battering back of any excavation face.

Based upon the results of the ground investigation, significant ingress of groundwater at shallow depths is not considered likely, although any groundwater ingress which does occur should be adequately controlled by traditional site pumping practices.

#### 5.4 Stabilisation of Shallow Mine Workings

The results of the intrusive mining investigation carried out to date are summarised within Drawing No. C3934.03 appended. The conclusions which can be drawn from the available information are summarised in Table 5.1 below with reference to the site areas shown on the above drawing.

Table 5.1 – Results of Intrusive Mining Investigation.

| Area | Boreholes Referenced | Conclusion                                                                                                               | Necessary further works                                                        |
|------|----------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| A    | RO1, RO4             | Barnsley seam removed by working at outcrop – no stabilisation works required                                            | None                                                                           |
| B    | RO6                  | Workings identified within influencing distance of surface                                                               | Drill and grout stabilisation works required                                   |
| C    | RO5                  | Workings identified within influencing distance of the surface – grout stabilisation required                            | Drill and grout stabilisation works required                                   |
| D    |                      | Workings recorded within influencing distance of surface                                                                 | Drill and grout stabilisation works required                                   |
| E    | RO8                  | Workings recorded and proven in RO8                                                                                      | Test drilling required to confirm need for drill and grout stabilisation works |
| F    | RO7                  | Barnsley seam present within influencing distance of surface. No recorded workings                                       | Test drilling required to confirm need for drill and grout stabilisation works |
| G    | RO2                  | No evidence of Barnsley Seam – no recorded workings, some fractured ground encountered possibly associated with faulting | Test drilling required to confirm need for drill and grout stabilisation works |

#### 5.5 Ground Gas

At this stage only preliminary gas monitoring results are available and no reliable conclusions can be drawn on the basis of the information available. However, no significant concentrations of methane have been detected to date and concentrations of carbon dioxide on both monitoring visits completed remained below 10%v/v. Gas flow rates were generally not significant being measured at <1l/s. The preliminary results available suggest that the site would be characterised as 'Amber 1' with regard to gas risk for a proposed residential development. Given the potential sources of hazardous ground gas identified within the vicinity of the site, further gas monitoring results will be required

before firm recommendations can be given regarding the level of gas protection measures required at the site.

We trust that this is adequate for your present needs. However, should you require any further information, or wish to discuss any aspect of these works further, please do not hesitate to contact me at our Durham office.

Yours sincerely;

*David Brooks*

David Brooks  
Senior Engineer

For and on behalf of  
Sirius Geotechnical and Environmental Ltd.

Enc.



# TRIAL PIT RECORD

TP No. **TP1**

Sheet 1 of 1

Site : Dodworth Road, Barnsley

Contract No: **C3934**

Client : Bellway Homes Ltd

Dates:  
29/06/2010

Method : JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By:

| Type | Depth |       | Vane<br>Results<br>kN/m <sup>2</sup> | Groundwater | Description                                                                                  | Depth<br>(m) | Level<br>(mAOD)<br>PID<br>LOC. 71 | Legend |
|------|-------|-------|--------------------------------------|-------------|----------------------------------------------------------------------------------------------|--------------|-----------------------------------|--------|
|      | From  | To(m) |                                      |             |                                                                                              |              |                                   |        |
|      |       |       |                                      |             | MADE GROUND: Tarmac.                                                                         | 0.00         |                                   |        |
|      |       |       |                                      |             | MADE GROUND: Concrete boulder (base of forecourt).                                           |              |                                   |        |
| D    | 0.60m | 1.00m |                                      |             | MADE GROUND: Dark grey sandy angular fine to coarse GRAVEL of ash and clinker.               | 0.60         |                                   |        |
|      |       |       |                                      |             | At 1.40m: Electric cable. Assumed to be redundant feed to petrol pumps. Trial pit abandoned. |              |                                   |        |
|      |       |       |                                      |             | End of Trial Pit at 1.40 m                                                                   | 1.40         |                                   |        |

## Remarks and Water Observations

- 1) Trial pit abandoned at 1.40m bgl due to live electric cable. Electric cable made safe by YEDL.
- 2) Excavation unstable.
- 3) No groundwater encountered.
- 4) Trial pit backfilled with arisings upon completion.

GL (m AOD) Fig. No.

Easting: TP1

Northing:

# TRIAL PIT RECORD

TP No. **TP2**

Sheet 1 of 1

Site : **Dodworth Road, Barnsley**

Contract No: C3934

Client: **Bellway Homes Ltd**

Dates:  
29/06/2010

Method : JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By JW

Checked By:

| Type: | Depth        | Vane              |
|-------|--------------|-------------------|
|       | From - To(m) | Results           |
|       |              | kN/m <sup>2</sup> |

## Groundwater

**Description**

| Depth<br>(m) | Level<br>(m AOD)<br>PID<br>(22-24) | Legend. |
|--------------|------------------------------------|---------|
|--------------|------------------------------------|---------|

MADE GROUND: Concrete.

0 12

□ 0.30m - 0.60m

**MADE GROUND:** Dark grey brown angular fine to coarse GRAVEL of sandstone, ash, clinker and concrete with occasional pockets of firm orange brown clay.

0 1 00m  
1 00m - 1 50m

MADE GROUND: Dark grey angular fine to coarse GRAVEL of ash and clinker.

0.50

D 3 50m - 3 60m

Firm blue green orange brown sandy CLAY. Low plasticity (field description).  
End of Trial Pit at 3.60 m

、 3.50

3.60

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with arisings upon completion

GL (m AOD)

Fig. No.

**Easting:**

TP2

Nothing:



# TRIAL PIT RECORD

TP No. **TP3**

Sheet 1 of 1

Site : Dodworth Road, Barnsley

Contract No.

**C3934**

Client : Bellway Homes Ltd

Dates :  
29/06/2010

Method : JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By

| Type | Depth         |        | Vane Results<br>kN/m <sup>2</sup> | Groundwater | Description                                                                                                                                              | Depth<br>(m) | Level<br>(m AOD)<br>PID | Legend |
|------|---------------|--------|-----------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|--------|
|      | From          | To (m) |                                   |             |                                                                                                                                                          |              |                         |        |
|      |               |        |                                   |             | MADE GROUND: Concrete.                                                                                                                                   |              |                         |        |
| D    | 0.50m         |        |                                   |             | MADE GROUND: Brown sandy gravelly angular COBBLES and BOULDERS (to 500mm) of concrete and brick. Gravel is angular fine to coarse of concrete and brick. | 0.20         |                         |        |
| D    | 1.50m         |        |                                   |             | MADE GROUND: Dark grey angular fine to coarse GRAVEL of ash and clinker. Occasional angular fine to coarse glass and ceramic fragments and bottles.      | 1.40         |                         |        |
| B    | 2.00m - 2.50m |        |                                   |             |                                                                                                                                                          |              |                         |        |
|      |               |        |                                   |             | End of Trial Pit at 3.60 m                                                                                                                               | 3.60         |                         |        |

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with arisings upon completion.

GL (m AOD)

Fig. No.

Easting:

TP3

Northing:

## TRIAL PIT RECORD

TP No: **TP4**

Sheet 1 of 1

Site : Dodworth Road, Barnsley

Contract No: C3934

Client : Bellway Homes Ltd

Dates;  
29/06/2010

**Method :** JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By, jrw

Checked By.

[illegible]

End of Trial Pit at 3.70 m

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with risings upon completion.

GL (m AOD)

Fig. No.

**Easting:**

TP4

Nothing:



# TRIAL PIT RECORD

TP No. **TP5**

Sheet 1 of 1

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates:  
29/06/2010

Method: JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By:

| Type | Depth         |       | Vane Results<br>kN/m <sup>2</sup> | Groundwater | Description                                                                                                                                                                             | Depth<br>(m) | Level<br>(mAOD)<br>P10<br>(25%) | Legend |
|------|---------------|-------|-----------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------|--------|
|      | From          | To(m) |                                   |             |                                                                                                                                                                                         |              |                                 |        |
|      |               |       |                                   |             | MADE GROUND: Tarmac.                                                                                                                                                                    | 0.05         |                                 |        |
|      |               |       |                                   |             | MADE GROUND: Grey brown angular fine to coarse clayey GRAVEL of ash, clinker and mixed lithologies.                                                                                     |              |                                 |        |
| D    | 0.30m         |       |                                   |             |                                                                                                                                                                                         |              |                                 |        |
|      |               |       |                                   |             | MADE GROUND: Brown sandy locally slightly clayey fine to coarse GRAVEL of mixed lithologies. Low to medium angular brick, concrete and sandstone cobble and boulder content (to 500mm). | 0.60         |                                 |        |
| D    | 0.90m         |       |                                   |             |                                                                                                                                                                                         |              |                                 |        |
| B    | 1.00m - 2.00m |       |                                   |             |                                                                                                                                                                                         |              |                                 |        |
|      |               |       |                                   |             | At 2.85m: 150mm thick band of orange brown sandy clay.                                                                                                                                  | 3.00         |                                 |        |
|      |               |       |                                   |             | MADE GROUND: Dark grey angular fine to coarse GRAVEL of ash and clinker. Occasional angular fine to coarse fragments of glass and ceramic and glass bottles.                            |              |                                 |        |
| D    | 3.50m         |       |                                   |             |                                                                                                                                                                                         | 3.70         |                                 |        |
|      |               |       |                                   |             | End of Trial Pit at 3.70 m                                                                                                                                                              |              |                                 |        |

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with arisings upon completion

GL (m AOD)

Fig. No.

Easting:

TP5

Northing:

## TRIAL PIT RECORD

TP No. TP6

Sheet 1 of 1

Site : Dodworth Road, Barnsley

Contract No: C3934

Client: Bellway Homes Ltd

. Dates:  
29/06/2010

**Method :** JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By JW

Checked By

| Type | Depth        | Vane              |
|------|--------------|-------------------|
|      | From - To(m) | Results           |
|      |              | kN/m <sup>2</sup> |

### Description

| Depth<br>(m) | Level<br>(m AOD)<br>PID<br>(%) | Legend |
|--------------|--------------------------------|--------|
|--------------|--------------------------------|--------|

## Groundwater

MADE GROUND: Tarmac.

005

MADE GROUND: Light brown slightly sandy angular fine to coarse of LIMESTONE.

**MADE GROUND:** Dark grey and brown slightly sandy angular fine to coarse GRAVEL of ash, clinker, concrete and brick. Low to medium angular brick and concrete cobble content. High brick cobble content to west face.

030

0.50m

D 2.00m

**MADE GROUND:** Dark grey angular fine to coarse GRAVEL of ash and clinker. Occasional angular fine to coarse fragments of glass and ceramic and glass bottles.

230

End of Trial Pil at 2.80 m

2.80

## Remarks and Water Observations

- 1) Excavation unstable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with arisings upon completion.

GL (m AOD)

Fig. No.

• **Easting:**

TP6

Nothing:



# TRIAL PIT RECORD

TP No. **TP7**

Sheet 1 of 1

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates:  
29/06/2010

Method: JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By:

| Type | Depth<br>From - To(m) | Vane<br>Results<br>kN/m <sup>2</sup> |
|------|-----------------------|--------------------------------------|
|------|-----------------------|--------------------------------------|

Description

Depth  
(m)Level  
(m AOD)  
PID  
(m)

Legend

MADE GROUND: Tarmac.

0.03

MADE GROUND: Grey and orange brown slightly sandy angular fine to coarse GRAVEL of ash, clinker, occasional metal waste, glass, brick, ceramic, plastic; rare glass fibre and glass bottles. Low angular brick cobble content.

D 0.50m

D 1.50m

D 2.50m

D 3.50m

End of Trial Pit at 3.80 m

3.80

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with screenings upon completion

GL (m AOD)

Fig. No.

Easting:

TP7

Northing:

Nothing:

# TRIAL PIT RECORD

TP No. **TP9**

Sheet 1 of 1

Site: Dodworth Road, Barnsley

Contract No: C3934

Client: Bellway Homes Ltd

• Dates:  
- 29/06/2010

Method : JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA.RECORD

Logged By. JW

Checked By \_\_\_\_\_

[illegible]

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with anisings upon completion.

GL (m AOD)

Fig. No.

**Easting:**

TP9

• Northing:



# TRIAL PIT RECORD

TP No. **TP10**

Sheet 1 of 1

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates:  
29/06/2010

Method: JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By:

| Type | Depth<br>From - To(m) | Vane<br>Results<br>kN/m <sup>2</sup> | Description                                                                                                                                                                                                            | Depth<br>(m) | Level<br>(m AOD)<br>PID | Legend |
|------|-----------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|--------|
|      |                       |                                      | MADE GROUND: Dark grey and red brown slightly sandy slightly clayey angular COBBLES of brick.                                                                                                                          |              |                         |        |
| D    | 0.50m                 |                                      | MADE GROUND: Dark grey slightly sandy angular fine to coarse GRAVEL of ash and clinker. Low to medium angular brick cobble content. Occasional angular fine to coarse GRAVEL of glass, ceramic and rare glass bottles. | 0.40         |                         |        |
| D    | 1.50m                 |                                      |                                                                                                                                                                                                                        |              |                         |        |
| D    | 2.50m                 |                                      |                                                                                                                                                                                                                        |              |                         |        |
|      |                       |                                      | Light brown slightly sandy slightly clayey angular tabular GRAVEL of sandstone.                                                                                                                                        | 3.55<br>3.60 |                         |        |
|      |                       |                                      | End of Trial Pit at 3.60 m                                                                                                                                                                                             |              |                         |        |

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with screenings upon completion.

GL (m AOD)

Fig. No.

Easting:

TP10

Northing:

# TRIAL PIT RECORD

TP No. **TP11**

Sheet 1 of 1

Site : Dodworth Road, Barnsley

**Contract No:**

C3934

Client: Bellway Homes Ltd

Dates:  
29/06/2010

**Method :** JCB 3CX equipped with 0.60m wide backhoe bucket

Scale 1:20

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW

Checked By:

Level  
(mAOD)  
PID

**Legend**

| Type | Depth        | Vane Results      |
|------|--------------|-------------------|
|      | From - To(m) | kN/m <sup>2</sup> |

### Description

0 10

MADE GROUND: Tarmac.

MADE GROUND: Light grey slightly sandy angular fine to coarse GRAVEL of limestone.

MADE GROUND: Brown grey slightly sandy slightly gravelly angular COBBLES of brick and concrete.

MADE GROUND: Orange grey brown sandy gravelly CLAY. Low plasticity (field description). Low angular brick and concrete cobble content. Gravel is angular fine to coarse of concrete, brick and rare wood.

3 10

Stiff light brown sandy gravelly CLAY. Low plasticity (field description). Gravel is angular tabular fine to coarse of sandstone.

3.40

End of Trial Pit at 3.40 m

## Remarks and Water Observations

- 1) Excavation stable.
- 2) No groundwater encountered.
- 3) Trial pit backfilled with arisings upon completion.

GL (m AOD)

Fig. No.

**Easting:**

TP11

Nothing:



# BOREHOLE RECORD

BH No. **R01**  
Sheet 1 of 4

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **30/06/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driter: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(FI) | Groundwater<br>(Casing) | Description                                                     | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-----------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND: Granular made ground including concrete and brick. |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 1            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 2            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 3            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 4            | 4.00            | 130.40 |      |
|      |                        |         |         |         |           |                         | MADE GROUND: Suspected made ground - few flush returns.         |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 5            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 6            | 5.90            | 128.50 |      |
|      |                        |         |         |         |           |                         | Brown / grey SANDSTONE with siltstone bands.                    |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 7            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 8            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                 | 9            |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.40  
Easting:  
Northing:

Fig. No.

R01



# BOREHOLE RECORD

BH No. **R01**  
Sheet 2 of 4

Site: Dodworth Road, Barnsley

Contract No:

**C3934**

Client: Bellway Homes Ltd

Dates:

30/06/2010

Method: Rotary openhole boring using water mist flush

Scale 1:50

Logged By: JW

Checked By:

Driller: JS

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                                    | Depth<br>(m) | Level<br>(mADD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Brown / grey SANDSTONE with siltstone bands.   |              |                 |        |      |
|      |                        |         |         |         | 11        |                         |                                                | 11           |                 |        |      |
|      |                        |         |         |         | 12        |                         | Grey MUDSTONE with occasional siltstone bands. | 12 12.00     | 122.40          |        |      |
|      |                        |         |         |         | 13        |                         |                                                | 13           |                 |        |      |
|      |                        |         |         |         | 14        |                         |                                                | 14           |                 |        |      |
|      |                        |         |         |         | 15        |                         |                                                | 15           |                 |        |      |
|      |                        |         |         |         | 16        |                         |                                                | 16           |                 |        |      |
|      |                        |         |         |         | 17        |                         |                                                | 17           |                 |        |      |
|      |                        |         |         |         | 18        |                         | COAL                                           | 18 18.10     | 116.30          |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE/SILTSTONE                        | 18.30        | 116.10          |        |      |
|      |                        |         |         |         | 19        |                         |                                                | 19           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.40

Easting:

Northing:

Fig. No.

R01



# BOREHOLE RECORD

BH No. **R01**  
Sheet 3 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
30/06/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                         | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE/SILTSTONE.            |              |                 |        |      |
|      |                        |         |         |         | 21        |                         |                                     | 21           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey SILTSTONE.                     | 21.80        | 112.60          |        |      |
|      |                        |         |         |         | 22        |                         |                                     | 22           |                 |        |      |
|      |                        |         |         |         | 23        |                         |                                     | 23           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE with siltstone bands. | 23.70        | 110.70          |        |      |
|      |                        |         |         |         | 24        |                         |                                     | 24           |                 |        |      |
|      |                        |         |         |         | 25        |                         |                                     | 25           |                 |        |      |
|      |                        |         |         |         | 26        |                         |                                     | 26           |                 |        |      |
|      |                        |         |         |         | 27        |                         |                                     | 27           |                 |        |      |
|      |                        |         |         |         | 28        |                         |                                     | 28           |                 |        |      |
|      |                        |         |         |         | 29        |                         |                                     | 29           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.40  
Easting:  
Northing:

Fig. No.  
**R01**



# BOREHOLE RECORD

BH No. **R01**  
Sheet 4 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
30/06/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

Logged By: JW Checked By:  
Driller: JS

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                         | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE with siltstone bands. |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 31           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 32           | 32.00           | 102.40 |      |
|      |                        |         |         |         |           |                         | End of Borehole at 32.00 m          |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 33           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 34           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 35           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 36           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 37           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 38           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 39           |                 |        |      |

### Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.40

Eastings:

Northings:

Fig. No.

**R01**



# BOREHOLE RECORD

BH No. **R02**  
Sheet 1 of 4

Site: **Dodworth Road, Barnsley**

Contract No: **C3934**

Client: **Bellway Homes Ltd**

Dates: **30/06/2010**

Method: **Rotary openhole boring using water mist flush**

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By:  
Diller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RDD (%) | N<br>(F) | Groundwater<br>(Casing) | Description                                                     | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|----------|-------------------------|-----------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |          |                         | MADE GROUND: Suspected made ground (no flush returns obtained). |              |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 1            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 2            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 3            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 4            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 5            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 6            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 7            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 8            |                 |        |      |
|      |                        |         |         |         |          |                         | Grey MUDSTONE.                                                  | 8.50         | 124.70          |        |      |
|      |                        |         |         |         |          |                         |                                                                 | 9            |                 |        |      |

Continued next sheet.

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown

GL (m AOD)  
**133.20**  
Easting:  
Northing:

Fig. No.  
**R02**



# BOREHOLE RECORD

BH No. **R02**  
Sheet 2 of 4

Site: **Dodworth Road, Barnsley**

Contract No:  
**C3934**

Client: **Bellway Homes Ltd**

Dates:  
**30/06/2010**

Method: **Rotary openhole boring using water mist flush**

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By

Driller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                                                             | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-------------------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE                                                           | 10.20        | 123.00          |        |      |
|      |                        |         |         |         |           |                         | Brown SANDSTONE (slight loss of flush returns noted)                    |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 11           |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 12           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE (some loss of flush indicating possible fractured ground) | 12.80        | 120.40          |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 13           |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 14           |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 15           |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 16           |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 17           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE with siltstone bands (poor returns noted)                 | 18.00        | 115.20          |        |      |
|      |                        |         |         |         |           |                         |                                                                         | 19           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

133.20

Eastings:

Northings:

Fig. No.

R02



# BOREHOLE RECORD

BH No. **R02**  
Sheet 3 of 4

Site: **Dodworth Road, Barnsley**

Contract No:  
**C3934**

Client: **Bellway Homes Ltd**

Dates:  
**30/06/2010**

Method: *Rotary openhole boring using water mist flush*

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By:  
Driller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RDD (%) | N<br>(FI) | Groundwater<br>(Craving) | Description                                             | Depth<br>(m) | Level<br>(mAOD) | Legend - Well |
|------|------------------------|---------|---------|---------|-----------|--------------------------|---------------------------------------------------------|--------------|-----------------|---------------|
|      |                        |         |         |         |           |                          | Grey MUDSTONE with siltstone bands (poor returns noted) |              |                 |               |
|      |                        |         |         |         |           | 21                       | Grey MUDSTONE (poor returns noted).                     | 21           | 21.00           | 112.20        |
|      |                        |         |         |         |           | 22                       |                                                         | 22           |                 |               |
|      |                        |         |         |         |           | 23                       |                                                         | 23           |                 |               |
|      |                        |         |         |         |           | 24                       |                                                         | 24           |                 |               |
|      |                        |         |         |         |           | 25                       |                                                         | 25           |                 |               |
|      |                        |         |         |         |           | 26                       |                                                         | 26           |                 |               |
|      |                        |         |         |         |           | 27                       |                                                         | 27           |                 |               |
|      |                        |         |         |         |           | 28                       |                                                         | 28           |                 |               |
|      |                        |         |         |         |           | 29                       |                                                         | 29           |                 |               |

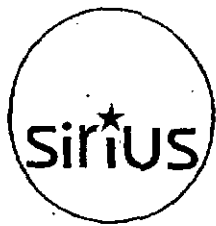
Continued next sheet

## Remarks and Water Observations

- Gas monitoring well installed on completion as shown.

GL (m AOD)  
**133.20**  
Easting:  
-  
Northing:  
-

Fig. No.  
**R02**



# BOREHOLE RECORD

BH No. **R02**  
Sheet 4 of 4

Site: Dodworth Road, Barnsley

Contract No:

**C3934**

Client: Bellway Homes Ltd

Dates:

30/06/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:

Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                         | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE (poor returns noted). |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 31           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 32           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 33           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 34           | 34.00           | 99.20  |      |
|      |                        |         |         |         |           |                         | End of Borehole at 34.00 m          |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 35           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 36           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 37           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 38           |                 |        |      |
|      |                        |         |         |         |           |                         |                                     | 39           |                 |        |      |

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

133.20

Easting:

Northings:

Fig. No.

**R02**



# BOREHOLE RECORD

BH No. **RO3**  
Sheet 1 of 4

Site: Dodworth Road, Barnsley

Contract No:

C3934

Client: Bellway Homes Ltd

Dates:

01/07/2010

Method: Rotary openhole boring using water mist flush

Scale 1:50

## SAMPLE DETAILS

## STRATA RECORD

Logged By JW Checked By:

Driller JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                                                                    | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|--------------------------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND: Sand and Gravel of ash, clinker and concrete. (few flush returns) |              |                 |        |      |
|      |                        |         |         |         | 1         |                         |                                                                                | 1            |                 |        |      |
|      |                        |         |         |         | 2         |                         |                                                                                | 2            |                 |        |      |
|      |                        |         |         |         | 3         |                         |                                                                                | 3            |                 |        |      |
|      |                        |         |         |         | 4         |                         |                                                                                | 4            |                 |        |      |
|      |                        |         |         |         | 5         |                         |                                                                                | 5            |                 |        |      |
|      |                        |         |         |         | 6         |                         |                                                                                | 6            |                 |        |      |
|      |                        |         |         |         | 7         |                         |                                                                                | 7            |                 |        |      |
|      |                        |         |         |         | 8         |                         |                                                                                | 8            |                 |        |      |
|      |                        |         |         |         | 8.50      |                         | Grey MUDSTONE.                                                                 | 8.50         | 124.90          |        |      |
|      |                        |         |         |         | 9         |                         | Brown SANDSTONE.                                                               | 9.10         | 124.30          |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

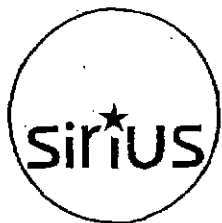
133.40

Easting:

Northing:

Fig. No.

RO3



# BOREHOLE RECORD

BH No. **R03**  
Sheet 2 of 4

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **01/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:

Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description      | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Brown SANDSTONE. |              |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 11           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.   | 12           | 11.90 121.50    |        |      |
|      |                        |         |         |         |           |                         |                  | 13           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 14           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 15           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 16           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 17           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 18           |                 |        |      |
|      |                        |         |         |         |           |                         |                  | 19           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

133.40

Easting:

Northing:

Fig. No.

**R03**



# BOREHOLE RECORD

BH No. **R03**  
Sheet 3 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
01/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RDD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description    | Depth<br>(m) | Level<br>(mAOD) | Legend | Wall |
|------|------------------------|---------|---------|---------|-----------|-------------------------|----------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE. |              |                 |        |      |
|      |                        |         |         |         |           | 21                      |                | 21           |                 |        |      |
|      |                        |         |         |         |           | 22                      |                | 22           |                 |        |      |
|      |                        |         |         |         |           | 23                      |                | 23           |                 |        |      |
|      |                        |         |         |         |           | 24                      |                | 24           |                 |        |      |
|      |                        |         |         |         |           | 25                      |                | 25           |                 |        |      |
|      |                        |         |         |         |           | 26                      |                | 26           |                 |        |      |
|      |                        |         |         |         |           | 27                      |                | 27           |                 |        |      |
|      |                        |         |         |         |           | 28                      |                | 28           |                 |        |      |
|      |                        |         |         |         |           | 29                      |                | 29           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.40  
Easting:  
Northing:

Fig. No.

R03



# BOREHOLE RECORD

BH No. **RO3**  
Sheet 4 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
**01/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:

Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | ROD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|----------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE.             |              |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 31           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 32           |                 |        |      |
|      |                        |         |         |         |           |                         | Dark grey MUDSTONE.        | 32.10        | 101.30          |        |      |
|      |                        |         |         |         |           |                         |                            | 33           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 34           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.             | 34.00        | 99.40           |        |      |
|      |                        |         |         |         |           |                         | End of Borehole at 34.50 m | 34.50        | 98.90           |        |      |
|      |                        |         |         |         |           |                         |                            | 35           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 36           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 37           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 38           |                 |        |      |
|      |                        |         |         |         |           |                         |                            | 39           |                 |        |      |

### Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.40

Easting:

Northing:

Fig. No.

**RO3**



# BOREHOLE RECORD

BH No. **R04**  
Sheet 1 of 2

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **01/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                                                                    | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|--------------------------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND: Dark grey SAND and GRAVEL of ash and clinker (few flush returns). |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 1            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 2            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 3            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 4            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 5            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 6            |                 |        |      |
|      |                        |         |         |         |           |                         | Grey brown CLAY.                                                               | 7            | 7.00            | 127.00 |      |
|      |                        |         |         |         |           |                         |                                                                                | 8            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                                | 9            |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.00  
Easting:  
Northing:

Fig. No.  
**R04**



# BOREHOLE RECORD

BH No. **R04**  
Sheet 2 of 2

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
01/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | ROD (%) | N<br>(FI) | Groundwater<br>(Casing) | Description                | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|----------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey brown CLAY.           |              |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.             | 10.50        | 123.50          |        |      |
|      |                        |         |         |         | 11        |                         |                            | 11           |                 |        |      |
|      |                        |         |         |         | 12        |                         |                            | 12           |                 |        |      |
|      |                        |         |         |         | 13        |                         |                            | 13           |                 |        |      |
|      |                        |         |         |         | 14        |                         |                            | 14           |                 |        |      |
|      |                        |         |         |         | 15        |                         | End of Borehole at 15.00 m | 15.15.00     | 119.00          |        |      |
|      |                        |         |         |         | 16        |                         |                            | 16           |                 |        |      |
|      |                        |         |         |         | 17        |                         |                            | 17           |                 |        |      |
|      |                        |         |         |         | 18        |                         |                            | 18           |                 |        |      |
|      |                        |         |         |         | 19        |                         |                            | 19           |                 |        |      |

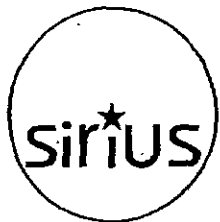
### Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
134.00  
Easting:  
Northing:

Fig. No.

R04



# BOREHOLE RECORD

BH No. **R05**  
Sheet 1 of 4

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **01/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                                                                                      | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|--------------------------------------------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND: Made ground including landfill type materials (driller noted fragments of plastic). |              |                 |        |      |
|      |                        |         |         |         | 1         |                         |                                                                                                  | 1            |                 |        |      |
|      |                        |         |         |         | 2         |                         |                                                                                                  | 2            |                 |        |      |
|      |                        |         |         |         | 3         |                         |                                                                                                  | 3            |                 |        |      |
|      |                        |         |         |         | 4         |                         |                                                                                                  | 4            |                 |        |      |
|      |                        |         |         |         |           |                         | Brown SANDSTONE.                                                                                 | 4.50         | 131.30          |        |      |
|      |                        |         |         |         | 5         |                         |                                                                                                  | 5            |                 |        |      |
|      |                        |         |         |         | 6         |                         |                                                                                                  | 6            |                 |        |      |
|      |                        |         |         |         | 7         |                         |                                                                                                  | 7            |                 |        |      |
|      |                        |         |         |         | 8         |                         |                                                                                                  | 8            |                 |        |      |
|      |                        |         |         |         | 9         |                         |                                                                                                  | 9            |                 |        |      |

Continued next sheet

## Remarks and Water Observations

- Gas monitoring well installed on completion as shown.

GL (m AOD)  
135.80  
Easting:  
Northing:

Fig. No.

**R05**



# BOREHOLE RECORD

BH No. **R05**  
Sheet 2 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
01/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RGD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description         | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|---------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Brown SANDSTONE.    |              |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 11           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 12           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 13           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 14           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 15           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 16           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 17           |                 |        |      |
|      |                        |         |         |         |           |                         | Weak grey MUDSTONE. | 17.80        | 118.00          |        |      |
|      |                        |         |         |         |           |                         |                     | 18           |                 |        |      |
|      |                        |         |         |         |           |                         |                     | 19           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

- Gas monitoring well installed on completion as shown.

GL (m AOD)  
135.80  
Easting:  
Northing:

Fig. No.  
**R05**



# BOREHOLE RECORD

BH No. **R05**  
Sheet 3 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
**01/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:

Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description         | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|---------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Weak grey MUDSTONE. |              |                 |        |      |
|      |                        |         |         |         |           |                         | COAL                | 20.30        | 115.50          |        |      |
|      |                        |         |         |         | 21        |                         |                     | 21           |                 |        |      |
|      |                        |         |         |         | 22        |                         | Grey MUDSTONE.      | 22           | 22.10           | 113.70 |      |
|      |                        |         |         |         | 23        |                         |                     | 23           |                 |        |      |
|      |                        |         |         |         | 24        |                         |                     | 24           |                 |        |      |
|      |                        |         |         |         | 25        |                         |                     | 25           |                 |        |      |
|      |                        |         |         |         | 26        |                         |                     | 26           |                 |        |      |
|      |                        |         |         |         | 27        |                         |                     | 27           |                 |        |      |
|      |                        |         |         |         | 28        |                         |                     | 28           |                 |        |      |
|      |                        |         |         |         | 29        |                         |                     | 29           |                 |        |      |

Continued next sheet

### Remarks and Water Observations:

- Gas monitoring well installed on completion as shown.

GL (m AOD)

135.80

Easting:

Northing:

Fig. No.

R05



# BOREHOLE RECORD

BH No. **R05**  
Sheet 4 of 4

Site: **Dodworth Road, Barnsley**

Contract No: **C3934**

Client: **Bellway Homes Ltd**

Dates: **01/07/2010**

Method: **Rotary openhole boring using water mist flush**

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By:

Driller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|----------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE.             |              |                 |        |      |
|      |                        |         |         |         |           |                         | End of Borehole at 30.50 m | 30.50        | 105.30          |        |      |
|      |                        |         |         |         |           | 31                      |                            | 31           |                 |        |      |
|      |                        |         |         |         |           | 32                      |                            | 32           |                 |        |      |
|      |                        |         |         |         |           | 33                      |                            | 33           |                 |        |      |
|      |                        |         |         |         |           | 34                      |                            | 34           |                 |        |      |
|      |                        |         |         |         |           | 35                      |                            | 35           |                 |        |      |
|      |                        |         |         |         |           | 36                      |                            | 36           |                 |        |      |
|      |                        |         |         |         |           | 37                      |                            | 37           |                 |        |      |
|      |                        |         |         |         |           | 38                      |                            | 38           |                 |        |      |
|      |                        |         |         |         |           | 39                      |                            | 39           |                 |        |      |

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown

GL (m AOD)

135.80

Easting:

Northing:

Fig. No.

R05



# BOREHOLE RECORD

BH.No. **R06**  
Sheet 1 of 2

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **02/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:

Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RDD (%) | N<br>(F) | Groundwater<br>(Casing) | Description                                    | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|----------|-------------------------|------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |          |                         | MADE GROUND: Insufficient returns to describe. |              |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 1            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 2            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 3            | 3.00            | 133.60 |      |
|      |                        |         |         |         |          |                         | Brown SANDSTONE.                               |              |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 4            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 5            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 6            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 7            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 8            |                 |        |      |
|      |                        |         |         |         |          |                         |                                                | 9            | 9.00            | 127.60 |      |
|      |                        |         |         |         |          |                         | Broken ground - loss of all flush returns.     |              |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

136.60

Easting:

Northing:

Fig. No.

R06



# BOREHOLE RECORD

BH No. **R06**  
Sheet 2 of 2

Site: **Dodworth Road, Barnsley**

Contract No: **C3934**

Client: **Bellway Homes Ltd**

Dates: **02/07/2010**

Method: **Rotary openhole boring using water mist flush**

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By:

Driller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                                | Depth<br>(m) | Level<br>(m AOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|--------------------------------------------|--------------|------------------|--------|------|
|      |                        |         |         |         |           |                         | Broken ground - loss of all flush returns. |              |                  |        |      |
|      |                        |         |         |         | 11        |                         | Hard Strata - No flush returns.            | 11 11.00     | 125.60           |        |      |
|      |                        |         |         |         | 12        |                         |                                            | 12           |                  |        |      |
|      |                        |         |         |         | 13        |                         | End of Borehole at 13.00 m                 | 13 13.00     | 123.60           |        |      |
|      |                        |         |         |         | 14        |                         |                                            | 14           |                  |        |      |
|      |                        |         |         |         | 15        |                         |                                            | 15           |                  |        |      |
|      |                        |         |         |         | 16        |                         |                                            | 16           |                  |        |      |
|      |                        |         |         |         | 17        |                         |                                            | 17           |                  |        |      |
|      |                        |         |         |         | 18        |                         |                                            | 18           |                  |        |      |
|      |                        |         |         |         | 19        |                         |                                            | 19           |                  |        |      |

### Remarks and Water Observations

1. Gas monitoring well installed on completion as shown

GL (m AOD)

136.60

Easting:

Northing:

Fig. No.

R06



# BOREHOLE RECORD

BH No. **R07**  
Sheet 1 of 4

Site: Dodworth Road, Barnsley

Contract No: **C3934**

Client: Bellway Homes Ltd

Dates: **02/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Diner: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description                                                       | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-------------------------------------------------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND: SAND and GRAVEL including ash, clinker and concrete. |              |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 1            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 2            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 3            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 4            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 5            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 6            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 7            |                 |        |      |
|      |                        |         |         |         |           |                         | Brown SANDSTONE.                                                  | 7.50         | 125.80          |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 8            |                 |        |      |
|      |                        |         |         |         |           |                         |                                                                   | 9            |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.30  
Easting:  
Northing:

Fig. No.

**R07**



# BOREHOLE RECORD

BH No. **R07**  
Sheet 2 of 4

Site: Dodworth Road, Barnsley

Contract No:

**C3934**

Client: Bellway Homes Ltd

Dates:

02/07/2010

Method: Rotary openhole boring using water mist flush

Scale 1:50

Logged By JW

Checked By:

Dither JS

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RQD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description      | Depth<br>(m) | Level<br>(m AOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|------------------|--------------|------------------|--------|------|
|      |                        |         |         |         |           |                         | Brown SANDSTONE. |              |                  |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.   | 10.30        | 123.00           |        |      |
|      |                        |         |         |         | 11        |                         |                  | 11           |                  |        |      |
|      |                        |         |         |         | 12        |                         |                  | 12           |                  |        |      |
|      |                        |         |         |         |           |                         | Brown SANDSTONE. | 12.50        | 120.80           |        |      |
|      |                        |         |         |         | 13        |                         |                  | 13           |                  |        |      |
|      |                        |         |         |         | 14        |                         | Grey MUDSTONE.   | 14.10        | 119.20           |        |      |
|      |                        |         |         |         | 15        |                         |                  | 15           |                  |        |      |
|      |                        |         |         |         | 16        |                         |                  | 16           |                  |        |      |
|      |                        |         |         |         | 17        |                         |                  | 17           |                  |        |      |
|      |                        |         |         |         | 18        |                         | COAL             | 18 18.00     | 115.30           |        |      |
|      |                        |         |         |         | 19        |                         |                  | 19           |                  |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown

GL (m AOD)

133.30

Easting:

Northing:

Fig. No.

R07



# BOREHOLE RECORD

BH No. **R07**  
Sheet 3 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
02/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

Logged By: JW Checked By:  
Driller: JS

## SAMPLE DETAILS

## STRATA RECORD

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(FI) | Groundwater<br>(Chang) | Description    | Depth<br>(m) | Level<br>(m AOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|------------------------|----------------|--------------|------------------|--------|------|
|      |                        |         |         |         |           |                        | COAL           |              |                  |        |      |
|      |                        |         |         |         |           |                        | Grey MUDSTONE. | 20.60        | 112.70           |        |      |
|      |                        |         |         |         | 21        |                        |                | 21           |                  |        |      |
|      |                        |         |         |         | 22        |                        |                | 22           |                  |        |      |
|      |                        |         |         |         | 23        |                        |                | 23           |                  |        |      |
|      |                        |         |         |         | 24        |                        |                | 24           |                  |        |      |
|      |                        |         |         |         | 25        |                        |                | 25           |                  |        |      |
|      |                        |         |         |         | 26        |                        |                | 26           |                  |        |      |
|      |                        |         |         |         | 27        |                        |                | 27           |                  |        |      |
|      |                        |         |         |         | 28        |                        |                | 28           |                  |        |      |
|      |                        |         |         |         | 29        |                        |                | 29           |                  |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.30  
Easting:  
-  
Northing:  
-

Fig. No.

R07



# BOREHOLE RECORD

BH No. **R07**  
Sheet 4 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
02/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Flt) | Groundwater<br>(Chasing) | Description                | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|------------|--------------------------|----------------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |            |                          | Grey MUDSTONE.             |              |                 |        |      |
|      |                        |         |         |         |            | 31                       |                            | 31           |                 |        |      |
|      |                        |         |         |         |            | 32                       |                            | 32           |                 |        |      |
|      |                        |         |         |         |            | 33                       |                            | 33           |                 |        |      |
|      |                        |         |         |         |            |                          | End of Borehole at 33.50 m | 33.50        | 99.80           |        |      |
|      |                        |         |         |         |            | 34                       |                            | 34           |                 |        |      |
|      |                        |         |         |         |            | 35                       |                            | 35           |                 |        |      |
|      |                        |         |         |         |            | 36                       |                            | 36           |                 |        |      |
|      |                        |         |         |         |            | 37                       |                            | 37           |                 |        |      |
|      |                        |         |         |         |            | 38                       |                            | 38           |                 |        |      |
|      |                        |         |         |         |            | 39                       |                            | 39           |                 |        |      |

### Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

133.30

Easting:

Northing:

Fig. No.

**R07**



# BOREHOLE RECORD

BH No. **R08**  
Sheet 1 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
**02/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driter: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | ROD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description      | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | MADE GROUND.     |              |                 |        |      |
|      |                        |         |         |         | 1         |                         |                  | 1            |                 |        |      |
|      |                        |         |         |         | 2         |                         |                  | 2            |                 |        |      |
|      |                        |         |         |         | 3         |                         |                  | 3            |                 |        |      |
|      |                        |         |         |         | 4         |                         |                  | 4            |                 |        |      |
|      |                        |         |         |         | 5         |                         |                  | 5            |                 |        |      |
|      |                        |         |         |         | 6         |                         |                  | 6            |                 |        |      |
|      |                        |         |         |         | 7         |                         | Brown SANDSTONE. | 7            | 7.00            | 126.00 |      |
|      |                        |         |         |         | 8         |                         |                  | 8            |                 |        |      |
|      |                        |         |         |         | 9         |                         |                  | 9            |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)

133.00

Easting:

Northing:

Fig. No.

**R08**



# BOREHOLE RECORD

BH No. **RO8**  
Sheet 2 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
02/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RDD (%) | N<br>(FI) | Groundwater<br>(Casing) | Description      | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|------------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Brown SANDSTONE. |              |                 |        |      |
|      |                        |         |         |         |           | 11                      |                  | 11           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.   | 11.60        | 121.40          |        |      |
|      |                        |         |         |         |           | 12                      |                  | 12           |                 |        |      |
|      |                        |         |         |         |           | 13                      |                  | 13           |                 |        |      |
|      |                        |         |         |         |           | 14                      |                  | 14           |                 |        |      |
|      |                        |         |         |         |           | 15                      |                  | 15           |                 |        |      |
|      |                        |         |         |         |           | 16                      |                  | 16           |                 |        |      |
|      |                        |         |         |         |           | 17                      |                  | 17           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey SILTSTONE.  | 17.50        | 115.50          |        |      |
|      |                        |         |         |         |           | 18                      |                  | 18           |                 |        |      |
|      |                        |         |         |         |           | 19                      |                  | 19           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.00  
Easting:  
Northing:

Fig. No.  
**RO8**



# BOREHOLE RECORD

BH No. **R08**  
Sheet 3 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
**02/07/2010**

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: **JW** Checked By:  
Driller: **JS**

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | RCD (%) | N<br>(Fl) | Groundwater<br>(Casing) | Description     | Depth<br>(m) | Level<br>(mAOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|-----------------|--------------|-----------------|--------|------|
|      |                        |         |         |         |           |                         | Grey SILTSTONE. |              |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 21           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 22           |                 |        |      |
|      |                        |         |         |         |           |                         | Grey MUDSTONE.  | 22.10        | 110.90          |        |      |
|      |                        |         |         |         |           |                         |                 | 23           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 24           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 25           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 26           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 27           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 28           |                 |        |      |
|      |                        |         |         |         |           |                         |                 | 29           |                 |        |      |

Continued next sheet

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
**133.00**

Easting:

Northing:

Fig. No.

**R08**



# BOREHOLE RECORD

BH No. **R08**  
Sheet 4 of 4

Site: Dodworth Road, Barnsley

Contract No:  
**C3934**

Client: Bellway Homes Ltd

Dates:  
02/07/2010

Method: Rotary openhole boring using water mist flush

Scale **1:50**

## SAMPLE DETAILS

## STRATA RECORD

Logged By: JW Checked By:  
Driller: JS

| Type | Depth<br>From - To (m) | TCR (%) | SCR (%) | ROD (%) | N<br>(Ft) | Groundwater<br>(Casing) | Description                                 | Depth<br>(m) | Level<br>(m AOD) | Legend | Well |
|------|------------------------|---------|---------|---------|-----------|-------------------------|---------------------------------------------|--------------|------------------|--------|------|
|      |                        |         |         |         |           |                         | Grey MUDSTONE.                              | 30.20        | 102.80           |        |      |
|      |                        |         |         |         |           |                         | Soft/broken ground - loss of flush returns. |              |                  |        |      |
|      |                        |         |         |         | 31        |                         |                                             | 31           |                  |        |      |
|      |                        |         |         |         | 32        |                         |                                             | 32           |                  |        |      |
|      |                        |         |         |         | 33        |                         | Hard strata - no flush returns recovered.   | 33.33.00     | 100.00           |        |      |
|      |                        |         |         |         | 34        |                         | End of Borehole at 34.00 m                  | 34.34.00     | 99.00            |        |      |
|      |                        |         |         |         | 35        |                         |                                             | 35           |                  |        |      |
|      |                        |         |         |         | 36        |                         |                                             | 36           |                  |        |      |
|      |                        |         |         |         | 37        |                         |                                             | 37           |                  |        |      |
|      |                        |         |         |         | 38        |                         |                                             | 38           |                  |        |      |
|      |                        |         |         |         | 39        |                         |                                             | 39           |                  |        |      |

## Remarks and Water Observations

1. Gas monitoring well installed on completion as shown.

GL (m AOD)  
133.00  
Easting:  
Northing:

Fig. No.

R08

# Ground Gas and Groundwater Monitoring Record Sheet



## JOB DETAILS:

Client: Bellway Homes  
Site: Dodworth Road, Barnsley.  
Date: 15/07/2010

Job No: C3934  
Visit No: 1 of 24 over 12 months  
Operator: TC Project Manager: DCB

| Monitoring Point | GAS CONCENTRATIONS |        |      |        |                       |        |                        |        |                          |        |               |        | VOLATILES      |                        | FLOW DATA       |        |                                     | WELL AND WATER DATA              |                    |                   |                      |                    | Comments |               |
|------------------|--------------------|--------|------|--------|-----------------------|--------|------------------------|--------|--------------------------|--------|---------------|--------|----------------|------------------------|-----------------|--------|-------------------------------------|----------------------------------|--------------------|-------------------|----------------------|--------------------|----------|---------------|
|                  | Methane (%v/v)     |        | %LEL |        | Carbon dioxide (%v/v) |        | Carbon monoxide (%v/v) |        | Hydrogen sulphide (%v/v) |        | Oxygen (%v/v) |        | PID Peak (ppm) | Product thickness (mm) | Flow rate (Vhr) |        | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Water level (mbgl) | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) |          | Response Zone |
|                  | Peak               | Steady | Peak | Steady | Peak                  | Steady | Peak                   | Steady | Peak                     | Steady | Min.          | Steady |                |                        | Peak            | Steady |                                     |                                  |                    |                   |                      |                    |          |               |
| RO 1             | ND                 | ND     | ND   | ND     | 8.2                   | 8.2    | ND                     | ND     | ND                       | ND     | 11.3          | 11.3   | ND             |                        | -0.2            | -0.2   |                                     | 5                                | 3.95               | 9.92              |                      |                    |          |               |
| RO 2             | ND                 | ND     | ND   | ND     | 0.4                   | 0.4    | ND                     | ND     | ND                       | ND     | 20.3          | 20.3   | ND             |                        | 0.5             | 0.5    |                                     | 2                                | 14.37              | 15.9              |                      |                    |          |               |
| RO 7             | ND                 | ND     | ND   | ND     | 0.6                   | 0.6    | ND                     | ND     | ND                       | ND     | 19            | 19     | ND             |                        | 0.8             | 0.6    |                                     |                                  | 7.53               | 9.85              |                      |                    |          |               |
| RO 4             |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    | 9                 |                      |                    |          |               |
| RO 5             |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    | 9.9               |                      |                    |          |               |
| RO 6             |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    | 10.1              |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                 |        |                                     |                                  |                    |                   |                      |                    |          |               |

## METEOROLOGICAL AND SITE INFORMATION:

State of ground: ☐ Dry ☐ Moist ☒ Wet ☐ Snow ☐ Frozen  
Wind: ☐ Light ☒ Moderate ☐ Strong  
Cloud cover: ☐ None ☐ Slight ☐ Cloudy ☒ Overcast  
Precipitation: ☐ None ☒ Slight ☐ Moderate ☐ Heavy  
Barometric pressure (mbar): 982 Before ☐ Falling ☒ Steady ☐ Rising  
Pressure trend: 20 Before ☐ After  
Air Temperature (Deg. C): 20 Before ☐ After

## INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: LMSx Multigas Analyser  
Gas concentration: CH<sub>4</sub> ND CO<sub>2</sub> ND O<sub>2</sub> 21.20%  
Gas Range: CH<sub>4</sub> 0-100% CO<sub>2</sub> 0-100% O<sub>2</sub> 0-25%  
Gas Flow range: -100l/hr to +300l/hr  
Differential Pressure: -0.10mbar to +0.80mbar  
Date of last calibration: 01/07/2010  
Date of next calibration:  
PID: Phoccheck 3000  
Calibrated range: 0-100ppm  
Calibration gas: Isobutylene  
Response time: 0.1s  
Accuracy: plus/minus 5% displayed Reading  
Date of last calibration: 01/07/2010  
Date of next calibration:

# Ground Gas and Groundwater Monitoring Record Sheet



## JOB DETAILS:

Client: Bellway Homes  
Site: Dodworth Road, Barnsley.  
Date: 26/07/2010

Job No: C3934  
Visit No: 2 of 24 over 12 months  
Operator: TC Project Manager: DCB

| Monitoring Point | GAS CONCENTRATIONS |        |      |        |                       |        |                        |        |                          |        |               |        | VOLATILES      |                        | FLOW DATA        |        |                                     |                                  | WELL AND WATER DATA |                   |                      |                    |               | Comments |
|------------------|--------------------|--------|------|--------|-----------------------|--------|------------------------|--------|--------------------------|--------|---------------|--------|----------------|------------------------|------------------|--------|-------------------------------------|----------------------------------|---------------------|-------------------|----------------------|--------------------|---------------|----------|
|                  | Methane (%v/v)     |        | %LEL |        | Carbon dioxide (%v/v) |        | Carbon monoxide (%v/v) |        | Hydrogen sulphide (%v/v) |        | Oxygen (%v/v) |        | PID Peak (ppm) | Product thickness (mm) | Flow rate (l/hr) |        | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Water level (mbgl)  | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) | Response Zone |          |
|                  | Peak               | Steady | Peak | Steady | Peak                  | Steady | Peak                   | Steady | Peak                     | Steady | Min.          | Steady |                |                        | Peak             | Steady |                                     |                                  |                     |                   |                      |                    |               |          |
| RO 1             | ND                 | ND     | ND   | ND     | 7.3                   | 7.3    | ND                     | ND     | ND                       | ND     | 10.7          | 10.7   | ND             |                        | ND               | ND     |                                     |                                  | 3.93                |                   |                      |                    |               |          |
| RO 2             | ND                 | ND     | ND   | ND     | 0.1                   | 0.1    | ND                     | ND     | ND                       | ND     | 20            | 20     | ND             |                        | 0.1              | 0.1    |                                     | 2                                | 14.97               |                   |                      |                    |               |          |
| RO 7             | ND                 | ND     | ND   | ND     | 0.1                   | 0.1    | ND                     | ND     | ND                       | ND     | 19.9          | 19.9   | ND             |                        | -0.2             | -0.2   |                                     |                                  | 7.4                 |                   |                      |                    |               |          |
| RO 4             | ND                 | ND     | ND   | ND     | 0.3                   | 0.3    | ND                     | ND     | ND                       | ND     | 19.8          | 19.8   | ND             |                        | -1.1             | -1.1   |                                     | 2                                | 5.56                |                   |                      |                    |               |          |
| RO 5             | ND                 | ND     | ND   | ND     | 7.4                   | 7.4    | ND                     | ND     | ND                       | ND     | 11            | 11     | 2.7            |                        | ND               | ND     |                                     |                                  | 7.45                |                   |                      |                    |               |          |
| RO 6             | ND                 | ND     | ND   | ND     | 0.8                   | 0.7    | ND                     | ND     | ND                       | ND     | 19.6          | 20     | 1.5            |                        | -0.2             | -0.2   |                                     | 2                                | 8.34                |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
|                  |                    |        |      |        |                       |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |
| Max              | 0                  | 0      | 0    | 0      | 7.4                   | 7.4    | 0                      | 0      | 0                        | 0      | 20            | 20     | 2.7            | 0                      | 0.1              | 0.1    | 0                                   | 2                                | 14.97               | 0                 | 0                    | 0.00               |               |          |
| Min              | 0                  | 0      | 0    | 0      | 0.1                   | 0.1    | 0                      | 0      | 0                        | 0      | 10.7          | 10.7   | 1.5            | 0                      | -1.1             | -1.1   | 0                                   | 2                                | 3.93                | 0                 | 0                    | 0.00               |               |          |
| GSV (l/hr)       | 0                  |        |      |        | 0.0074                |        |                        |        |                          |        |               |        |                |                        |                  |        |                                     |                                  |                     |                   |                      |                    |               |          |

## METEOROLOGICAL AND SITE INFORMATION:

State of ground:

☐ Dry  
☒ Calm  
☐ None  
☐ None

Wind:

Cloud cover:

Precipitation:

Barometric pressure (mbar):

Pressure trend:

Air Temperature (Deg. C):

(Select correct box with X or enter data, as applicable)

☐ Moist  
☐ Light  
☐ Slight  
☒ Slight  
999 Before  
Falling  
19 Before  
☒ Wet  
☐ Moderate  
☐ Cloudy  
☐ Moderate  
☒ Steady

☐ Snow  
☐ Strong  
☒ Overcast  
☐ Heavy  
999 After  
Rising  
19 After  
☐ Frozen

## INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GA2000

Gas concentration: CH<sub>4</sub> ND

Gas Range: CH<sub>4</sub> 0-100% CO<sub>2</sub> 0-100% O<sub>2</sub> 0-25%

Gas Flow range: -100l/hr to +300l/hr

Differential Pressure: -0.10mbar to +0.80mbar

Date of last calibration: 01/07/2010

Date of next calibration:

PID: Phoccheck 3000

Calibrated range: 0-100ppm

Calibration gas: Isobutylene

Response time: 0.1s

Accuracy: plus/minus 5% displayed Reading

Date of last calibration: 01/07/2010

Date of next calibration:

## APPENDIX V

Data from Landmark Report

## STATUTORY SOURCES OF INFORMATION

Information from the Landmark Information Group Ltd has been summarised in the Table below. The site sensitivity map and full copy of the Envirocheck data is available on request.

| Distance from an Approximate Central Point on Site*           |         |           |             |                             |
|---------------------------------------------------------------|---------|-----------|-------------|-----------------------------|
| Agency & Hydrological                                         | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| Contaminated Land Register Entries and Notices                |         |           |             |                             |
| Discharge Consents                                            |         |           | 2           | 5                           |
| Enforcement and Prohibition Notices                           |         |           |             |                             |
| Integrated Pollution Controls                                 |         | 4         |             |                             |
| Integrated Pollution Prevention and Control                   |         | 2         |             |                             |
| Local Authority Integrated Pollution Prevention and Control   |         |           |             |                             |
| Local Authority Pollution Prevention and Controls             | 1       | 4         |             | 6                           |
| Local Authority Pollution Prevention and Control Enforcements |         |           |             |                             |
| Nearest Surface Water Feature                                 |         | Yes       |             |                             |
| Pollution Incidents to Controlled Waters                      |         | 1         | 2           | 7                           |
| Prosecutions Relating to Authorised Processes                 |         |           |             |                             |
| Prosecutions Relating to Controlled Waters                    |         |           |             |                             |
| Registered Radioactive Substances                             |         |           |             | 12                          |
| River Quality                                                 |         |           |             |                             |
| River Quality Biology Sampling Points                         |         |           |             |                             |
| River Quality Chemistry Sampling Points                       |         |           |             |                             |
| Substantiated Pollution Incident Register                     |         |           |             |                             |
| Water Abstractions                                            |         |           |             | 4(*2)                       |
| Water Industry Act Referrals                                  |         |           |             |                             |
| Groundwater Vulnerability                                     | Yes     | n/a       | n/a         | n/a                         |
| Source Protection Zones                                       |         |           |             |                             |
| Extreme Flooding from Rivers or Sea without Defences          |         |           | n/a         | n/a                         |
| Flooding from Rivers or Sea with Defences                     |         |           | n/a         | n/a                         |
| Areas Benefiting from Flood Defences                          |         |           | n/a         | n/a                         |
| Flood Water Storage Areas                                     |         |           | n/a         | n/a                         |
| Flood Defences                                                |         |           | n/a         | n/a                         |
| Waste                                                         | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| BGS Recorded Landfill Sites                                   |         | 1         |             |                             |
| Integrated Pollution Control Registered Waste Sites           | 1       | 7         |             |                             |
| Licensed Waste Management Facilities (Landfills Boundaries)   |         |           |             |                             |
| Licensed Waste Management Facilities (Locations)              |         | 1         |             |                             |
| Local Authority Recorded Landfill Sites                       | 1       | 6         |             |                             |
| Registered Landfill Sites                                     |         | 3         |             |                             |
| Registered Waste Transfer Sites                               |         | 1         |             |                             |
| Registered Waste Treatment or Disposal Sites                  |         |           |             | 2                           |
| Hazardous Substances                                          | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| Control of Major Accident Hazards Sites (COMAH)               |         |           |             |                             |
| Explosive Sites                                               |         |           |             |                             |
| Notification of Installations Handling Hazardous Substances   |         |           |             |                             |



| (NIHHS)                                                           |         |           |             |                             |
|-------------------------------------------------------------------|---------|-----------|-------------|-----------------------------|
| Planning Hazardous Substance Consents                             |         |           |             |                             |
| Planning Hazardous Substance Enforcements                         |         |           |             |                             |
| Geological                                                        | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| Brine Compensation Areas                                          |         | n/a       | n/a         | n/a                         |
| Coal Mining Affected Areas                                        | Yes     | n/a       | n/a         | n/a                         |
| Mining Stability                                                  | Yes     | n/a       | n/a         | n/a                         |
| Natural and Mining Cavities                                       |         |           |             |                             |
| Potential for Collapsible Ground Stability Hazards                |         |           | n/a         | n/a                         |
| Potential for Compressible Ground Stability Hazards               | Yes     | Yes       | n/a         | n/a                         |
| Potential for Ground Dissolution Stability Hazards                |         |           | n/a         | n/a                         |
| Potential for Landslide Ground Stability Hazards                  | Yes     | Yes       | n/a         | n/a                         |
| Potential for Running Sand Ground Stability Hazards               | Yes     | Yes       | n/a         | n/a                         |
| Potential for Shrinking or Swelling Clay Ground Stability Hazards | Yes     | Yes       | n/a         | n/a                         |
| Radon Affected Areas                                              | Yes     | n/a       | n/a         | n/a                         |
| Radon Protection Measures                                         |         | n/a       | n/a         | n/a                         |
| Shallow Mining Hazards                                            |         |           | n/a         | n/a                         |
| Industrial Land Use                                               | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| Contemporary Trade Directory Entries                              | 2       | 14        | 15          | 73                          |
| Fuel Station Entries                                              |         | 3         |             | 1                           |
| Sensitive Land Use                                                | On Site | 0 to 250m | 251 to 500m | 501 to 1000m (*up to 2000m) |
| Areas of Adopted Green Belt                                       |         |           | 1           |                             |
| Areas of Unadopted Green Belt                                     |         |           |             |                             |
| Areas of Outstanding Natural Beauty                               |         |           |             |                             |
| Environmentally Sensitive Areas                                   |         |           |             |                             |
| Forest Parks                                                      |         |           |             |                             |
| Local Nature Reserves                                             |         |           |             |                             |
| Marine Nature Reserves                                            |         |           |             |                             |
| National Nature Reserves                                          |         |           |             |                             |
| National Parks                                                    |         |           |             |                             |
| National Sensitive Areas                                          |         |           |             |                             |
| Nitrate Vulnerable Zones                                          | 1       | 1         |             |                             |
| RAMSAR Sites                                                      |         |           |             |                             |
| Sites of Special Scientific Interest                              |         |           |             |                             |
| Special Areas of Conservation                                     |         |           |             |                             |
| Special Protection Areas                                          |         |           |             |                             |

\*The distances recorded are approximate and measured from the site boundary.

\*\* Where 'Yes' and 'No' are referred to this indicates the presence or absence of data and does not imply a potential risk or hazard.



**wardell  
armstrong**

## **APPENDIX VI**

**British Geological Survey Radon Report**



**British  
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

**GeoReports**

**Michael Kelly  
Wardell Armstrong LLP  
Unit 5 Newton Business Centre  
Thornccliffe Park Estate  
Chapelton  
Sheffield  
South Yorkshire  
S74 9PJ**

## **BR211 Radon Report:**

Advisory report on the requirement for radon protective measures in new buildings and extensions.

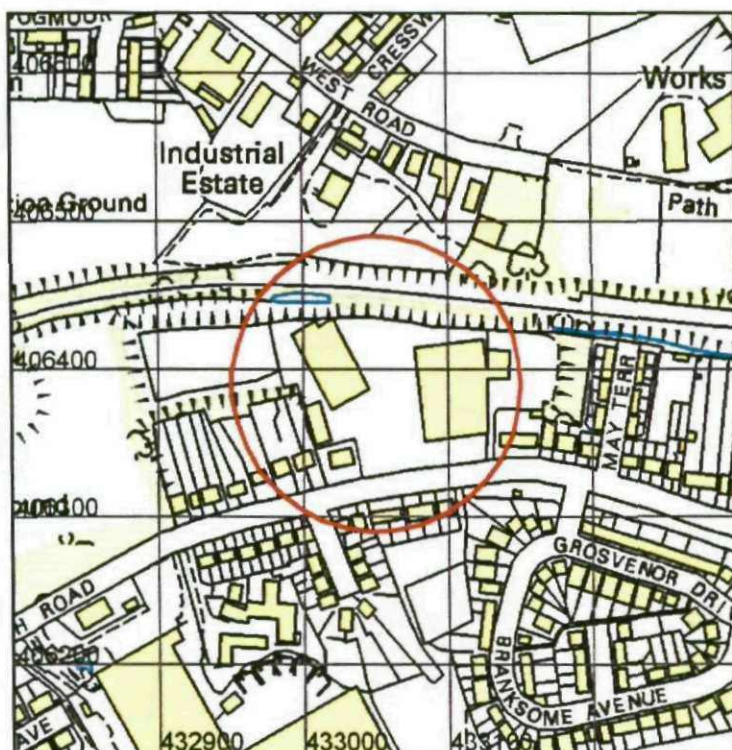
**Report Id: GR\_201538/1**

**Client reference: SH10615**



## Location and extent of site

*This report describes a site located at National Grid Reference 433050, 406390.  
Note that for sites of irregular shape, this point may lie outside the site boundary.  
Where the client has submitted a site plan the assessment will be based on the area given.*



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Scale: 1:5 000 (1cm = 50 m)

**Search area indicated in red**



## **BR211 Radon Report**

This is an advisory report on the requirement for radon protective measures in new buildings and extensions.

### **Requirement for radon protective measures**

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

**NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.**

The BGS is not able to provide advice on the technical specifications of 'basic' and 'full' radon protective measures. This information is detailed in **BRE Report BR211 :Radon: Protective measures for new buildings** which may be purchased from **brebookshop.com**. BR211 offers guidance on the technical solutions that are required to satisfy Building Regulations requirements. Summary guidance is available on the web at: <http://www.bre.co.uk/radon/protect.html>.

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Contact 020 7944 5758 or Email: [partsac.br@communities.gsi.gov.uk](mailto:partsac.br@communities.gsi.gov.uk) for advice on the interpretation of guidance contained in BRE Report BR211 (2007).



### What is radon ?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre ( $\text{Bq m}^{-3}$ ). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

### Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293): **Radon in the workplace**. BRE publications may be obtained from The BRE Bookshop, I H S Technical Indexes Ltd., Willoughby Road, Bracknell, Berkshire RG12 8DW. Tel: 01344 404407, Fax: 01344 714440, website: [www.brebookshop.com](http://www.brebookshop.com)



### Radon in existing buildings

Useful information is given in the following free publications which can be obtained by writing to:

Radon Studies, Radiation Protection Division, Health Protection Agency, Chilton,  
Didcot, Oxfordshire OX11 0RQ

#### Radon - A Householder's Guide

#### Radon - You Can Test for it

#### Radon - A Guide for Homebuyers and Sellers

#### Radon - A Guide to Reducing Levels in Your Home

Information in the booklets is also available on the DEFRA website at:

<http://www.defra.gov.uk/environment/radioactivity/background/radon.htm>

Householders are recommended to follow advice in **Radon - a householder's guide**.

The guide outlines simple solutions for dealing with the radon problem depending on whether or not the home has been tested for radon. In radon affected homes, the problem of radon can usually be tackled with simple, effective and relatively inexpensive measures. These measures are comparable in cost to work such as damp-proofing and timber treatment. You can get practical advice about construction work to reduce radon levels from the Building Control Officer at your local council.

#### Is this property in a radon affected area – **YES**

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area** is **YES** this property is in a Radon Affected Area as defined by the Health Protection Agency (HPA).

The estimated probability of the property being above the Action Level for radon is:  
**1-3%.**

In addition to the search area, the radon data includes a 75 metre zone around the site to allow for uncertainties in location data and geological line work.

The result informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property. The only way to determine whether it is above or below the Action Level is to carry out a radon measurement within the existing property.

Radon Affected Areas are designated by the HPA. They advise that radon gas should be measured in all properties within Radon Affected Areas.



If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

For further information, advice about radon, its health risks and details of how to order the radon test, please contact the HPA Radon Helpline on 01235 822622 or go online at [www.ukradon.org](http://www.ukradon.org) or write to Radon Studies at the Health Protection Agency, address above. You can obtain an information pack from the HPA free Radon answer phone on 0800 614529.



---

## **Contact Details**

### ***Keyworth (KW) Office***

British Geological Survey  
Kingsley Dunham Centre  
Keyworth  
Nottingham  
NG12 5GG  
Tel: 0115 9363143  
Fax: 0115 9363276  
Email: [enquiries@bgs.ac.uk](mailto:enquiries@bgs.ac.uk)

### ***Wallingford (WL) Office***

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Maclean Building  
Wallingford  
Oxford  
OX10 8BB  
Tel: 01491 838800  
Fax: 01491 692345  
Email: [hydroenq@bgs.ac.uk](mailto:hydroenq@bgs.ac.uk)

### ***Murchison House (MH) Office***

British Geological Survey  
Murchison House  
West Mains Road  
Edinburgh  
EH9 3LA  
Tel: 0131 650 0282  
Fax: 0131 650 0252  
Email: [enquiry@bgs.ac.uk](mailto:enquiry@bgs.ac.uk)



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### **Important notes about this Report**

- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

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**Report issued by  
BGS Enquiry Service**

## APPENDIX VII

### Coal Authority Report

**Issued by:**

The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG  
ON-Line Service: [www.groundstability.com](http://www.groundstability.com) - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

CUSTOMER SERVICES,  
LANDMARK INFORMATION GROUP LIMITED,  
ABBAY COURT UNIT 5/7,  
EAGLE WAY,  
SOWTON INDUSTRIAL ESTATE,  
EXETER,  
DEVON,  
EX2 7HY

Person dealing with this matter: **Darren Moody**  
Our reference: **00056126-10**  
Your reference: **33371863**  
Electronic Ref: **EME\_00015086910006\_005**  
RRUID: **005.00015086910006**  
Date of your enquiry: **10 December 2010**  
Date we received your enquiry: **10 December 2010**  
Date of issue: **15 December 2010**

This report is for the property described in the address below and the attached plan.

## Non-Residential Coal and Brine Report

Site At, Dodworth Road, Barnsley, South Yorkshire

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

|                             |     |
|-----------------------------|-----|
| Coal mining                 | Yes |
| Brine Compensation District | No  |

### Information from the Coal Authority

#### Underground Coal Mining

##### Past

The property is in the likely zone of influence from workings in 8 seams of coal at shallow to 370m depth, and last worked in 1978.

##### Present

The property is not in the likely zone of influence of any present underground coal workings.

##### Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove coal using underground methods.

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The property is not in an area that is likely to be affected at the surface from any planned future workings.

However reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

### **Mine entries**

Within, or within 20 metres of, the boundary of the property there are 2 mine entries, the approximate positions of which are shown on the attached plan.

There is no record of what steps, if any, have been taken to treat the mine entries.

Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

### **Coal-mining geology**

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

### **Opencast Coal Mining**

#### **Past**

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

#### **Present**

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

#### **Future**

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

### **Coal-mining subsidence**

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

### **Mine gas**

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

### **Hazards related to coal mining**

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

### **Withdrawal of Support**

The property is in an area for which a notice of entitlement to withdraw support was published in 1950.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

### **Working Facilities Orders**

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

### **Payments to Owners of Former Copyhold Land**

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

### **Comments on Coal Authority information**

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/ former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

The attached plan shows the approximate location of the disused mine entry/entries referred to in this report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan. Property owners have the benefit of statutory protection (under the Coal Mining Subsidence act 1991\*). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and the obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by telephoning 0845 762 6848 or online at [www.coal.gov.uk/services/subsidence](http://www.coal.gov.uk/services/subsidence). If you wish to discuss the relevance of any of the information contained in this report you should seek the advice of a qualified mining engineer or surveyor. If you or your adviser wish to examine the source plans from which the information has been taken these are normally available at our Mansfield office, free of charge, by prior appointment, telephone 01623 637233. Should you or your adviser wish to carry out any physical investigations that may enter, disturb or interfere with any disused mine entry the prior permission of the owner must be sought. For coal mine entries the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries). Our emergency telephone number at all times is 01623 646333.

\*Note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

### ***Information from the Cheshire Brine Subsidence Compensation Board***

The property lies outside the Cheshire Brine Compensation District.

### **Additional remarks**

This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006. The report is compliant with Home Information Pack requirements.

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## Location map



Approximate  
position  
of property



## Enquiry boundary

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## Key

Approximate position of enquiry boundary shown



Disused Adit or Mineshaft



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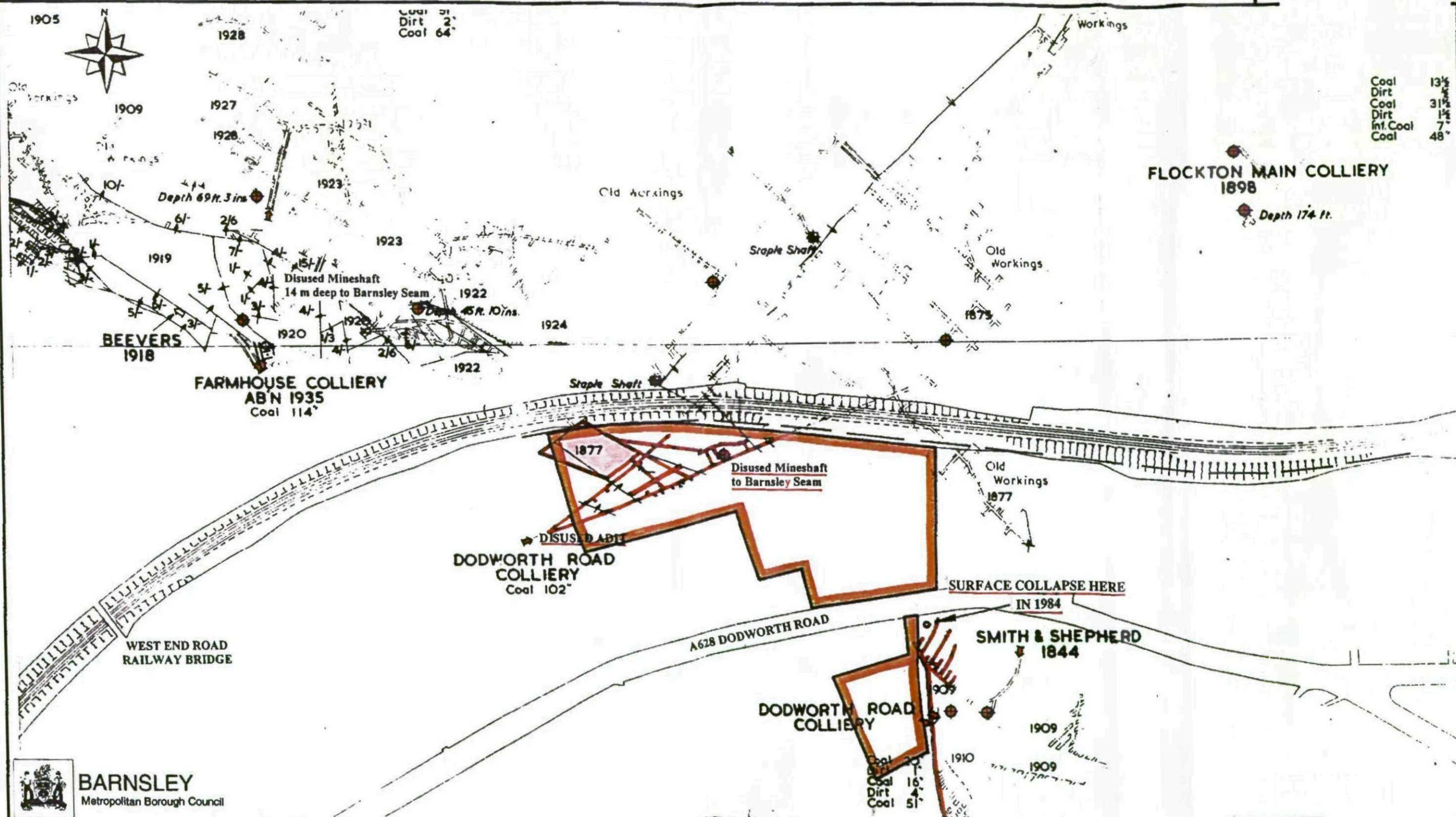
## APPENDIX VIII

### Additional Mining Data

DRAWING TITLE

DRAWING NO.

**LAND OFF DODWORTH ROAD, BARNSELY**  
**COMPILATION OF MINE ABANDONMENT PLANS**  
**BARNSELY SEAM**



**BARNSELY**  
 Metropolitan Borough Council

SCALE

1:2500

DRAWN BY

AS

**SOUTH YORKSHIRE MINING**  
**ADVISORY SERVICE**

O.S. REFERENCE

SE 3206

P. JAMES BSc (Hons)

PRINCIPAL MINING ENGINEER



## APPENDIX IX

### List of Land Uses and Associated Chemicals of Potential Concern



## APPENDIX X

### Borehole Logs



Site  
Polar Ford Extension Site

Borehole  
Number  
**BH1**

|                                   |                                     |                     |                              |                          |
|-----------------------------------|-------------------------------------|---------------------|------------------------------|--------------------------|
| Boring Method<br>Cable Percussion | Casing Diameter                     | Ground Level (mOD)  | Client<br>Bellway Homes Ltd. | Job<br>Number<br>SH10753 |
|                                   | Location<br>See Drawing SH10753-002 | Dates<br>04/08/2011 | Engineer<br>M Kelly          | Sheet<br>1/1             |

| Depth<br>(m)                                | Sample / Tests               | Casing<br>Depth<br>(m) | Water<br>Depth<br>(m) | Field Records  | Level<br>(mOD) | Depth<br>(m)<br>(Thickness)      | Description                                                                                                                                                                                                                     | Legend | Water | Instr |
|---------------------------------------------|------------------------------|------------------------|-----------------------|----------------|----------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|-------|
| 0.40<br>0.50-0.95<br>0.50-0.95<br>0.50-1.20 | D1<br>SPT(C) N=12<br>C<br>B2 |                        |                       | 2,1/3,2,3,4    |                | (0.20)<br>0.20<br>(0.20)<br>0.40 | Tarmac.<br><br>MADE GROUND: Loose greyish brown sandy gravel of limestone aggregate.<br><br>MADE GROUND: Loose black very gravelly sand. Gravel of ash, brick, clinker, ceramic and bottle fragments with sandstone from 3.85m. |        |       |       |
| 1.50-1.95<br>1.50-1.95                      | SPT(C) N=9<br>C              |                        |                       | 1,1/2,3,2,2    |                |                                  |                                                                                                                                                                                                                                 |        |       |       |
| 2.10<br>2.30                                | D3<br>D4                     |                        |                       |                |                | (4.00)                           |                                                                                                                                                                                                                                 |        |       |       |
| 2.50-2.95<br>2.50-2.95<br>2.50-3.50         | SPT N=15<br>S5<br>B6         |                        |                       | 2,2/4,5,3,3    |                |                                  |                                                                                                                                                                                                                                 |        |       |       |
| 3.50-3.95<br>3.50-3.85                      | SPT N=50<br>S7               |                        |                       | 1,4/5,8,37     |                |                                  |                                                                                                                                                                                                                                 |        |       |       |
| 4.40<br>4.50-4.80                           | D8<br>U                      |                        |                       | 100 blows      |                | 4.40<br>(0.30)<br>4.70           | Stiff orange brown mottled light grey CLAY.                                                                                                                                                                                     |        |       |       |
| 4.80-5.25<br>4.80-5.25<br>4.80-5.80         | SPT N=43<br>S9<br>B10        |                        |                       | 5,7/8,10,11,14 |                | (1.70)                           | Stiff greyish brown slightly gravelly CLAY.<br>Gravel of mudstone and coal fragments.                                                                                                                                           |        |       |       |
| 5.80-6.25<br>5.80-6.20                      | SPT N=50<br>S11              |                        |                       | 8,8/9,15,21,5  |                | 6.40                             | Weak grey weathered MUDSTONE.                                                                                                                                                                                                   |        |       |       |
| 6.40<br>6.50-6.95<br>6.50-6.95              | D12<br>SPT N=37<br>S13       |                        |                       | 7,7/8,8,10,11  |                | (2.35)                           |                                                                                                                                                                                                                                 |        |       |       |
| 7.50                                        | D14                          |                        |                       |                |                | 8.75                             | Complete at 8.75m                                                                                                                                                                                                               |        |       |       |
| 8.50-8.95<br>8.50-8.75                      | SPT N=50<br>S15              |                        |                       | 16,9/39,11     |                |                                  |                                                                                                                                                                                                                                 |        |       |       |

Remarks

Scale  
(approx)  
1:50

Logged  
By  
M Kelly

Figure No.  
SH10753.BH1



Site  
Polar Ford Extension Site

Borehole Number  
**BH2**

|                                   |                                     |                                    |                              |                       |
|-----------------------------------|-------------------------------------|------------------------------------|------------------------------|-----------------------|
| Boring Method<br>Cable Percussion | Casing Diameter                     | Ground Level (mOD)                 | Client<br>Bellway Homes Ltd. | Job Number<br>SH10753 |
|                                   | Location<br>See Drawing SH10753-002 | Dates<br>04/08/2011-<br>05/08/2011 | Engineer<br>M Kelly          | Sheet<br>1/1          |

| Depth (m)                                   | Sample / Tests            | Casing Depth (m) | Water Depth (m) | Field Records  | Level (mOD) | Depth (m) (Thickness)                              | Description                                                                                                                                                                                                                          | Legend | Water |
|---------------------------------------------|---------------------------|------------------|-----------------|----------------|-------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| 0.45<br>0.50-0.95<br>0.50-0.95<br>1.00-2.00 | D1<br>SPT N=9<br>S2<br>B3 |                  |                 | 1,2/3,2,2,2    |             | (0.05)<br>0.05<br>(0.15)<br>0.20<br>(0.25)<br>0.45 | Tarmac.<br>Concrete.<br>MADE GROUND: Loose greyish brown sandy gravel of limestone aggregate.<br>MADE GROUND: Loose black very gravelly sand. Gravel of ash, brick, clinker, ceramic and bottle fragments with sandstone from 3.85m. |        |       |
| 1.50-1.95<br>1.50-1.95                      | SPT N=9<br>S4             |                  |                 | 2,1/2,1,2,4    |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 2.50-2.95<br>2.50-2.95                      | SPT N=6<br>S5             |                  |                 | 1,3/1,1,1,3    |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 3.00-4.00                                   | B6                        |                  |                 |                |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 3.50-3.95<br>3.50-3.95                      | SPT N=12<br>S7            |                  |                 | 1,2/3,2,3,4    |             | (5.95)                                             |                                                                                                                                                                                                                                      |        |       |
| 4.50-4.95<br>4.50-4.95                      | SPT N=9<br>S8             |                  |                 | 1,1/1,2,3,3    |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 5.00-6.00                                   | B9                        |                  |                 |                |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 5.50-5.95<br>5.50-5.95                      | SPT N=14<br>S10           |                  |                 | 2,1/3,2,4,5    |             |                                                    |                                                                                                                                                                                                                                      |        |       |
| 6.40                                        | D11                       |                  |                 |                |             | 6.40                                               | Firm greyish brown silty CLAY.                                                                                                                                                                                                       |        |       |
| 6.70-7.15<br>6.70-7.15                      | SPT N=24<br>S12           |                  |                 | 3,4/5,6,6,7    |             | (0.40)<br>6.80                                     | Firm-Stiff orange brown mottled light grey CLAY.                                                                                                                                                                                     |        |       |
| 7.60<br>7.70-8.15<br>7.70-8.15              | D13<br>SPT N=46<br>S14    |                  |                 | 5,8/9,11,12,14 |             | (0.80)<br>7.60                                     | Weak grey weathered MUDSTONE with traces of coal and silty clay.                                                                                                                                                                     |        |       |
| 8.30<br>8.50-8.95<br>8.50-8.82              | D15<br>SPT N=50<br>S16    |                  |                 | 10,14/18,21,11 |             | 8.30<br>(1.20)                                     | Medium Strong grey brown MUDSTONE.                                                                                                                                                                                                   |        |       |
| 9.20-9.65<br>9.20<br>9.20-9.50              | SPT N=50<br>D17<br>S18    |                  |                 | 16,9/23,25,2   |             | 9.50                                               | Complete at 9.50m                                                                                                                                                                                                                    |        |       |

|         |                           |           |
|---------|---------------------------|-----------|
| Remarks | Scale (approx)            | Logged By |
|         | 1:50                      | M Kelly   |
|         | Figure No.<br>SH10753.BH2 |           |

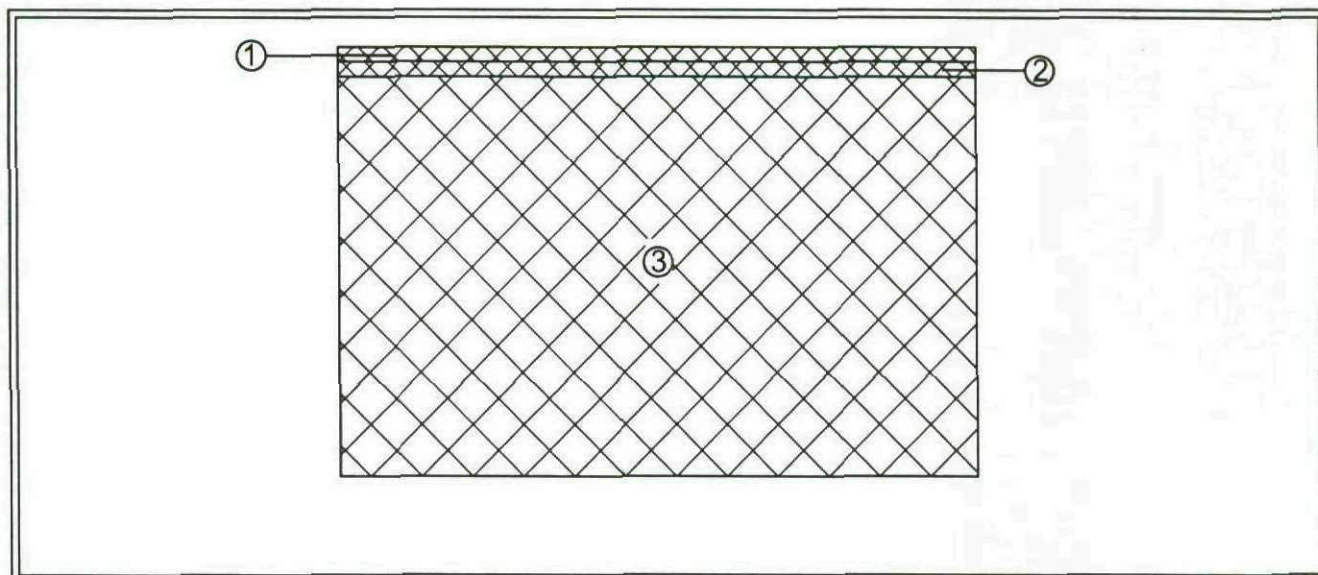
## APPENDIX XI

### Trial Pit Logs



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP301 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |

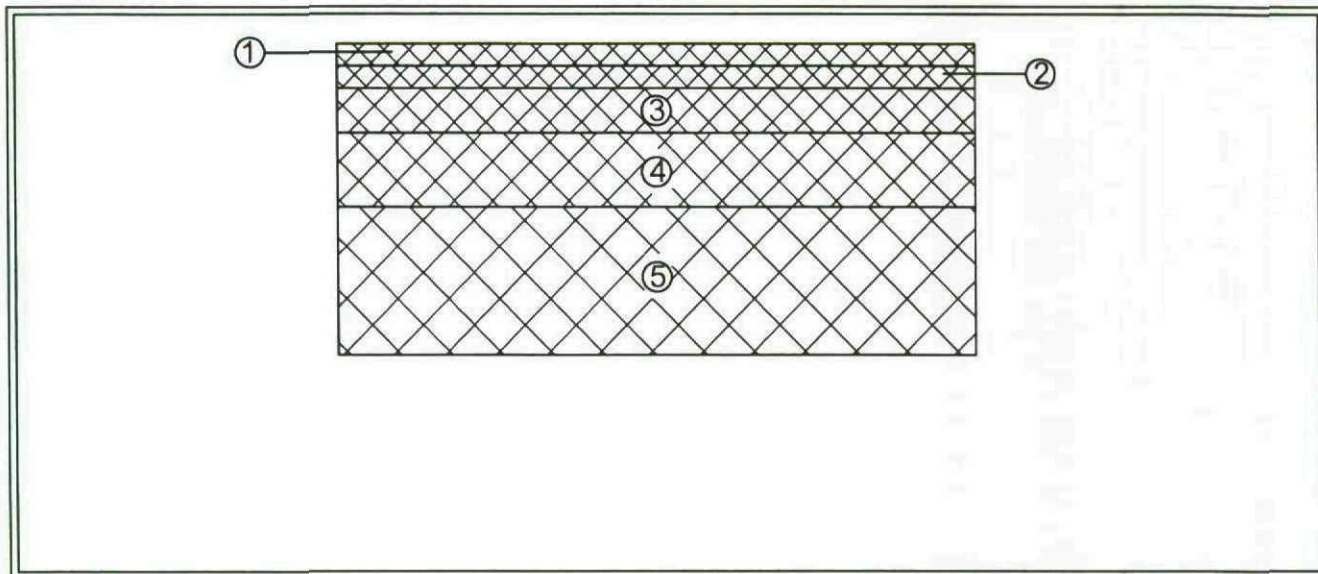


| STRATA    |               |     |                                                                                                                       | SAMPLES   |      | TESTS                                                                                |
|-----------|---------------|-----|-----------------------------------------------------------------------------------------------------------------------|-----------|------|--------------------------------------------------------------------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                           | Depth (m) | Type | Chemical / Geotechnical                                                              |
| 0.00-0.10 | 0.10          | 1   | MADE GROUND: Loose grey sandy gravel of brick, limestone aggregate and pebbles.                                       |           |      |                                                                                      |
| 0.10-0.20 | 0.10          | 2   | MADE GROUND: Stiff red sandy gravelly clay. Gravel of brick.                                                          |           |      |                                                                                      |
| 0.20-2.90 | 2.70          | 3   | MADE GROUND: Loose black very sandy gravel of ash, brick, ceramic and bottle fragments, shale, clinker and rare slag. | 0.5       | D    | Soil MAXI SVOC, UKCWG, VOC, Asbestos, TOC.<br>Soil MIDI PAH, Soluble Sulphate (2:1). |
|           |               |     |                                                                                                                       | 1.8       | D    |                                                                                      |



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP302 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |

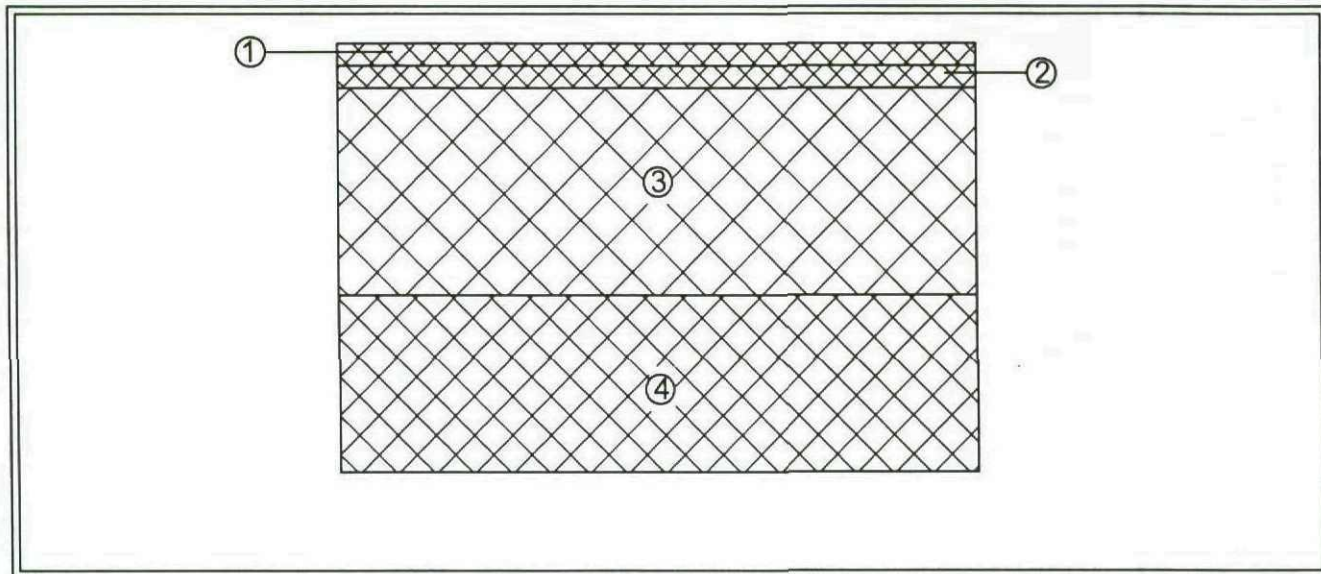


| STRATA    |               |     |                                                                                                                          | SAMPLES   |      | TESTS                                    |
|-----------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------|-----------|------|------------------------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                              | Depth (m) | Type | Chemical / Geotechnical                  |
| 0.00-0.15 | 0.15          | 1   | MADE GROUND: Loose greyish brown sandy gravel of limestone aggregate.                                                    |           |      |                                          |
| 0.15-0.30 | 0.15          | 2   | MADE GROUND: Loose black very gravelly sand. Gravel of ash, brick, limestone aggregate, tarmac, shale and rare slates.   |           |      |                                          |
| 0.30-0.60 | 0.30          | 3   | MADE GROUND: Medium Dense light yellowish brown sandy gravel of limestone aggregate.                                     |           |      |                                          |
| 0.60-1.10 | 0.50          | 4   | MADE GROUND: Medium Dense red/black sandy cobbly gravel of ash and brick. Cobbles of whole bricks.                       | 0.7       | D    | Soil MAXI SVOC, Asbestos, TOC.           |
| 1.10-2.10 | 1.00          | 5   | MADE GROUND: Firm brownish grey slightly sandy slightly cobbly gravelly clay. Cobbles and gravel of brick and sandstone. | 1.3       | D    | Soil MIDI PAH, Soluble Sulphate (2:1).   |
|           |               |     | Refusal at 2.1m on sandstone boulder.                                                                                    | 1.4       | B    | Moisture Content, Atterberg Limits, PSD. |



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP303 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |

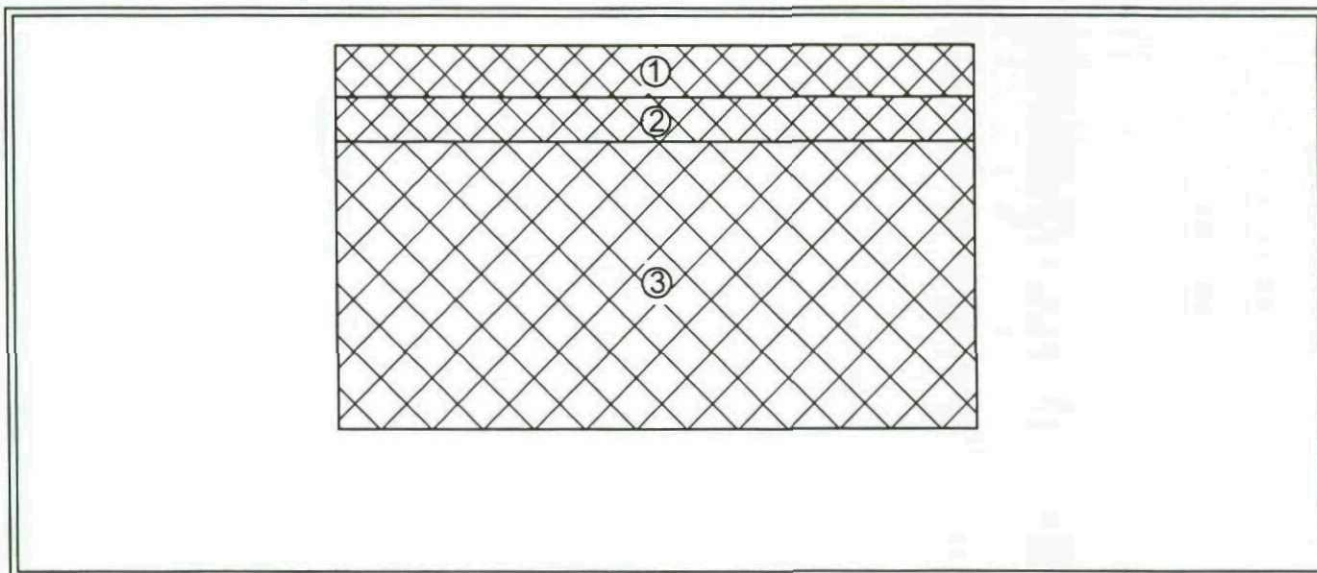


| STRATA    |               |     |                                                                                                                            | SAMPLES   |      | TESTS                                       |
|-----------|---------------|-----|----------------------------------------------------------------------------------------------------------------------------|-----------|------|---------------------------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                                | Depth (m) | Type | Chemical / Geotechnical                     |
| 0.00-0.15 | 0.15          | 1   | MADE GROUND: Loose grey brown sandy gravel of limestone aggregate, brick and tarmac.                                       | 0.2       | D    | Soil MAXI SVOC, UKCWG, VOC, Asbestos.       |
| 0.15-0.30 | 0.15          | 2   | MADE GROUND: Loose black slightly cobbly sandy gravel of ash and brick.                                                    |           |      |                                             |
| 0.30-1.70 | 1.40          | 3   | MADE GROUND: Stiff greyish brown slightly sandy slightly cobbly gravelly clay. Cobbles and gravel of brick and sandstone.  | 1.8       | D    | Soil MIDI PAH, Soluble Sulphate (2:1), TOC. |
| 1.70-2.90 | 1.20          | 4   | MADE GROUND: Loose red/black cobbly gravelly sand. Gravel of ash, brick, slates and rare clinker; cobbles of whole bricks. |           |      |                                             |



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP304 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |

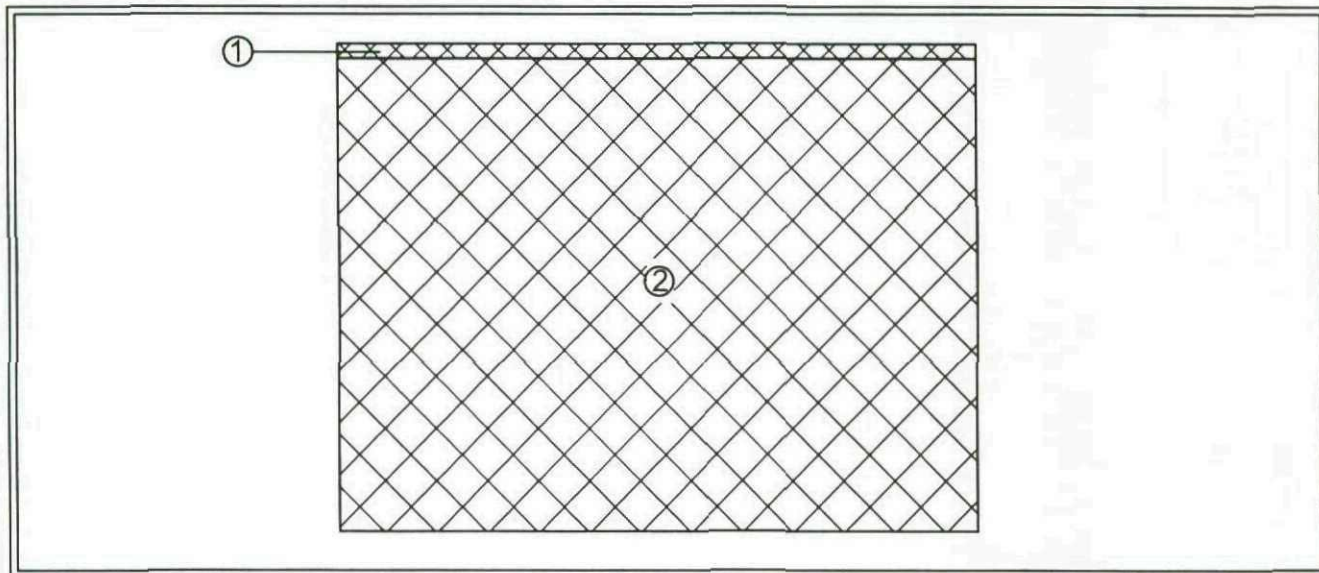


| STRATA    |               |     |                                                                                                                                | SAMPLES    |        | TESTS                                                                               |
|-----------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------|------------|--------|-------------------------------------------------------------------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                                    | Depth (m)  | Type   | Chemical / Geotechnical                                                             |
| 0.00-0.35 | 0.35          | 1   | MADE GROUND: Loose dark grey sandy gravel of brick, limestone aggregate, pebbles, concrete and tarmac.                         |            |        |                                                                                     |
| 0.35-0.65 | 0.30          | 2   | MADE GROUND: Loose black sandy cobbly gravel of ash, brick, sandstone, tarmac, limestone aggregate and rare slate.             |            |        |                                                                                     |
| 0.65-2.60 | 1.95          | 3   | MADE GROUND: Stiff brownish grey slightly sandy slightly cobbly gravelly clay. Cobbles and gravel of sandstone and rare brick. | 0.8<br>1.0 | D<br>B | Soil MAXI SVOC, Soluble Sulphate (2:1), TOC.<br>Moisture Content, Atterberg Limits. |



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP305 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |

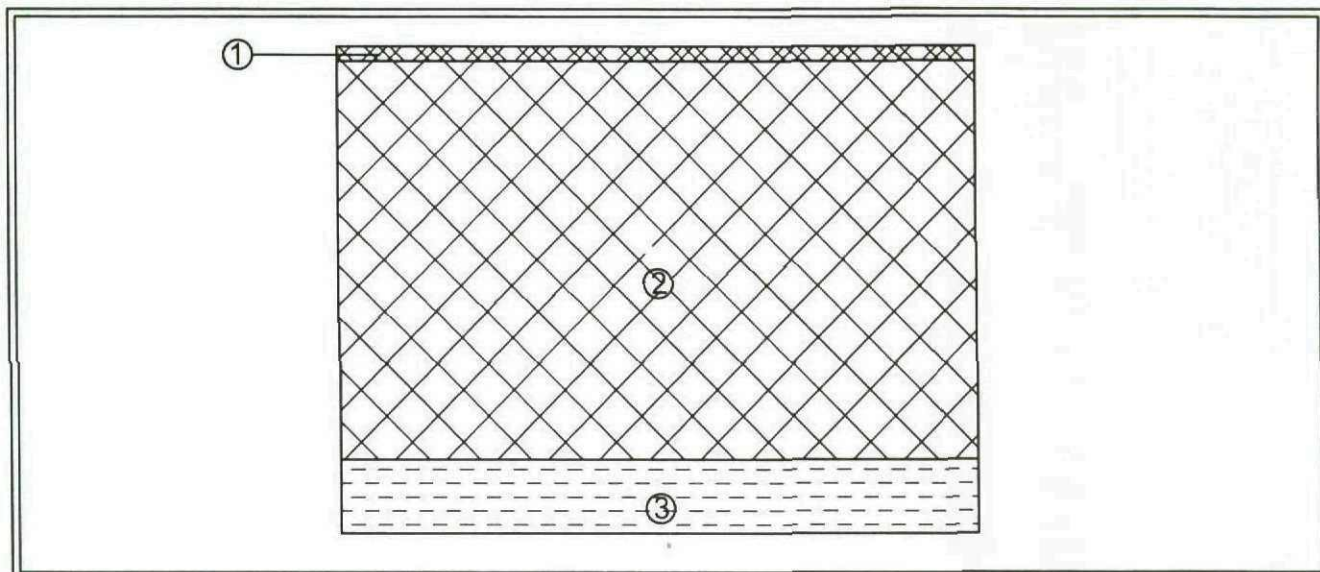


| STRATA    |               |     |                                                                                                                                                | SAMPLES   |      | TESTS                                      |
|-----------|---------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------------------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                                                    | Depth (m) | Type | Chemical / Geotechnical                    |
| 0.00-0.10 | 0.10          | 1   | MADE GROUND: Loose brownish grey sandy gravel of limestone aggregate, brick, tarmac and pebbles.                                               |           |      |                                            |
| 0.10-3.20 | 3.10          | 2   | MADE GROUND: Loose black very gravelly sand. Gravel of ash, brick, clinker, ceramic and bottle fragments, animal bone fragments and rare slag. | 0.4       | D    | Soil MAXI SVOC, UKCWG, VOC, PCB, Asbestos. |



## TRIAL PIT RECORD

|                                       |                                       |                     |
|---------------------------------------|---------------------------------------|---------------------|
| Excavator:<br>Zaxis 30                | Project:<br>Polar Ford Extension Site | Job No:<br>SH10753  |
| Weather: Warm, overcast with showers. |                                       | Trial Pit:<br>TP306 |
| Grid Ref:                             | Remarks:                              | Date:<br>04/08/2011 |
| Logged By: M Kelly                    |                                       |                     |



| STRATA    |               |     |                                                                                                                                                | SAMPLES   |      | TESTS                       |
|-----------|---------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|-----------------------------|
| Depth (m) | Thickness (m) | No. | Description                                                                                                                                    | Depth (m) | Type | Chemical / Geotechnical     |
| 0.00-0.10 | 0.10          | 1   | MADE GROUND: Loose brownish grey sandy gravel of limestone aggregate, brick, tarmac and pebbles.                                               | 0.6       | D    | Soil MAXI SVOC, UKCWG, VOC. |
| 0.10-2.70 | 2.60          | 2   | MADE GROUND: Loose black very gravelly sand. Gravel of ash, brick, clinker, ceramic and bottle fragments, animal bone fragments and rare slag. |           |      |                             |
| 2.60-3.10 | 0.50          | 3   | MADE GROUND: Stiff greyish brown slightly sandy slightly gravelly clay. Gravel of sandstone.                                                   |           |      |                             |



## APPENDIX XII

### Geochemical Laboratory Results



Wardell Armstrong LLP  
Unit 4 Newton Business Centre  
Thornccliffe Park  
Sheffield  
South Yorkshire  
S35 2PH

Attention: Mike Kelly

## CERTIFICATE OF ANALYSIS

Date: 25 August 2011  
Customer: H\_WARDELL\_SHF  
Sample Delivery Group (SDG): 110809-50  
Your Reference: SH10753  
Location:  
Report No: 146949

We received 9 samples on Saturday August 06, 2011 and 9 of these samples were scheduled for analysis which was completed on Thursday August 25, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

**Sonia McWhan**  
Operations Manager





SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

Location:  
Customer: Wardell Armstrong LLP  
Attention: Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

## Received Sample Overview

| Lab Sample No(s) | Customer Sample Ref. | AGS Ref. | Depth (m) | Sampled Date |
|------------------|----------------------|----------|-----------|--------------|
| 4060611          | TP301                |          | 0.50      | 04/08/2011   |
| 4060612          | TP301                |          | 1.80      | 04/08/2011   |
| 4060617          | TP302                |          | 0.70      | 04/08/2011   |
| 4060619          | TP302                |          | 1.30      | 04/08/2011   |
| 4060621          | TP303                |          | 0.20      | 04/08/2011   |
| 4060623          | TP303                |          | 1.80      | 04/08/2011   |
| 4060625          | TP304                |          | 0.80      | 04/08/2011   |
| 4060626          | TP305                |          | 0.40      | 04/08/2011   |
| 4060627          | TP306                |          | 0.60      | 04/08/2011   |

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

**Location:**  
**Customer:** Wardell Armstrong LLP  
**Attention:** Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

**SOLID**

### Results Legend

**X** Test

**N** No Determination Possible

| Lab Sample No(s) | Customer Sample Reference | AGS Reference | Depth (m) | Container                                                     |
|------------------|---------------------------|---------------|-----------|---------------------------------------------------------------|
| 4060627          | TP306                     |               | 0.60      | 600g VOC (ALE215)<br>400g Tub (ALE214)<br>250g Amber Jar (AL) |
| 4060626          | TP305                     |               | 0.40      | 600g VOC (ALE215)<br>400g Tub (ALE214)<br>250g Amber Jar (AL) |
| 4060625          | TP304                     |               | 0.80      | 400g Tub (ALE214)<br>250g Amber Jar (AL)                      |
| 4060623          | TP303                     |               | 1.80      | 400g Tub (ALE214)<br>250g Amber Jar (AL)                      |
| 4060621          | TP303                     |               | 0.20      | 600g VOC (ALE215)<br>400g Tub (ALE214)<br>250g Amber Jar (AL) |
| 4060619          | TP302                     |               | 1.30      | 250g Amber Jar (AL)<br>400g Tub (ALE214)                      |
| 4060617          | TP302                     |               | 0.70      | 400g Tub (ALE214)<br>250g Amber Jar (AL)                      |
| 4060612          | TP301                     |               | 1.80      | 400g Tub (ALE214)<br>250g Amber Jar (AL)                      |
| 4060611          | TP301                     |               | 0.50      | 250g Amber Jar (AL)                                           |
| All              | NDPs: 0<br>Tests: 8       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 2       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 4       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 3       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 2       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 8       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 2       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 3       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 3       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 2       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 3       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 8       |               |           | X                                                             |
| All              | NDPs: 0<br>Tests: 2       |               |           | X                                                             |



## CERTIFICATE OF ANALYSIS

Validated

SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## SOLID

## Results Legend

- X** Test  
**N** No Determination Possible

| SOLID<br>Results Legend<br><div><div>X</div> Test</div> <div><div>N</div> No Determination Possible</div> | Lab Sample No(s) |                     | Customer Sample Reference |                   | AGS Reference |                  | Depth (m) |                     | Container |                   |         |                  |         |                     |         |                   |         |  |
|-----------------------------------------------------------------------------------------------------------|------------------|---------------------|---------------------------|-------------------|---------------|------------------|-----------|---------------------|-----------|-------------------|---------|------------------|---------|---------------------|---------|-------------------|---------|--|
|                                                                                                           | 4060611          |                     | 4060612                   |                   | 4060617       |                  | 4060619   |                     | 4060621   |                   | 4060623 |                  | 4060625 |                     | 4060626 |                   | 4060627 |  |
|                                                                                                           | TP301            |                     | TP301                     |                   | TP302         |                  | TP302     |                     | TP303     |                   | TP303   |                  | TP304   |                     | TP305   |                   | TP306   |  |
|                                                                                                           |                  |                     |                           |                   |               |                  |           |                     |           |                   |         |                  |         |                     |         |                   |         |  |
|                                                                                                           | 0.50             |                     | 1.80                      |                   | 0.70          |                  | 1.30      |                     | 0.20      |                   | 1.80    |                  | 0.80    |                     | 0.40    |                   | 0.60    |  |
|                                                                                                           |                  | 250g Amber Jar (AL) |                           | 400g Tub (ALE214) |               | 60g VOC (ALE215) |           | 250g Amber Jar (AL) |           | 400g Tub (ALE214) |         | 60g VOC (ALE215) |         | 250g Amber Jar (AL) |         | 400g Tub (ALE214) |         |  |
| Metals by iCap-OES (Soil)                                                                                 | Arsenic          | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Cadmium          | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Chromium         | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Copper           | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Lead             | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Mercury          | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Nickel           | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Selenium         | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Vanadium         | NDPs: 0<br>Tests: 5 |                           | X                 |               | X                |           | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
|                                                                                                           | Zinc             | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
| PAH by GCMS                                                                                               | All              | NDPs: 0<br>Tests: 3 | X                         |                   | X             |                  |           | X                   |           |                   |         |                  |         |                     |         |                   |         |  |
| PAH Spec MS - Aqueous (W)                                                                                 | All              | NDPs: 0<br>Tests: 2 |                           |                   |               |                  |           |                     |           |                   |         |                  |         | X                   |         | X                 |         |  |
| PCBs by GCMS                                                                                              | All              | NDPs: 0<br>Tests: 1 |                           |                   |               |                  |           |                     |           |                   |         |                  | X       |                     |         |                   |         |  |
| pH                                                                                                        | All              | NDPs: 0<br>Tests: 8 | X                         | X                 | X             | X                | X         | X                   | X         | X                 | X       | X                | X       | X                   | X       | X                 | X       |  |
| pH Value                                                                                                  | All              | NDPs: 0<br>Tests: 2 |                           |                   |               |                  |           |                     |           |                   |         |                  |         |                     | X       |                   | X       |  |

## CERTIFICATE OF ANALYSIS

Validated

SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## SOLID

## Results Legend

**X** Test  
**N** No Determination Possible

|                                 | Lab Sample No(s)    |                     | Customer Sample Reference |                     | AGS Reference       |                     | Depth (m)           |                     | Container           |                  |
|---------------------------------|---------------------|---------------------|---------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------------|
|                                 | 4080611             | 4080612             | 4080617                   | 4080619             | 4080621             | 4080623             | 4080625             | 4080626             | 4080627             |                  |
|                                 | TP301               | TP301               | TP302                     | TP302               | TP303               | TP303               | TP304               | TP305               | TP306               |                  |
|                                 |                     |                     |                           |                     |                     |                     |                     |                     |                     |                  |
|                                 | 0.50                | 1.80                | 0.70                      | 1.30                | 0.20                | 1.80                | 0.80                | 0.40                | 0.60                |                  |
|                                 | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 250g Amber Jar (AL)       | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 250g Amber Jar (AL) | 60g VOC (ALE215) |
| Phenols by HPLC (S)             | All                 | NDPs: 0<br>Tests: 8 | X                         | X                   | X                   | X                   | X                   | X                   | X                   |                  |
| Phenols by HPLC (W)             | All                 | NDPs: 0<br>Tests: 2 |                           |                     |                     |                     |                     | X                   | X                   |                  |
| Sample description              | All                 | NDPs: 0<br>Tests: 8 | X                         | X                   | X                   | X                   | X                   | X                   | X                   |                  |
| Semi Volatile Organic Compounds | All                 | NDPs: 0<br>Tests: 5 | X                         |                     | X                   |                     | X                   | X                   | X                   |                  |
| Sulphide                        | All                 | NDPs: 0<br>Tests: 2 |                           |                     |                     |                     |                     | X                   | X                   |                  |
| Total Organic Carbon            | All                 | NDPs: 0<br>Tests: 3 | X                         |                     |                     | X                   | X                   |                     |                     |                  |
| Total Sulphate                  | All                 | NDPs: 0<br>Tests: 8 | X                         | X                   | X                   | X                   | X                   | X                   | X                   |                  |
| Total Sulphur                   | All                 | NDPs: 0<br>Tests: 3 | X                         | X                   |                     | X                   |                     |                     |                     |                  |
| TPH CWG GC (S)                  | All                 | NDPs: 0<br>Tests: 3 |                           |                     | X                   |                     |                     | X                   | X                   |                  |
| VOC MS (S)                      | All                 | NDPs: 0<br>Tests: 3 |                           |                     |                     | X                   |                     | X                   | X                   |                  |



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Superseded Report:

## Sample Descriptions

## Grain Sizes

|           |          |      |                 |        |             |        |            |             |       |
|-----------|----------|------|-----------------|--------|-------------|--------|------------|-------------|-------|
| very fine | <0.063mm | fine | 0.063mm - 0.1mm | medium | 0.1mm - 2mm | coarse | 2mm - 10mm | very coarse | >10mm |
|-----------|----------|------|-----------------|--------|-------------|--------|------------|-------------|-------|

| Lab Sample No(s) | Customer Sample Ref. | Depth (m) | Colour      | Description | Grain size     | Inclusions      | Inclusions 2  |
|------------------|----------------------|-----------|-------------|-------------|----------------|-----------------|---------------|
| 4060612          | TP301                | 1.80      | Black       | Sand        | 0.1 - 2 mm     | Stones          | N/A           |
| 4060617          | TP302                | 0.70      | Dark Brown  | Silty Sand  | 0.1 - 2 mm     | Stones          | Crushed Brick |
| 4060619          | TP302                | 1.30      | Light Brown | Silty Clay  | 0.063 - 0.1 mm | Stones          | N/A           |
| 4060621          | TP303                | 0.20      | Dark Brown  | Sandy Clay  | 0.1 - 2 mm     | Hardcore/Rubble | Oil/Petroleum |
| 4060623          | TP303                | 1.80      | Black       | Sand        | 0.1 - 2 mm     | Stones          | Brick         |
| 4060625          | TP304                | 0.80      | Dark Brown  | Sandy Clay  | 0.1 - 2 mm     | Stones          | N/A           |
| 4060626          | TP305                | 0.40      | Black       | Loamy Sand  | 0.1 - 2 mm     | Stones          | Tar           |
| 4060627          | TP306                | 0.60      | Dark Brown  | Sand        | 0.1 - 2 mm     | Stones          | N/A           |

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

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Superseded Report:

| Results Legend                            |                                                                                                                                                                  |            | Customer Sample R | TP301      | TP302      | TP302      | TP303  | TP303  | TP304  |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|------------|------------|------------|--------|--------|--------|
| #                                         | ISO17025 accredited.                                                                                                                                             |            |                   |            |            |            |        |        |        |
| M                                         | mCERTS accredited.                                                                                                                                               |            |                   |            |            |            |        |        |        |
| S                                         | Deviating sample.                                                                                                                                                |            |                   |            |            |            |        |        |        |
| aq                                        | Aqueous / settled sample.                                                                                                                                        |            |                   |            |            |            |        |        |        |
| diss.filt                                 | Dissolved / filtered sample.                                                                                                                                     |            |                   |            |            |            |        |        |        |
| tot.unfilt                                | Total / unfiltered sample.                                                                                                                                       |            |                   |            |            |            |        |        |        |
| +                                         | Subcontracted test.                                                                                                                                              |            |                   |            |            |            |        |        |        |
| -                                         | % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery |            |                   |            |            |            |        |        |        |
| (F)                                       | Trigger breach confirmed                                                                                                                                         |            |                   |            |            |            |        |        |        |
| Depth (m)                                 | 1.80                                                                                                                                                             | 0.70       | 1.30              | 0.20       | 1.80       | 0.80       |        |        |        |
| Sample Type                               | Soil/Solid                                                                                                                                                       | Soil/Solid | Soil/Solid        | Soil/Solid | Soil/Solid | Soil/Solid |        |        |        |
| Date Sampled                              | 04/08/2011                                                                                                                                                       | 04/08/2011 | 04/08/2011        | 04/08/2011 | 04/08/2011 | 04/08/2011 |        |        |        |
| Date Received                             | 06/08/2011                                                                                                                                                       | 06/08/2011 | 06/08/2011        | 06/08/2011 | 06/08/2011 | 06/08/2011 |        |        |        |
| SDG Ref                                   | 110809-50                                                                                                                                                        | 110809-50  | 110809-50         | 110809-50  | 110809-50  | 110809-50  |        |        |        |
| Lab Sample No.(s)                         | 4060612                                                                                                                                                          | 4060617    | 4060619           | 4060621    | 4060623    | 4060625    |        |        |        |
| AGS Reference                             |                                                                                                                                                                  |            |                   |            |            |            |        |        |        |
| Component                                 | LOD/Units                                                                                                                                                        | Method     |                   |            |            |            |        |        |        |
| Phenol                                    | <0.01 mg/kg                                                                                                                                                      | TM062 (S)  | <0.01             |            | <0.01      |            | <0.01  |        |        |
| Phenols, Total Detected monohydric        | <0.035 mg/kg                                                                                                                                                     | TM062 (S)  | <0.035            | <0.035     | <0.035     | <0.035     | <0.035 | <0.035 | <0.035 |
| Organic Carbon, Total                     | <0.2 %                                                                                                                                                           | TM132      |                   | 3.06       |            |            | 3.01   |        | 1.55   |
| Sulphur, Total                            | <0.02 %                                                                                                                                                          | TM132      | 0.96              |            | 0.05       |            | 0.141  |        |        |
| pH                                        | 1 pH Units                                                                                                                                                       | TM133      | 8.02              | 8.48       | 8.73       | 8.04       | 8.84   | 8.83   |        |
| Chromium, Hexavalent                      | <0.6 mg/kg                                                                                                                                                       | TM151      | <0.6              | <0.6       | <0.6       | <0.6       | <0.6   | <1.2   |        |
| Total Cyanide                             | <1 mg/kg                                                                                                                                                         | TM153      | <1                |            | 1.67       |            | <1     |        |        |
| Free Cyanide                              | <1 mg/kg                                                                                                                                                         | TM153      | <1                |            | <1         |            | <1     |        |        |
| Thiocyanate                               | <1 mg/kg                                                                                                                                                         | TM153      | <1                |            | <1         |            | <1     |        |        |
| Cyanide, Free                             | <1 mg/kg                                                                                                                                                         | TM153      |                   | <1         |            | <1         |        | <1     |        |
| Sulphide, Easily liberated                | <15 mg/kg                                                                                                                                                        | TM180      | <15               |            | <15        |            | <15    |        |        |
| Arsenic                                   | <0.6 mg/kg                                                                                                                                                       | TM181      | 112               | 8.4        | 11.2       | 16         | 18.5   | 10.8   |        |
| Cadmium                                   | <0.02 mg/kg                                                                                                                                                      | TM181      | 1.39              | 0.549      | 0.529      | 0.972      | 0.619  | 0.601  |        |
| Chromium                                  | <0.9 mg/kg                                                                                                                                                       | TM181      | 182               | 27.3       | 19.6       | 28.4       | 14.2   | 20.3   |        |
| Copper                                    | <1.4 mg/kg                                                                                                                                                       | TM181      | 257               | 34.8       | 25.3       | 57.3       | 188    | 27.1   |        |
| Lead                                      | <0.7 mg/kg                                                                                                                                                       | TM181      | 426               | 63.7       | 34.7       | 100        | 587    | 42     |        |
| Mercury                                   | <0.14 mg/kg                                                                                                                                                      | TM181      | 1.21              | <0.14      | <0.14      | <0.14      | <0.14  | <0.14  |        |
| Nickel                                    | <0.2 mg/kg                                                                                                                                                       | TM181      | 50.8              | 11.9       | 24.8       | 39.2       | 14.2   | 29.3   |        |
| Selenium                                  | <1 mg/kg                                                                                                                                                         | TM181      | 1.52              | <1         | <1         | <1         | <1     | <1     |        |
| Vanadium                                  | <0.2 mg/kg                                                                                                                                                       | TM181      |                   | 23.9       |            | 22.3       |        | 21.4   |        |
| Zinc                                      | <1.9 mg/kg                                                                                                                                                       | TM181      | 273               | 107        | 79.2       | 110        | 124    | 92.7   |        |
| Sulphate, Total                           | <48 mg/kg                                                                                                                                                        | TM221      | 1090              | 1280       | 1020       | 1290       | 1720   | 223    |        |
| Boron, water soluble                      | <1 mg/kg                                                                                                                                                         | TM222      | 1.58              |            | <1         |            | <1     |        |        |
| Water Soluble Sulphate as SO4 2:1 Extract | <0.008 g/l                                                                                                                                                       | TM243      | 0.0974            | 0.106      | 0.225      | 0.347      | 0.31   | 0.0532 |        |



SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

**Location:**  
**Customer:** Wardell Armstrong LLP  
**Attention:** Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

### PAH by GCMS

[illegible]



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location: Wardell Armstrong LLP  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## Semi Volatile Organic Compounds

| Results Legend              |                                                                                                                                                                  |        | Customer Sample R | TP302      | TP303      | TP304      | TP305      | TP306      |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|------------|------------|------------|------------|------------|
| #                           | ISO17025 accredited.                                                                                                                                             |        | Depth (m)         | 0.70       | 0.20       | 0.80       | 0.40       | 0.60       |
| M                           | mCERTS accredited.                                                                                                                                               |        | Sample Type       | Soil/Solid | Soil/Solid | Soil/Solid | Soil/Solid | Soil/Solid |
| S                           | Deviating sample.                                                                                                                                                |        | Date Sampled      | 04/08/2011 | 04/08/2011 | 04/08/2011 | 04/08/2011 | 04/08/2011 |
| aq                          | Aqueous / settled sample.                                                                                                                                        |        | Date Received     | 06/08/2011 | 06/08/2011 | 06/08/2011 | 06/08/2011 | 06/08/2011 |
| diss.filt                   | Dissolved / filtered sample.                                                                                                                                     |        | SDG Ref           | 110809-50  | 110809-50  | 110809-50  | 110809-50  | 110809-50  |
| tot.unfilt                  | Total / unfiltered sample.                                                                                                                                       |        | Lab Sample No.(s) | 4060617    | 4060621    | 4060625    | 4060626    | 4060627    |
| *                           | Subcontracted test.                                                                                                                                              |        | AGS Reference     |            |            |            |            |            |
| **                          | % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery |        |                   |            |            |            |            |            |
| (F)                         | Trigger breach confirmed                                                                                                                                         |        |                   |            |            |            |            |            |
| Component                   | LOD/Units                                                                                                                                                        | Method |                   |            |            |            |            |            |
| Phenol                      | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Pentachlorophenol           | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| n-Nitroso-n-dipropylamine   | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Nitrobenzene                | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Isophorone                  | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Hexachloroethane            | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Hexachlorocyclopentadiene   | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Hexachlorobutadiene         | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Hexachlorobenzene           | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| n-Dioctyl phthalate         | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Dimethyl phthalate          | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Diethyl phthalate           | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| n-Dibutyl phthalate         | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Dibenzofuran                | <100<br>µg/kg                                                                                                                                                    | TM157  | 357               | 322        | <100       | 342        | 420        |            |
| Carbazole                   | <100<br>µg/kg                                                                                                                                                    | TM157  | 444               | 264        | <100       | <200       | 450        |            |
| Butylbenzyl phthalate       | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| bis(2-Ethylhexyl) phthalate | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | 275        | <100       | <200       | 333        |            |
| bis(2-Chloroethoxy)methane  | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| bis(2-Chloroethyl)ether     | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| Azobenzene                  | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Nitrophenol               | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Nitroaniline              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Methylphenol              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Chlorophenylphenylether   | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Chloroaniline             | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Chloro-3-methylphenol     | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 4-Bromophenylphenylether    | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 3-Nitroaniline              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2-Nitrophenol               | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2-Nitroaniline              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2-Methylphenol              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 1,2,4-Trichlorobenzene      | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2-Chlorophenol              | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2,6-Dinitrotoluene          | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |
| 2,4-Dinitrotoluene          | <100<br>µg/kg                                                                                                                                                    | TM157  | <200              | <200       | <100       | <200       | <500       |            |

**SDG:** 110809-50  
**Job:** H\_WARDELL\_SHF-40  
**Client Reference:** SH10753

**Location:**  
**Customer:** Wardell Armstrong LLP  
**Attention:** Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

### Semi Volatile Organic Compounds

[illegible]



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## TPH CWG (S)

| Results Legend                       |                                                                                                                                                                  |                                                                                                            | Customer Sample R | TP303  | TP305  | TP306 |   |   |  |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------|--------|--------|-------|---|---|--|
| #                                    | ISO17025 accredited.                                                                                                                                             | Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG Ref<br>Lab Sample No.(s)<br>AGS Reference |                   |        |        |       |   |   |  |
| M                                    | mCERTS accredited.                                                                                                                                               |                                                                                                            |                   |        |        |       |   |   |  |
| S                                    | Deviating sample.                                                                                                                                                |                                                                                                            |                   |        |        |       |   |   |  |
| aq                                   | Aqueous / settled sample.                                                                                                                                        |                                                                                                            |                   |        |        |       |   |   |  |
| dis.filt                             | Dissolved / filtered sample.                                                                                                                                     |                                                                                                            |                   |        |        |       |   |   |  |
| tot.unfilt                           | Total / unfiltered sample.                                                                                                                                       |                                                                                                            |                   |        |        |       |   |   |  |
| -                                    | Subcontracted test.                                                                                                                                              |                                                                                                            |                   |        |        |       |   |   |  |
| **                                   | % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery |                                                                                                            |                   |        |        |       |   |   |  |
| (F)                                  | Trigger breach confirmed                                                                                                                                         |                                                                                                            |                   |        |        |       |   |   |  |
| Component                            | LOD/Units                                                                                                                                                        | Method                                                                                                     |                   |        |        |       |   |   |  |
| GRO Surrogate % recovery**           | %                                                                                                                                                                | TM089                                                                                                      | 77                | 33     | 43     |       |   |   |  |
| GRO >C5-C12                          | <44<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 1290              | <88    | <88    |       |   |   |  |
| Methyl tertiary butyl ether (MTBE)   | <5 µg/kg                                                                                                                                                         | TM089                                                                                                      | <5                | <10    | <10    | #     | # | # |  |
| Benzene                              | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | <10               | <20    | <20    | M     | M | M |  |
| Toluene                              | <2 µg/kg                                                                                                                                                         | TM089                                                                                                      | 6.78              | 9.76   | <4     | M     | M | M |  |
| Ethylbenzene                         | <3 µg/kg                                                                                                                                                         | TM089                                                                                                      | 3.39              | 25.6   | <6     | M     | M | M |  |
| m,p-Xylene                           | <6 µg/kg                                                                                                                                                         | TM089                                                                                                      | <6                | <12    | <12    | M     | M | M |  |
| o-Xylene                             | <3 µg/kg                                                                                                                                                         | TM089                                                                                                      | 3.39              | <6     | <6     | M     | M | M |  |
| sum of detected mpo xylene by GC     | <9 µg/kg                                                                                                                                                         | TM089                                                                                                      | <9                | <9     | <9     |       |   |   |  |
| sum of detected BTEX by GC           | <24<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | <24               | 35.4   | <24    |       |   |   |  |
| Aliphatics >C5-C6                    | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 19.2              | <20    | <20    |       |   |   |  |
| Aliphatics >C6-C8                    | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 50.9              | <20    | <20    |       |   |   |  |
| Aliphatics >C8-C10                   | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 91.5              | <20    | <20    |       |   |   |  |
| Aliphatics >C10-C12                  | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 616               | <20    | <20    |       |   |   |  |
| Aliphatics >C12-C16                  | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 153000            | 21100  | 12900  |       |   |   |  |
| Aliphatics >C16-C21                  | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 413000            | 21100  | 21600  |       |   |   |  |
| Aliphatics >C21-C35                  | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 367000            | 36700  | 99500  |       |   |   |  |
| Aliphatics >C35-C44                  | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 89600             | 3600   | 57300  |       |   |   |  |
| Total Aliphatics >C12-C44            | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 1020000           | 82600  | 191000 |       |   |   |  |
| Aromatics >EC5-EC7                   | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | <10               | <20    | <20    |       |   |   |  |
| Aromatics >EC7-EC8                   | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | <10               | <20    | <20    |       |   |   |  |
| Aromatics >EC8-EC10                  | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 73.5              | 37.8   | <20    |       |   |   |  |
| Aromatics >EC10-EC12                 | <10<br>µg/kg                                                                                                                                                     | TM089                                                                                                      | 411               | <20    | <20    |       |   |   |  |
| Aromatics >EC12-EC16                 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 132000            | 38400  | 36000  |       |   |   |  |
| Aromatics >EC16-EC21                 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 490000            | 83200  | 94800  |       |   |   |  |
| Aromatics >EC21-EC35                 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 595000            | 153000 | 257000 |       |   |   |  |
| Aromatics >EC35-EC44                 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 164000            | 26000  | 125000 |       |   |   |  |
| Aromatics >EC40-EC44                 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 58900             | 9110   | 53300  |       |   |   |  |
| Total Aromatics >EC12-EC44           | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 1380000           | 300000 | 513000 |       |   |   |  |
| Total Aliphatics & Aromatics >C5-C44 | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 2410000           | 383000 | 704000 |       |   |   |  |
| Total Aliphatics >C5-35              | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 934000            | 79000  | 134000 |       |   |   |  |
| Total Aromatics >C5-35               | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 1220000           | 275000 | 388000 |       |   |   |  |
| Total Aliphatics & Aromatics >C5-35  | <100<br>µg/kg                                                                                                                                                    | TM173                                                                                                      | 2150000           | 354000 | 522000 |       |   |   |  |
|                                      |                                                                                                                                                                  |                                                                                                            |                   |        |        |       |   |   |  |
|                                      |                                                                                                                                                                  |                                                                                                            |                   |        |        |       |   |   |  |



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## VOC MS (S)

| Results Legend              |                                                                                                                                                                  |                                                                                                            | Customer Sample R                                                      | TP303                                                                  | TP305                                                                  | TP306 |  |  |  |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|-------|--|--|--|
| #                           | ISO17025 accredited.                                                                                                                                             | Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG Ref<br>Lab Sample No.(s)<br>AGS Reference | 0.20<br>Soil/Solid<br>04/08/2011<br>06/08/2011<br>110809-50<br>4060621 | 0.40<br>Soil/Solid<br>04/08/2011<br>06/08/2011<br>110809-50<br>4060626 | 0.60<br>Soil/Solid<br>04/08/2011<br>06/08/2011<br>110809-50<br>4060627 |       |  |  |  |
| M                           | mCERTS accredited.                                                                                                                                               |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| 5                           | Deviating sample.                                                                                                                                                |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| aq                          | Aqueous / settled sample.                                                                                                                                        |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| dis.filt                    | Dissolved / filtered sample.                                                                                                                                     |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| tot.unfilt                  | Total / unfiltered sample.                                                                                                                                       |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| *                           | Subcontracted test.                                                                                                                                              |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| **                          | % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| (F)                         | Trigger breach confirmed                                                                                                                                         |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| Component                   |                                                                                                                                                                  |                                                                                                            |                                                                        |                                                                        |                                                                        |       |  |  |  |
| Dibromofluoromethane**      |                                                                                                                                                                  | %                                                                                                          | TM116                                                                  | 67.9                                                                   | 105                                                                    | 103   |  |  |  |
| Toluene-d8**                |                                                                                                                                                                  | %                                                                                                          | TM116                                                                  | 90.7                                                                   | 98.5                                                                   | 99.3  |  |  |  |
| 4-Bromofluorobenzene**      |                                                                                                                                                                  | %                                                                                                          | TM116                                                                  | 133                                                                    | 110                                                                    | 107   |  |  |  |
| Dichlorodifluoromethane     |                                                                                                                                                                  | <4 µg/kg                                                                                                   | TM116                                                                  | <4                                                                     | <80                                                                    | <80   |  |  |  |
| Chloromethane               |                                                                                                                                                                  | <7 µg/kg                                                                                                   | TM116                                                                  | <7                                                                     | <140                                                                   | <140  |  |  |  |
| Vinyl Chloride              |                                                                                                                                                                  | <10 µg/kg                                                                                                  | TM116                                                                  | <10                                                                    | <200                                                                   | <200  |  |  |  |
| Bromomethane                |                                                                                                                                                                  | <13 µg/kg                                                                                                  | TM116                                                                  | <13                                                                    | <260                                                                   | <260  |  |  |  |
| Chloroethane                |                                                                                                                                                                  | <14 µg/kg                                                                                                  | TM116                                                                  | <14                                                                    | <280                                                                   | <280  |  |  |  |
| Trichlorofluoromethane      |                                                                                                                                                                  | <6 µg/kg                                                                                                   | TM116                                                                  | <6                                                                     | <120                                                                   | <120  |  |  |  |
| 1,1-Dichloroethene          |                                                                                                                                                                  | <10 µg/kg                                                                                                  | TM116                                                                  | <10                                                                    | <200                                                                   | <200  |  |  |  |
| Carbon Disulphide           |                                                                                                                                                                  | <7 µg/kg                                                                                                   | TM116                                                                  | 53.7                                                                   | <140                                                                   | <140  |  |  |  |
| Dichloromethane             |                                                                                                                                                                  | <10 µg/kg                                                                                                  | TM116                                                                  | <10                                                                    | <200                                                                   | <200  |  |  |  |
| Methyl Tertiary Butyl Ether |                                                                                                                                                                  | <11 µg/kg                                                                                                  | TM116                                                                  | <11                                                                    | <220                                                                   | <220  |  |  |  |
| trans-1-2-Dichloroethene    |                                                                                                                                                                  | <11 µg/kg                                                                                                  | TM116                                                                  | <11                                                                    | <220                                                                   | <220  |  |  |  |
| 1,1-Dichloroethane          |                                                                                                                                                                  | <8 µg/kg                                                                                                   | TM116                                                                  | <8                                                                     | <160                                                                   | <160  |  |  |  |
| cis-1-2-Dichloroethene      |                                                                                                                                                                  | <5 µg/kg                                                                                                   | TM116                                                                  | <5                                                                     | <100                                                                   | <100  |  |  |  |
| 2,2-Dichloropropane         |                                                                                                                                                                  | <12 µg/kg                                                                                                  | TM116                                                                  | <12                                                                    | <240                                                                   | <240  |  |  |  |
| Bromochloromethane          |                                                                                                                                                                  | <14 µg/kg                                                                                                  | TM116                                                                  | <14                                                                    | <280                                                                   | <280  |  |  |  |
| Chloroform                  |                                                                                                                                                                  | <8 µg/kg                                                                                                   | TM116                                                                  | <8                                                                     | <160                                                                   | <160  |  |  |  |
| 1,1,1-Trichloroethane       |                                                                                                                                                                  | <7 µg/kg                                                                                                   | TM116                                                                  | <7                                                                     | <140                                                                   | <140  |  |  |  |
| 1,1-Dichloropropene         |                                                                                                                                                                  | <11 µg/kg                                                                                                  | TM116                                                                  | <11                                                                    | <220                                                                   | <220  |  |  |  |
| Carbontetrachloride         |                                                                                                                                                                  | <14 µg/kg                                                                                                  | TM116                                                                  | <14                                                                    | <280                                                                   | <280  |  |  |  |
| 1,2-Dichloroethane          |                                                                                                                                                                  | <5 µg/kg                                                                                                   | TM116                                                                  | <5                                                                     | <100                                                                   | <100  |  |  |  |
| Benzene                     |                                                                                                                                                                  | <9 µg/kg                                                                                                   | TM116                                                                  | <9                                                                     | <180                                                                   | <180  |  |  |  |
| Trichloroethene             |                                                                                                                                                                  | <9 µg/kg                                                                                                   | TM116                                                                  | <9                                                                     | <180                                                                   | <180  |  |  |  |
| 1,2-Dichloropropane         |                                                                                                                                                                  | <12 µg/kg                                                                                                  | TM116                                                                  | <12                                                                    | <240                                                                   | <240  |  |  |  |
| Dibromomethane              |                                                                                                                                                                  | <9 µg/kg                                                                                                   | TM116                                                                  | <9                                                                     | <180                                                                   | <180  |  |  |  |
| Bromodichloromethane        |                                                                                                                                                                  | <7 µg/kg                                                                                                   | TM116                                                                  | <7                                                                     | <140                                                                   | <140  |  |  |  |
| cis-1-3-Dichloropropene     |                                                                                                                                                                  | <14 µg/kg                                                                                                  | TM116                                                                  | <14                                                                    | <280                                                                   | <280  |  |  |  |
| Toluene                     |                                                                                                                                                                  | <5 µg/kg                                                                                                   | TM116                                                                  | 11.2                                                                   | <100                                                                   | <100  |  |  |  |
| trans-1-3-Dichloropropene   |                                                                                                                                                                  | <14 µg/kg                                                                                                  | TM116                                                                  | <14                                                                    | <280                                                                   | <280  |  |  |  |
| 1,1,2-Trichloroethane       |                                                                                                                                                                  | <10 µg/kg                                                                                                  | TM116                                                                  | <10                                                                    | <200                                                                   | <200  |  |  |  |
| 1,3-Dichloropropane         |                                                                                                                                                                  | <7 µg/kg                                                                                                   | TM116                                                                  | <7                                                                     | <140                                                                   | <140  |  |  |  |
| Tetrachloroethene           |                                                                                                                                                                  | <5 µg/kg                                                                                                   | TM116                                                                  | <5                                                                     | <100                                                                   | <100  |  |  |  |
| Dibromochloromethane        |                                                                                                                                                                  | <13 µg/kg                                                                                                  | TM116                                                                  | <13                                                                    | <260                                                                   | <260  |  |  |  |

SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

**Location:**  
**Customer:** Wardell Armstrong LLP  
**Attention:** Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

## VOC MS (S)

[illegible]



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## Asbestos Identification

|                                                                                                                              |                                                                                           | Date of Analysis | Analysed By     | Comments             | Amosite<br>(Brown)<br>Asbestos | Chrysotile<br>(White)<br>Asbestos | Crocidolite<br>(Blue) Asbestos | Fibrous<br>Actinolite | Fibrous<br>Anthrophyllite | Fibrous<br>Tremolite | Non-Asbestos<br>Fibre |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------|-----------------|----------------------|--------------------------------|-----------------------------------|--------------------------------|-----------------------|---------------------------|----------------------|-----------------------|
| Customer Sample Ref.<br>Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG<br>Original Sample<br>Method Number | TP301 NS 2<br>0.50<br>SOLID<br>04/08/2011 00:00:00<br><br>110809-50<br>4,060,611<br>TM048 | 15/08/11         | Lauren Sargeant | Loose fibres in soil | Not Detected (#)               | Detected (#)                      | Not Detected (#)               | Not Detected (#)      | Not Detected (#)          | Not Detected (#)     | Not Detected          |
| Customer Sample Ref.<br>Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG<br>Original Sample<br>Method Number | TP302 NS 2<br>0.70<br>SOLID<br>04/08/2011 00:00:00<br><br>110809-50<br>4,060,617<br>TM048 | 15/08/11         | Lauren Sargeant | -                    | Not Detected (#)               | Not Detected (#)                  | Not Detected (#)               | Not Detected (#)      | Not Detected (#)          | Not Detected (#)     | Not Detected          |
| Customer Sample Ref.<br>Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG<br>Original Sample<br>Method Number | TP303 NS 2<br>0.30<br>SOLID<br>04/08/2011 00:00:00<br><br>110809-50<br>4,060,621<br>TM048 | 15/08/11         | Lauren Sargeant | -                    | Not Detected (#)               | Not Detected (#)                  | Not Detected (#)               | Not Detected (#)      | Not Detected (#)          | Not Detected (#)     | Not Detected          |
| Customer Sample Ref.<br>Depth (m)<br>Sample Type<br>Date Sampled<br>Date Received<br>SDG<br>Original Sample<br>Method Number | TP305 NS 2<br>0.40<br>SOLID<br>04/08/2011 00:00:00<br><br>110809-50<br>4,060,626<br>TM048 | 15/08/11         | Lauren Sargeant | -                    | Not Detected (#)               | Not Detected (#)                  | Not Detected (#)               | Not Detected (#)      | Not Detected (#)          | Not Detected (#)     | Detected              |



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.123  
 Mass of dry sample (kg) 0.175  
 Particle Size <4mm >95%

## Site Location

Moisture Content Ratio (%) 36.9  
 Dry Matter Content Ratio (%) 73.1

## Case

SDG 110809-50  
 Lab Sample Number(s) 4060626  
 Sampled Date 04-Aug-2011  
 Customer Sample Ref. TP305  
 Depth (m) 0.40

## Solid Waste Analysis

## Result

Total Organic Carbon (%)  
 Loss on Ignition (%)  
 Sum of BTEX (mg/kg)  
 Sum of 7 PCBs (mg/kg)  
 Mineral Oil (mg/kg)  
 PAH Sum of 17 (mg/kg)  
 pH (pH Units)  
 ANC to pH 6 (mol/kg)  
 ANC to pH 4 (mol/kg)

-  
 -  
 0.0354  
 <21.0  
 -  
 -  
 7.48  
 -  
 -

## Eluate Analysis

C2 Conc<sup>n</sup> in 10:1 eluate (mg/l)A2 10:1 conc<sup>n</sup> leached (mg/kg)Limit values for compliance leaching test  
using BS EN 12457-3 at L/S 10 l/kg

|                              | Result   | Limit of Detection | Result  | Limit of Detection |   |
|------------------------------|----------|--------------------|---------|--------------------|---|
| Arsenic                      | 0.00419  | <0.00012           | 0.0419  | <0.0012            | - |
| Barium                       | -        | -                  | -       | -                  | - |
| Cadmium                      | <0.0001  | <0.0001            | <0.001  | <0.001             | - |
| Chromium                     | 0.00257  | <0.00022           | 0.0257  | <0.0022            | - |
| Copper                       | 0.002    | <0.00085           | 0.02    | <0.0085            | - |
| Mercury Dissolved (CVAf)     | 0.000011 | <0.00001           | 0.00011 | <0.0001            | - |
| Molybdenum                   | -        | -                  | -       | -                  | - |
| Nickel                       | 0.000984 | <0.00015           | 0.00984 | <0.0015            | - |
| Lead                         | 0.000271 | <0.00002           | 0.00271 | <0.0002            | - |
| Antimony                     | -        | -                  | -       | -                  | - |
| Selenium                     | 0.00117  | <0.00039           | 0.0117  | <0.0039            | - |
| Zinc                         | 0.00227  | <0.00041           | 0.0227  | <0.0041            | - |
| Chloride                     | -        | -                  | -       | -                  | - |
| Fluoride                     | -        | -                  | -       | -                  | - |
| Sulphate (soluble)           | 40.2     | <2                 | 402     | <20                | - |
| Total Dissolved Solids       | -        | -                  | -       | -                  | - |
| Total Monohydric Phenols (W) | -        | -                  | -       | -                  | - |
| Dissolved Organic Carbon     | -        | -                  | -       | -                  | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
 pH (pH Units) 7.70  
 Conductivity (µS/cm) 248.00  
 Temperature (°C) 20.50  
 Volume Leachant (Litres) 0.867  
 Volume of Eluate VE1 (Litres)

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable  
 Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation  
 Mcerts Certification does not apply to leachates

25/08/2011 14:25:33

14:25:21 25/08/2011

SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.123  
 Mass of dry sample (kg) 0.175  
 Particle Size <4mm >95%

## Site Location

Moisture Content Ratio (%) 36.9  
 Dry Matter Content Ratio (%) 73.1

## Case

SDG 110809-50  
 Lab Sample Number(s) 4060626  
 Sampled Date 04-Aug-2011  
 Customer Sample Ref. TP305  
 Depth (m) 0.40

## Solid Waste Analysis

## Result

Total Organic Carbon (%) -  
 Loss on Ignition (%) -  
 Sum of BTEX (mg/kg) 0.0354  
 Sum of 7 PCBs (mg/kg) <21.0  
 Mineral Oil (mg/kg) -  
 PAH Sum of 17 (mg/kg) -  
 pH (pH Units) 7.48  
 ANC to pH 6 (mol/kg) -  
 ANC to pH 4 (mol/kg) -

## Eluate Analysis

C2 Conc<sup>n</sup> in 10:1 eluate (mg/l)A2 10:1 conc<sup>n</sup> leached (mg/kg)

Limit values for compliance leaching test  
 using BS EN 12457-3 at L/S 10 l/kg

|                                          | Result | Limit of Detection | Result | Limit of Detection |   |
|------------------------------------------|--------|--------------------|--------|--------------------|---|
| Hexavalent Chromium                      | <0.03  | <0.03              | <0.3   | <0.3               | - |
| pH                                       | 7.9    | <0.001             | 79     | <0.01              | - |
| Sulphide                                 | <0.01  | <0.01              | <0.1   | <0.1               | - |
| Free Sulphur                             | <0.05  | <0.05              | <0.5   | <0.5               | - |
| Total Cyanide (W)                        | <0.05  | <0.05              | <0.5   | <0.5               | - |
| Free Cyanide (W)                         | <0.05  | <0.05              | <0.5   | <0.5               | - |
| Phenol by HPLC (W)                       | <0.002 | <0.002             | <0.02  | <0.02              | - |
| Cresols by HPLC (W)                      | <0.006 | <0.006             | <0.06  | <0.06              | - |
| Thiocyanate (W)                          | <0.05  | <0.05              | <0.5   | <0.5               | - |
| Xylenols by HPLC (W)                     | <0.008 | <0.008             | <0.08  | <0.08              | - |
| Napthol by HPLC (W)                      | <0.01  | <0.01              | <0.1   | <0.1               | - |
| 2,3,5 Trimethyl-Phenol by HPLC (W)       | <0.003 | <0.003             | <0.03  | <0.03              | - |
| Boron                                    | 0.157  | <0.0094            | 1.57   | <0.094             | - |
| Phenols Total of 5 Speciated by HPLC (W) | <0.025 | <0.025             | <0.25  | <0.25              | - |

## PAH Spec MS - Aqueous (W)

|                        |           |           |          |          |   |
|------------------------|-----------|-----------|----------|----------|---|
| Naphthalene by GCMS    | <0.0001   | <0.0001   | <0.001   | <0.001   | - |
| Acenaphthene by GCMS   | <0.000015 | <0.000015 | <0.00015 | <0.00015 | - |
| Acenaphthylene by GCMS | <0.000011 | <0.000011 | <0.00011 | <0.00011 | - |
| Fluoranthene by GCMS   | <0.000017 | <0.000017 | <0.00017 | <0.00017 | - |
| Anthracene by GCMS     | <0.000015 | <0.000015 | <0.00015 | <0.00015 | - |
| Phenanthrene by GCMS   | <0.000022 | <0.000022 | <0.00022 | <0.00022 | - |
| Fluorene by GCMS       | <0.000014 | <0.000014 | <0.00014 | <0.00014 | - |
| Chrysene by GCMS       | 0.0000241 | <0.000013 | 0.000241 | <0.00013 | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
 pH (pH Units) 7.70  
 Conductivity (µS/cm) 248.00  
 Temperature (°C) 20.50  
 Volume Leachant (Litres) 0.867  
 Volume of Eluate VE1 (Litres)

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable  
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25/08/2011 14:25:33  
 14:25:21 25/08/2011

SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location: Wardell Armstrong LLP  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.123  
 Mass of dry sample (kg) 0.175  
 Particle Size <4mm >95%

## Site Location

Moisture Content Ratio (%) 36.9  
 Dry Matter Content Ratio (%) 73.1

## Case

SDG 110809-50  
 Lab Sample Number(s) 4060626  
 Sampled Date 04-Aug-2011  
 Customer Sample Ref. TP305  
 Depth (m) 0.40

## Solid Waste Analysis

## Result

Total Organic Carbon (%) -  
 Loss on Ignition (%) -  
 Sum of BTEX (mg/kg) 0.0354  
 Sum of 7 PCBs (mg/kg) <21.0  
 Mineral Oil (mg/kg) -  
 PAH Sum of 17 (mg/kg) -  
 pH (pH Units) 7.48  
 ANC to pH 6 (mol/kg) -  
 ANC to pH 4 (mol/kg) -

## Eluate Analysis

C2 Conc<sup>n</sup> in 10:1 eluate (mg/l)A2 10:1 conc<sup>n</sup> leached (mg/kg)

Limit values for compliance leaching test  
 using BS EN 12457-3 at L/S 10 l/kg

## Result

## Limit of Detection

## Result

## Limit of Detection

## PAH Spec MS - Aqueous (W)

|                               |           |           |          |          |   |   |   |
|-------------------------------|-----------|-----------|----------|----------|---|---|---|
| Pyrene by GCMS                | 0.0000175 | <0.000015 | 0.000175 | <0.00015 | - | - | - |
| Benz(a)anthracene by GCMS     | 0.0000235 | <0.000017 | 0.000235 | <0.00017 | - | - | - |
| Benzo(b)fluoranthene by GCMS  | <0.000023 | <0.000023 | <0.00023 | <0.00023 | - | - | - |
| Benzo(k)fluoranthene by GCMS  | <0.000027 | <0.000027 | <0.00027 | <0.00027 | - | - | - |
| Benzo(a)pyrene by GCMS        | 0.0000161 | <0.000009 | 0.000161 | <0.00009 | - | - | - |
| Dibenzo(ah)anthracene by GCMS | <0.000016 | <0.000016 | <0.00016 | <0.00016 | - | - | - |
| Benzo(ghi)perylene by GCMS    | <0.000016 | <0.000016 | <0.00016 | <0.00016 | - | - | - |
| Indeno(123cd)pyrene by GCMS   | <0.000014 | <0.000014 | <0.00014 | <0.00014 | - | - | - |
| PAH 16 EPA Total by GCMS      | <0.000247 | <0.000247 | <0.00247 | <0.00247 | - | - | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
 pH (pH Units) 7.70  
 Conductivity (µS/cm) 248.00  
 Temperature (°C) 20.50  
 Volume Leachant (Litres) 0.867  
 Volume of Eluate VE1 (Litres)

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SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

Location:  
Customer: Wardell Armstrong LLP  
Attention: Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.122  
Mass of dry sample (kg) 0.175  
Particle Size <4mm >95%

## Site Location

Moisture Content Ratio (%) 35.9  
Dry Matter Content Ratio (%) 73.6

## Case

SDG 110809-50  
Lab Sample Number(s) 4060627  
Sampled Date 04-Aug-2011  
Customer Sample Ref. TP306  
Depth (m) 0.60

## Solid Waste Analysis

## Result

Total Organic Carbon (%) -  
Loss on Ignition (%) -  
Sum of BTEX (mg/kg) <24.0  
Sum of 7 PCBs (mg/kg) -  
Mineral Oil (mg/kg) -  
PAH Sum of 17 (mg/kg) -  
pH (pH Units) 7.87  
ANC to pH 6 (mol/kg) -  
ANC to pH 4 (mol/kg) -

## Eluate Analysis

## C2

Conc<sup>n</sup> in 10:1 eluate (mg/l)

## A2

10:1 conc<sup>n</sup> leached (mg/kg)Limit values for compliance leaching test  
using BS EN 12457-3 at L/S 10 l/kg

|                              | Result    | Limit of Detection | Result   | Limit of Detection |   |
|------------------------------|-----------|--------------------|----------|--------------------|---|
| Arsenic                      | 0.00819   | <0.00012           | 0.0819   | <0.0012            | - |
| Barium                       | -         | -                  | -        | -                  | - |
| Cadmium                      | <0.0001   | <0.0001            | <0.001   | <0.001             | - |
| Chromium                     | 0.0357    | <0.00022           | 0.357    | <0.0022            | - |
| Copper                       | 0.00446   | <0.00085           | 0.0446   | <0.0085            | - |
| Mercury Dissolved (CVAF)     | 0.0000485 | <0.00001           | 0.000485 | <0.0001            | - |
| Molybdenum                   | -         | -                  | -        | -                  | - |
| Nickel                       | 0.000831  | <0.00015           | 0.00831  | <0.0015            | - |
| Lead                         | 0.00071   | <0.00002           | 0.0071   | <0.0002            | - |
| Antimony                     | -         | -                  | -        | -                  | - |
| Selenium                     | 0.00155   | <0.00039           | 0.0155   | <0.0039            | - |
| Zinc                         | 0.00329   | <0.00041           | 0.0329   | <0.0041            | - |
| Chloride                     | -         | -                  | -        | -                  | - |
| Fluoride                     | -         | -                  | -        | -                  | - |
| Sulphate (soluble)           | 15.3      | <2                 | 153      | <20                | - |
| Total Dissolved Solids       | -         | -                  | -        | -                  | - |
| Total Monohydric Phenols (W) | -         | -                  | -        | -                  | - |
| Dissolved Organic Carbon     | -         | -                  | -        | -                  | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
pH (pH Units) 8.07  
Conductivity (µS/cm) 151.00  
Temperature (°C) 20.50  
Volume Leachant (Litres) 0.868  
Volume of Eluate VE1 (Litres)

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable  
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25/08/2011 14:25:33  
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 Attention: Mike Kelly

Order Number: SH3129  
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## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.122  
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SDG 110809-50  
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## Solid Waste Analysis

## Result

Total Organic Carbon (%) -  
 Loss on Ignition (%) -  
 Sum of BTEX (mg/kg) <24.0  
 Sum of 7 PCBs (mg/kg) -  
 Mineral Oil (mg/kg) -  
 PAH Sum of 17 (mg/kg) -  
 pH (pH Units) 7.87  
 ANC to pH 5 (mol/kg) -  
 ANC to pH 4 (mol/kg) -

## Eluate Analysis

C2 Conc<sup>n</sup> in 10:1 eluate (mg/l)A2 10:1 conc<sup>n</sup> leached (mg/kg)Limit values for compliance leaching test  
using BS EN 12457-3 at L/S 10 l/kg

|                                          | Result    | Limit of Detection | Result   | Limit of Detection |   |
|------------------------------------------|-----------|--------------------|----------|--------------------|---|
| Hexavalent Chromium                      | 0.046     | <0.03              | 0.46     | <0.3               | - |
| pH                                       | 7.6       | <0.001             | 76       | <0.01              | - |
| Sulphide                                 | <0.01     | <0.01              | <0.1     | <0.1               | - |
| Free Sulphur                             | <0.05     | <0.05              | <0.5     | <0.5               | - |
| Total Cyanide (W)                        | <0.05     | <0.05              | <0.5     | <0.5               | - |
| Free Cyanide (W)                         | <0.05     | <0.05              | <0.5     | <0.5               | - |
| Phenol by HPLC (W)                       | <0.002    | <0.002             | <0.02    | <0.02              | - |
| Cresols by HPLC (W)                      | <0.006    | <0.006             | <0.06    | <0.06              | - |
| Thiocyanate (W)                          | <0.05     | <0.05              | <0.5     | <0.5               | - |
| Xylenols by HPLC (W)                     | <0.008    | <0.008             | <0.08    | <0.08              | - |
| Napthol by HPLC (W)                      | <0.01     | <0.01              | <0.1     | <0.1               | - |
| 2,3,5 Trimethyl-Phenol by HPLC (W)       | <0.003    | <0.003             | <0.03    | <0.03              | - |
| Boron                                    | 0.0723    | <0.0094            | 0.723    | <0.094             | - |
| Phenols Total of 5 Speciated by HPLC (W) | <0.025    | <0.025             | <0.25    | <0.25              | - |
| <b>PAH Spec MS - Aqueous (W)</b>         |           |                    |          |                    |   |
| Naphthalene by GCMS                      | <0.0001   | <0.0001            | <0.001   | <0.001             | - |
| Acenaphthene by GCMS                     | <0.000015 | <0.000015          | <0.00015 | <0.00015           | - |
| Acenaphthylene by GCMS                   | <0.000011 | <0.000011          | <0.00011 | <0.00011           | - |
| Fluoranthene by GCMS                     | <0.000017 | <0.000017          | <0.00017 | <0.00017           | - |
| Anthracene by GCMS                       | <0.000015 | <0.000015          | <0.00015 | <0.00015           | - |
| Phenanthrene by GCMS                     | <0.000022 | <0.000022          | <0.00022 | <0.00022           | - |
| Fluorene by GCMS                         | <0.000014 | <0.000014          | <0.00014 | <0.00014           | - |
| Chrysene by GCMS                         | 0.0000139 | <0.000013          | 0.000139 | <0.00013           | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
 pH (pH Units) 8.07  
 Conductivity (µS/cm) 151.00  
 Temperature (°C) 20.50  
 Volume Leachant (Litres) 0.868  
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SDG: 110809-50  
Job: H\_WARDELL\_SHF-40  
Client Reference: SH10753

Location:  
Customer: Wardell Armstrong LLP  
Attention: Mike Kelly

Order Number: SH3129  
Report Number: 146949  
Superseded Report:

## CEN 10:1 STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

## Client Reference

Mass Sample taken (kg) 0.122  
Mass of dry sample (kg) 0.175  
Particle Size <4mm >95%

## Site Location

Moisture Content Ratio (%) 35.9  
Dry Matter Content Ratio (%) 73.6

## Case

SDG 110809-50  
Lab Sample Number(s) 4060627  
Sampled Date 04-Aug-2011  
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Depth (m) 0.60

## Solid Waste Analysis

## Result

Total Organic Carbon (%) -  
Loss on Ignition (%) -  
Sum of BTEX (mg/kg) <24.0  
Sum of 7 PCBs (mg/kg) -  
Mineral Oil (mg/kg) -  
PAH Sum of 17 (mg/kg) -  
pH (pH Units) 7.87  
ANC to pH 6 (mol/kg) -  
ANC to pH 4 (mol/kg) -

## Eluate Analysis

## C2

Conc<sup>n</sup> in 10:1 eluate (mg/l)

## A2

10:1 conc<sup>n</sup> leached (mg/kg)

Limit values for compliance leaching test  
using BS EN 12457-3 at L/S 10 l/kg

## Result

## Limit of Detection

## Result

## Limit of Detection

## PAH Spec MS - Aqueous (W)

|                               |           |           |           |           |   |   |   |
|-------------------------------|-----------|-----------|-----------|-----------|---|---|---|
| Pyrene by GCMS                | <0.000015 | <0.000015 | <0.000015 | <0.000015 | - | - | - |
| Benz(a)anthracene by GCMS     | 0.0000199 | <0.000017 | 0.0000199 | <0.000017 | - | - | - |
| Benzo(b)fluoranthene by GCMS  | <0.000023 | <0.000023 | <0.000023 | <0.000023 | - | - | - |
| Benzo(k)fluoranthene by GCMS  | <0.000027 | <0.000027 | <0.000027 | <0.000027 | - | - | - |
| Benzo(a)pyrene by GCMS        | <0.000009 | <0.000009 | <0.000009 | <0.000009 | - | - | - |
| Dibenzo(ah)anthracene by GCMS | <0.000016 | <0.000016 | <0.000016 | <0.000016 | - | - | - |
| Benzo(ghi)perylene by GCMS    | <0.000016 | <0.000016 | <0.000016 | <0.000016 | - | - | - |
| Indeno(123cd)pyrene by GCMS   | <0.000014 | <0.000014 | <0.000014 | <0.000014 | - | - | - |
| PAH 16 EPA Total by GCMS      | <0.000247 | <0.000247 | <0.000247 | <0.000247 | - | - | - |

## Leach Test Information

Date Prepared 18-Aug-2011  
pH (pH Units) 8.07  
Conductivity (µS/cm) 151.00  
Temperature (°C) 20.50  
Volume Leachant (Litres) 0.868  
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SDG: 110809-50  
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 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## Table of Results - Appendix

## REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

|     |                           |     |                          |   |                                                       |    |                                      |
|-----|---------------------------|-----|--------------------------|---|-------------------------------------------------------|----|--------------------------------------|
| NDP | No Determination Possible | #   | ISO 17025 Accredited     | * | Subcontracted Test                                    | M  | MCERTS Accredited                    |
| NFD | No Fibres Detected        | PFD | Possible Fibres Detected | ▶ | Result previously reported (Incremental reports only) | EC | Equivalent Carbon (Aromatics C8-C35) |

Note: Method detection limits are not always achievable due to various circumstances beyond our control

| Method No | Reference                                                                                                                                                   | Description                                                                                                                             | Wet/Dry Sample * | Surrogate Corrected |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| PM001     |                                                                                                                                                             | Preparation of Samples for Metals Analysis                                                                                              |                  |                     |
| PM024     | Modified BS 1377                                                                                                                                            | Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material                                   |                  |                     |
| PM114     |                                                                                                                                                             | Leaching Procedure for CEN Two Stage Batch Test 2.1/8.1 Cumulative                                                                      |                  |                     |
| PM115     |                                                                                                                                                             | Leaching Procedure for CEN One Stage Leach Test 2.1 & 10.1 1 Step                                                                       |                  |                     |
| TM001     | In - house Method                                                                                                                                           | Determination of asbestos containing material by screening on solids                                                                    |                  |                     |
| TM048     | HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures                                                                      | Identification of Asbestos in Bulk Material                                                                                             |                  |                     |
| TM062 (S) | National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9                                 | Determination of Phenols in Soils by HPLC                                                                                               |                  |                     |
| TM089     | Modified: US EPA Methods 8020 & 602                                                                                                                         | Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)                               |                  |                     |
| TM101     | Method 4500B & C, AWWA/APHA, 20th Ed., 1999                                                                                                                 | Determination of Sulphide in soil and water samples using the Kone Analyser                                                             |                  |                     |
| TM116     | Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602                                                                                                    | Determination of Volatile Organic Compounds by Headspace / GC-MS                                                                        |                  |                     |
| TM132     | In - house Method                                                                                                                                           | ELTRA CS800 Operators Guide                                                                                                             |                  |                     |
| TM133     | BS 1377: Part 3 1990; BS 6068-2.5                                                                                                                           | Determination of pH in Soil and Water using the GLpH pH Meter                                                                           |                  |                     |
| TM151     | Method 3500D, AWWA/APHA, 20th Ed., 1999                                                                                                                     | Determination of Hexavalent Chromium using Kone analyser                                                                                |                  |                     |
| TM152     | Method 3125B, AWWA/APHA, 20th Ed., 1999                                                                                                                     | Analysis of Aqueous Samples by ICP-MS                                                                                                   |                  |                     |
| TM153     | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999                                                                                                            | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser |                  |                     |
| TM157     | HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).                                                                            | Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone                                                          |                  |                     |
| TM168     | EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography                                                                                            | Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils                                                     |                  |                     |
| TM173     | Analysis of Petroleum Hydrocarbons in Environmental Media - Total Petroleum Hydrocarbon Criteria                                                            | Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID                                                        |                  |                     |
| TM178     | Modified: US EPA Method 8100                                                                                                                                | Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters                                                             |                  |                     |
| TM180     | Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)                                                                       | The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique                                     |                  |                     |
| TM181     | US EPA Method 6010B                                                                                                                                         | Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES                                                                        |                  |                     |
| TM183     | BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3                                                                                                    | Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry                        |                  |                     |
| TM184     | EPA Methods 325.1 & 325.2,                                                                                                                                  | The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers                                             |                  |                     |
| TM218     | Microwave extraction - EPA method 3546                                                                                                                      | Microwave extraction - EPA method 3546                                                                                                  |                  |                     |
| TM221     | Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd                              | Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer                                                       |                  |                     |
| TM222     | In-House Method                                                                                                                                             | Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer                                       |                  |                     |
| TM227     | Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.                                                         | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate                                                       |                  |                     |
| TM241     | Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.                               | The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser                                                |                  |                     |
| TM243     |                                                                                                                                                             | Mixed Anions In Soils By Kone                                                                                                           |                  |                     |
| TM256     | The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4. | Determination of pH in Water and Leachate using the GLpH pH Meter                                                                       |                  |                     |
| TM259     | by HPLC                                                                                                                                                     | Determination of Phenols in Waters and Leachates by HPLC                                                                                |                  |                     |
| TM294     |                                                                                                                                                             | Determination of Free Sulphur in liquids by HPLC                                                                                        |                  |                     |

\* Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG: 110809-50  
 Job: H\_WARDELL\_SHF-40  
 Client Reference: SH10753

Location:  
 Customer: Wardell Armstrong LLP  
 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 146949  
 Superseded Report:

## Test Completion Dates

| Lab Sample No(s)                    | 4060611     | 4060612     | 4060617     | 4060619     | 4060621     | 4060623     | 4060625     | 4060626     | 4060627     |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Customer Sample Ref.                | TP301       | TP301       | TP302       | TP302       | TP303       | TP303       | TP304       | TP305       | TP308       |
| AGS Ref.                            |             |             |             |             |             |             |             |             |             |
| Depth                               | 0.50        | 1.80        | 0.70        | 1.30        | 0.20        | 1.80        | 0.80        | 0.40        | 0.60        |
| Type                                | SOLID       | SOLID       | SOLID       | SOLID       | SOLID       | SOLID       | SOLID       | SOLID       | SOLID       |
| Anions by Kone (soil)               |             | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 |
| Anions by Kone (w)                  |             |             |             |             |             |             |             | 24-Aug-2011 | 24-Aug-2011 |
| Asbestos Containing Material Screen |             |             |             |             |             | 12-Aug-2011 |             |             |             |
| Asbestos Identification (Soil)      | 15-Aug-2011 |             | 15-Aug-2011 |             | 15-Aug-2011 |             |             | 15-Aug-2011 |             |
| Boron Water Soluble                 |             | 15-Aug-2011 |             | 15-Aug-2011 |             | 16-Aug-2011 |             |             |             |
| CEN 10:1 Leachate (1 Stage)         |             |             |             |             |             |             |             | 18-Aug-2011 | 18-Aug-2011 |
| CEN Readings                        |             |             |             |             |             |             |             | 19-Aug-2011 | 19-Aug-2011 |
| Cyanide Comp/Free/Total/Thiocyanate |             | 12-Aug-2011 | 16-Aug-2011 | 12-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 12-Aug-2011 | 23-Aug-2011 | 23-Aug-2011 |
| Dissolved Metals by ICP-MS          |             |             |             |             |             |             |             | 23-Aug-2011 | 23-Aug-2011 |
| Easily Liberated Sulphide           |             | 12-Aug-2011 |             | 12-Aug-2011 |             | 15-Aug-2011 |             |             |             |
| EPH CWG (Aliphatic) GC (S)          |             |             |             |             | 17-Aug-2011 |             |             | 16-Aug-2011 | 16-Aug-2011 |
| EPH CWG (Aromatic) GC (S)           |             |             |             |             | 17-Aug-2011 |             |             | 16-Aug-2011 | 16-Aug-2011 |
| Free Sulphur                        |             |             |             |             |             |             |             | 23-Aug-2011 | 23-Aug-2011 |
| GRO by GC-FID (S)                   |             |             |             |             | 21-Aug-2011 |             |             | 21-Aug-2011 | 18-Aug-2011 |
| Hexavalent Chromium (#)             |             | 16-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 |
| Hexavalent Chromium (w)             |             |             |             |             |             |             |             | 22-Aug-2011 | 22-Aug-2011 |
| Mercury Dissolved                   |             |             |             |             |             |             |             | 22-Aug-2011 | 22-Aug-2011 |
| Metals by iCap-OES (Soil)           |             | 15-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 |
| PAH by GCMS                         |             | 12-Aug-2011 |             | 12-Aug-2011 |             | 15-Aug-2011 |             |             |             |
| PAH Spec MS - Aqueous (W)           |             |             |             |             |             |             |             | 25-Aug-2011 | 25-Aug-2011 |
| PCBs by GCMS                        |             |             |             |             |             |             |             | 17-Aug-2011 |             |
| pH                                  |             | 11-Aug-2011 | 15-Aug-2011 | 12-Aug-2011 | 15-Aug-2011 | 15-Aug-2011 | 11-Aug-2011 | 15-Aug-2011 | 15-Aug-2011 |
| pH Value                            |             |             |             |             |             |             |             | 22-Aug-2011 | 22-Aug-2011 |
| Phenols by HPLC (S)                 |             | 12-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 |
| Phenols by HPLC (W)                 |             |             |             |             |             |             |             | 23-Aug-2011 | 23-Aug-2011 |
| Sample description                  |             | 10-Aug-2011 | 15-Aug-2011 | 10-Aug-2011 | 15-Aug-2011 | 10-Aug-2011 | 10-Aug-2011 | 15-Aug-2011 | 10-Aug-2011 |
| Semi Volatile Organic Compounds     |             |             | 16-Aug-2011 |             | 16-Aug-2011 |             | 16-Aug-2011 | 15-Aug-2011 | 16-Aug-2011 |
| Sulphide                            |             |             |             |             |             |             |             | 22-Aug-2011 | 22-Aug-2011 |
| Total Organic Carbon                |             |             | 16-Aug-2011 |             |             | 15-Aug-2011 | 16-Aug-2011 |             |             |
| Total Sulphate                      |             | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 16-Aug-2011 | 15-Aug-2011 |
| Total Sulphur                       |             | 12-Aug-2011 |             | 12-Aug-2011 |             | 15-Aug-2011 |             |             |             |
| TPH CWG GC (S)                      |             |             |             |             | 21-Aug-2011 |             |             | 21-Aug-2011 | 18-Aug-2011 |
| VOC MS (S)                          |             |             |             |             | 18-Aug-2011 |             |             | 19-Aug-2011 | 19-Aug-2011 |

## CERTIFICATE OF ANALYSIS

SDG: 110809-50 Location: Wardell Armstrong LLP  
 Job: H\_WARDELL\_SHF-40 Customer:  
 Client Reference: SH10753 Attention: Mike Kelly

Order Number: SH3129  
 Report Number: 148949  
 Superseded Report:

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH<sub>4</sub> by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. Surrogate recoveries -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. Product analyses -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GC/FID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GC/FID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GC/MS should be utilised.

## SOLID MATRICES EXTRACTION SUMMARY

| ANALYSIS                          | D/C OR WET | EXTRACTION SOLVENT | EXTRACTION METHOD | ANALYSIS    |
|-----------------------------------|------------|--------------------|-------------------|-------------|
| SOLVENT EXTRACTABLE MATTER        | D&C        | DOM                | SOX THERM         | GRAVIMETRIC |
| CYCLOHEXANE EXT. MATTER           | D&C        | CYCLOHEXANE        | SOX THERM         | GRAVIMETRIC |
| ELEMENTAL SULPHUR                 | D&C        | DOM                | SOX THERM         | HPLC        |
| PHENOLS BY GC/MS                  | WET        | DOM                | SOX THERM         | GC-MS       |
| HERBICIDES                        | D&C        | HEXANE/ACETONE     | SOX THERM         | GC-MS       |
| PESTICIDES                        | D&C        | HEXANE/ACETONE     | SOX THERM         | GC-MS       |
| EPH (DRO)                         | D&C        | HEXANE/ACETONE     | END OVER END      | GC-FID      |
| EPH (MIN OIL)                     | D&C        | HEXANE/ACETONE     | END OVER END      | GC-FID      |
| EPH (CLEANED UP)                  | D&C        | HEXANE/ACETONE     | END OVER END      | GC-FID      |
| EPH CWG BY GC                     | D&C        | HEXANE/ACETONE     | END OVER END      | GC-FID      |
| PCB TOT./PCB CON                  | D&C        | HEXANE/ACETONE     | END OVER END      | GC-MS       |
| POLYAROMATIC HYDROCARBONS (MS)    | WET        | HEXANE/ACETONE     | MICROWAVE TM218   | GC-MS       |
| OS-C40 (OS-C40) EZ FLASH          | WET        | HEXANE/ACETONE     | SHAKER            | GC-EZ       |
| POLYAROMATIC HYDROCARBONS RARO GC | WET        | HEXANE/ACETONE     | SHAKER            | GC-EZ       |
| SEM VOLATILE ORGANIC COMPOUNDS    | WET        | DOM/ACETONE        | SONICATE          | GC-MS       |

## LIQUID MATRICES EXTRACTION SUMMARY

| ANALYSIS             | EXTRACTION SOLVENT | EXTRACTION METHOD             | ANALYSIS |
|----------------------|--------------------|-------------------------------|----------|
| PAHMS                | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC/MS    |
| EPH                  | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC-FID   |
| EPH CWG              | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC-FID   |
| MINERAL OIL          | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC-FID   |
| PCB 7 CONGENERS      | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC/MS    |
| PCB TOTAL            | HEXANE             | STIRRED EXTRACTION (STIR-BAR) | GC/MS    |
| SVOC                 | DOM                | LIQUID/LIQUID SHAKE           | GC/MS    |
| FREE SULPHUR         | DOM                | SOLID PHASE EXTRACTION        | HPLC     |
| PEST OC/OPP          | DOM                | LIQUID/LIQUID SHAKE           | GC/MS    |
| TRIAZINE HERBES      | DOM                | LIQUID/LIQUID SHAKE           | GC/MS    |
| PHENOLS MS           | DOM                | SOLID PHASE EXTRACTION        | GC/MS    |
| TPH by INFRARED (IR) | TCE                | LIQUID/LIQUID SHAKE           | HPLC     |
| MINERAL OIL by IR    | TCE                | LIQUID/LIQUID SHAKE           | HPLC     |
| GLYCOLS              | NONE               | DIRECT INJECTION              | GC/MS    |

## Identification of Asbestos in Bulk Materials &amp; Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

## Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

| Asbestos Type           | Common Name    |
|-------------------------|----------------|
| Chrysotile              | White Asbestos |
| Amosite                 | Brown Asbestos |
| Crocidolite             | Blue Asbestos  |
| Fibrous Actinolite      | -              |
| Fibrous Anorthophyllite | -              |
| Fibrous Tremolite       | -              |

## APPENDIX XIII

### Statistical Analysis of Geochemical Results



# STATISTICAL ANALYSIS OF SOIL CONTAMINATION DATA - PLANNING SCENARIO

(Based on CL:AIRE/CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008)

Job Number: SH10753

Job Name: Land to east of Polar Ford, Barnsley

Assessor: J Lymer

Date: 17-Aug-11

Proposed Land Use: Residential with Homegrown Produce

Zone:

Key Question: Is there significant evidence that the true mean concentration of the contaminant is less than the screening value (critical concentration)?

Null Hypothesis (H<sub>0</sub>): The true mean concentration is equal to or greater than the screening value (critical concentration;  $\mu \geq C_c$ )

Alternative Hypothesis (H<sub>1</sub>): The true mean concentration is less than the screening value (critical concentration;  $\mu < C_c$ )

| SAMPLE IDENTIFICATION / STATISTICAL TEST                                                                          |               | RECORDED CONCENTRATION / STATISTICAL RESULT |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
|-------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------|---------------|----------------|--------------|------------|---------------|--------------|----------------|----------------|------------|----------------------|----------------------------|--------------------|--------------------|-----------------------------------|-------------------|
| Location                                                                                                          | Depth (m/bgl) | Arsenic mg/kg                               | Cadmium mg/kg | Chromium mg/kg | Copper mg/kg | Lead mg/kg | Mercury mg/kg | Nickel mg/kg | Selenium mg/kg | Vanadium mg/kg | Zinc mg/kg | Cyanide (free) mg/kg | Phenol (total-mono)* mg/kg | Sulphate (total) % | Sulphate (2:1) g/l | Sulphide (S <sub>2</sub> -) mg/kg | Chromium VI mg/kg |
| TP301                                                                                                             | 1.80-         | 112.00                                      | 1.39          | 182.00         | 257.00       | 426.00     | 1.21          | 50.80        | 1.52           |                | 273.00     | 0.50                 | 0.02                       | 0.1090             | 0.0974             | 0.55                              | 0.30              |
| TP302                                                                                                             | 0.70-         | 8.40                                        | 0.55          | 27.30          | 34.80        | 63.70      | 0.07          | 11.90        | 0.50           | 23.90          | 107.00     | 0.50                 | 0.02                       | 0.1280             | 0.1060             |                                   | 0.30              |
| TP302                                                                                                             | 1.30-         | 11.20                                       | 0.53          | 19.60          | 25.30        | 34.70      | 0.07          | 24.80        | 0.50           |                | 79.20      | 0.50                 | 0.02                       | 0.1020             | 0.2250             | 0.55                              | 0.30              |
| TP303                                                                                                             | 0.20-         | 16.00                                       | 0.97          | 28.40          | 57.30        | 100.00     | 0.07          | 39.20        | 0.50           | 22.30          | 110.00     | 0.50                 | 0.02                       | 0.1290             | 0.3470             |                                   | 0.30              |
| TP303                                                                                                             | 1.80-         | 18.50                                       | 0.62          | 14.20          | 188.00       | 587.00     | 0.07          | 14.20        | 0.50           |                | 124.00     | 0.50                 | 0.02                       | 0.1720             | 0.3100             | 0.55                              | 0.30              |
| TP304                                                                                                             | 0.80-         | 10.80                                       | 0.60          | 20.30          | 27.10        | 42.00      | 0.07          | 29.30        | 0.50           | 21.40          | 92.70      | 0.50                 | 0.02                       | 0.0223             | 0.0532             |                                   | 0.60              |
| TP305                                                                                                             | 0.40-         | 129.00                                      | 0.81          | 23.90          | 237.00       | 1380.00    | 0.17          | 50.10        | 0.50           | 70.90          | 238.00     | 0.50                 | 0.02                       | 0.2700             | 0.1700             |                                   | 0.30              |
| TP306                                                                                                             | 0.60-         | 184.00                                      | 1.15          | 46.20          | 319.00       | 1819.00    | 4.27          | 48.40        | 0.50           | 67.70          | 534.00     | 0.50                 | 0.02                       | 0.2910             | 0.6510             |                                   | 0.30              |
| Number of samples (N)                                                                                             |               | 8                                           | 8             | 8              | 8            | 8          | 8             | 8            | 8              | 5              | 8          | 8                    | 8                          | 8                  | 8                  | 3                                 | 8                 |
| Minimum                                                                                                           |               | 8.4                                         | 0.529         | 14.2           | 25.3         | 34.7       | 0.07          | 11.9         | 0.5            | 21.4           | 79.2       | 0.5                  | 0.0175                     | 0.0223             | 0.0532             | 0.55                              | 0.3               |
| Maximum                                                                                                           |               | 129                                         | 1.39          | 182.0          | 319          | 1380       | 4.27          | 50.8         | 1.52           | 70.9           | 534        | 0.5                  | 0.0175                     | 0.291              | 0.651              | 0.550                             | 0.6               |
| Standard Deviation                                                                                                |               | 53                                          | 0             | 56             | 120          | 508        | 1             | 16           | 0              | 26             | 154        | 0                    | 0                          | 0                  | 0                  | 0                                 | 0                 |
| Screening Value (Critical Conc., C <sub>c</sub> )                                                                 |               | 32                                          | 10            | 627            | 2330         | 480        | 170           | 130          | 350            | 75             | 3750       | 20                   | 420                        | n/a                | n/a                | n/a                               | 4.3               |
| Source of Screening Value                                                                                         |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Outlier Identification                                                                                            |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Standardised Value (T <sub>n</sub> )                                                                              |               | 1.282                                       | 1.588         | 2.232          | 1.142        | 1.284      | 1.946         | 0.943        | 2.475          | 1.130          | 1.852      | 0.000                | #DIV/0!                    | 1.073              | 1.547              | #DIV/0!                           | 2.475             |
| Critical Value (T <sub>crit</sub> )                                                                               |               | 2.032                                       | 2.032         | 2.032          | 2.032        | 2.032      | 2.032         | 2.032        | 2.032          | 1.671          | 2.032      | 0.000                | 2.032                      | 2.032              | 2.032              | 1.153                             | 2.032             |
| Is there an Outlier (T <sub>n</sub> > T <sub>crit</sub> )                                                         |               | NO                                          | NO            | YES            | NO           | NO         | NO            | NO           | YES            | NO             | NO         | NO                   | #DIV/0!                    | NO                 | NO                 | #DIV/0!                           | YES               |
| Outlier location(s) and depth(s)                                                                                  |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Outlier status                                                                                                    |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Does the Data have a Normal Distribution?                                                                         |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Visual Estimate (probability plot)                                                                                |               | NO                                          | YES           | NO             | YES          | YES        | NO            | YES          | NO             | NO             | NO         | n/a stdev=0          | n/a stdev=0                | YES                | YES                | n/a stdev=0                       | NO                |
| Shapiro-Wilk statistic (W)                                                                                        |               | 0.74                                        | 0.88          | 0.57           | 0.85         | 0.84       | 0.56          | 0.89         | 0.42           | 0.05           | 0.76       | n/a stdev=0          | n/a stdev=0                | 0.92               | 0.87               | n/a stdev=0                       | 0.42              |
| Shapiro-Wilk Test (Is W > Sig(0.95))                                                                              |               | NO                                          | YES           | NO             | YES          | YES        | NO            | YES          | NO             | NO             | NO         | n/a stdev=0          | n/a stdev=0                | YES                | YES                | n/a stdev=0                       | NO                |
| Mean Concentration (85% UCL)                                                                                      |               | n/a                                         | 1             | n/a            | 224          | 798        | n/a           | 44           | n/a            | n/a            | n/a        | 0                    | 0                          | 0                  | 0                  | 1                                 | n/a               |
| Is there significant evidence that the mean concentration is less than the screening value (μ < C <sub>c</sub> )? |               | n/a                                         | YES           | n/a            | YES          | NO         | n/a           | YES          | n/a            | n/a            | n/a        | YES                  | YES                        | YES                | YES                | YES                               | n/a               |
| Level of Evidence (p <sub>1</sub> , %)                                                                            |               | n/a                                         | 100           | n/a            | 100          | <51        | n/a           | 100          | n/a            | n/a            | n/a        | 0                    | #DIV/0!                    | n/a                | n/a                | n/a                               | n/a               |
| Does the Data have a Non-normal Distribution?                                                                     |               |                                             |               |                |              |            |               |              |                |                |            |                      |                            |                    |                    |                                   |                   |
| Chebyshev Theorem                                                                                                 |               | YES                                         | NO            | YES            | NO           | NO         | YES           | NO           | YES            | YES            | YES        | NO                   | NO                         | NO                 | NO                 | NO                                | YES               |
| Mean Concentration (85% UCL)                                                                                      |               | 133                                         | n/a           | 132            | n/a          | n/a        | 3             | n/a          | 1              | 81             | 433        | n/a                  | n/a                        | n/a                | n/a                | n/a                               | 1                 |
| Is there significant evidence that the mean concentration is less than the screening value (μ < C <sub>c</sub> )? |               | NO                                          | n/a           | YES            | n/a          | n/a        | YES           | n/a          | YES            | NO             | YES        | n/a                  | n/a                        | n/a                | n/a                | n/a                               | YES               |
| Level of Evidence (p <sub>1</sub> , %)                                                                            |               | <51                                         | n/a           | 99             | n/a          | n/a        | 99            | n/a          | 99             | 89             | 99         | n/a                  | n/a                        | n/a                | n/a                | n/a                               | 99                |

NB: 1) values shown in bold exceed the critical concentration (adopted generic screening value); 2) Non-detects have been entered as the limit of detection for that substance and these values are shown in italics.



# STATISTICAL ANALYSIS OF SOIL CONTAMINATION DATA - PLANNING SCENARIO

(Based on CL:AIRE/CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008)

Job Number: SH10753

Job Name: Land to east of Polar Ford, Barnsley

Assessor: J Lymer

Date: 17-Aug-11

Proposed Land Use: Residential with Homegrown Produce

Zone:

Key Question: Is there significant evidence that the true mean concentration of the contaminant is less than the screening value (critical concentration)?

Null Hypothesis (H<sub>0</sub>): The true mean concentration is equal to or greater than the screening value (critical concentration;  $\mu \geq C_c$ )

Alternative Hypothesis (H<sub>1</sub>): The true mean concentration is less than the screening value (critical concentration;  $\mu < C_c$ )

| SAMPLE IDENTIFICATION / STATISTICAL TEST                                                                    |                | RECORDED CONCENTRATION / STATISTICAL RESULT |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
|-------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------|-------------------------|---------------------|-----------------------------|-------------------------|-------------------------------|-----------------------------|-------------------------------|-------------------|--------------------------------|-----------------------|-------------------|---------------------------------|----------------------|-----------------------|-----------------|
| Location                                                                                                    | Depth (m/boll) | Acenaphthene<br>ug/kg                       | Acenaphthylene<br>ug/kg | Anthracene<br>ug/kg | Benzo(a)anthracene<br>ug/kg | Benzo(a)pyrene<br>ug/kg | Benzo(b)fluoranthene<br>ug/kg | Benzo(ghi)perylene<br>ug/kg | Benzo(k)fluoranthene<br>ug/kg | Chrysene<br>ug/kg | Dibenz(a,h)anthracene<br>ug/kg | Fluoranthene<br>ug/kg | Fluorene<br>ug/kg | Indeno(1,2,3-cd)pyrene<br>ug/kg | Naphthalene<br>ug/kg | Phenanthrene<br>ug/kg | Pyrene<br>ug/kg |
| TP301                                                                                                       | 1.80           | 188                                         | 1060.0                  | 1480                | 7530                        | 7430                    | 8648                          | 3950                        | 3280                          | 5440              | 1158                           | 12200                 | 368.00            | 3600                            | 1940                 | 4760.000              | 10400           |
| TP302                                                                                                       | 0.70           | 400                                         | 372.0                   | 2250                | 7478                        | 8288                    | 5530                          | 4620                        | 5710                          | 6520              | 888                            | 15500                 | 612.00            | 4388                            | 288                  | 7960.000              | 12900           |
| TP302                                                                                                       | 1.30           | 28                                          | 46.5                    | 147                 | 495                         | 409                     | 502                           | 239                         | 181                           | 434               | 85                             | 1190                  | 35.50             | 195                             | 33                   | 651.000               | 962             |
| TP303                                                                                                       | 0.20           | 228                                         | 328.0                   | 1490                | 4680                        | 4680                    | 2830                          | 1940                        | 2900                          | 3850              | 531                            | 9150                  | 471.00            | 1990                            | 357                  | 4730.000              | 7450            |
| TP303                                                                                                       | 1.80           | 24                                          | 152.0                   | 267                 | 916                         | 721                     | 1090                          | 449                         | 419                           | 843               | 130                            | 1720                  | 52.30             | 366                             | 393                  | 1210.000              | 1410            |
| TP304                                                                                                       | 0.80           | 50.0                                        | 50.0                    | 242                 | 642                         | 462                     | 218                           | 182                         | 550                           | 712               | 50.0                           | 1450                  | 50.0              | 160                             | 50.0                 | 1040.000              | 1150            |
| TP305                                                                                                       | 0.40           | 100.0                                       | 301.0                   | 929                 | 4320                        | 4520                    | 3260                          | 2340                        | 3150                          | 3760              | 567                            | 7460                  | 100.0             | 2340                            | 625                  | 3390.000              | 6200            |
| TP306                                                                                                       | 0.60           | 316                                         | 992.0                   | 2910                | 19000                       | 19500                   | 13400                         | 9680                        | 13700                         | 16800             | 2080                           | 30400                 | 451.00            | 8490                            | 658                  | 8360.000              | 27500           |
| Number of samples (N)                                                                                       |                | 8                                           | 8                       | 8                   | 8                           | 8                       | 8                             | 8                           | 8                             | 8                 | 8                              | 8                     | 8                 | 8                               | 8                    | 8                     | 8               |
| Minimum                                                                                                     |                | 23.5                                        | 46.5                    | 147                 | 495                         | 409                     | 218                           | 182                         | 181                           | 434               | 50                             | 1190                  | 35.5              | 160                             | 32.9                 | 651                   | 962             |
| Maximum                                                                                                     |                | 400                                         | 1060                    | 2910.0              | 19000                       | 19500                   | 13400                         | 9680                        | 13700                         | 16800             | 2090                           | 30400                 | 612               | 9480                            | 1940                 | 8360.000              | 27500           |
| Standard Deviation                                                                                          |                | 141                                         | 398                     | 1011                | 6116                        | 6372                    | 4586                          | 3201                        | 4444                          | 5356              | 694                            | 9839                  | 233               | 3122                            | 609                  | 3022                  | 8876            |
| Screening Value (Critical Conc., C <sub>c</sub> )                                                           |                | 480000                                      | 490000                  | 490000              | 4700                        | 940                     | 6000                          | 46000                       | 9600                          | 8000              | 880                            | 46000                 | 380000            | 3900                            | 9700                 | 200000                | 1000000         |
| Source of Screening Value                                                                                   |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Outlier Identification                                                                                      |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Standardised Value (T <sub>n</sub> )                                                                        |                | 1.195                                       | 1.225                   | 1.168               | 1.388                       | 1.343                   | 1.252                         | 1.308                       | 1.389                         | 1.461             | 1.269                          | 1.366                 | 1.129             | 1.294                           | 1.398                | 1.106                 | 1.398           |
| Critical Value (T <sub>crit</sub> )                                                                         |                | 2.032                                       | 2.032                   | 2.032               | 2.032                       | 2.032                   | 2.032                         | 2.032                       | 2.032                         | 2.032             | 2.032                          | 2.032                 | 2.032             | 2.032                           | 2.032                | 2.032                 | 2.032           |
| Is there an Outlier (T <sub>n</sub> > T <sub>crit</sub> )                                                   |                | NO                                          | NO                      | NO                  | NO                          | NO                      | NO                            | NO                          | NO                            | NO                | NO                             | NO                    | NO                | NO                              | NO                   | NO                    | NO              |
| Outlier location(s) and depth(s)                                                                            |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Outlier status                                                                                              |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Does the Data have a Normal Distribution?                                                                   |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Visual Estimate (probability plot)                                                                          |                | YES                                         | NO                      | YES                 | NO                          | NO                      | YES                           | YES                         | NO                            | NO                | YES                            | YES                   | YES               | YES                             | NO                   | YES                   | YES             |
| Shapiro-Wilk statistic (W)                                                                                  |                | 0.91                                        | 0.81                    | 0.91                | 0.81                        | 0.81                    | 0.87                          | 0.84                        | 0.77                          | 0.78              | 0.87                           | 0.85                  | 0.85              | 0.83                            | 0.76                 | 0.89                  | 0.83            |
| Shapiro-Wilk Test (Is W > Sig(0.05))                                                                        |                | YES                                         | NO                      | YES                 | NO                          | NO                      | YES                           | YES                         | NO                            | NO                | YES                            | YES                   | YES               | YES                             | NO                   | YES                   | YES             |
| Mean Concentration (95% UCL)                                                                                |                | 261                                         | n/a                     | 1882                | n/a                         | n/a                     | 7482                          | 5070                        | n/a                           | n/a               | 1198                           | 16475                 | 423               | 4893                            | n/a                  | 6037                  | 14443           |
| Is there significant evidence that the mean concentration is less than the screening value ( $\mu < C_c$ )? |                | YES                                         | n/a                     | YES                 | n/a                         | n/a                     | NO                            | YES                         | n/a                           | n/a               | NO                             | YES                   | YES               | NO                              | n/a                  | YES                   | YES             |
| Level of Evidence (p <sub>1</sub> , %)                                                                      |                | 100                                         | n/a                     | 100                 | n/a                         | n/a                     | 90                            | 100                         | n/a                           | n/a               | 75                             | 100                   | 100               | 80                              | n/a                  | 100                   | 100             |
| Does the Data have a Non-normal Distribution?                                                               |                |                                             |                         |                     |                             |                         |                               |                             |                               |                   |                                |                       |                   |                                 |                      |                       |                 |
| Chebychev Theorem                                                                                           |                | NO                                          | YES                     | NO                  | YES                         | YES                     | NO                            | NO                          | YES                           | YES               | NO                             | NO                    | NO                | NO                              | YES                  | NO                    | NO              |
| Mean Concentration (95% UCL)                                                                                |                | n/a                                         | 1026                    | n/a                 | 19088                       | 19088                   | n/a                           | n/a                         | 19088                         | 13051             | n/a                            | n/a                   | n/a               | n/a                             | 1462                 | n/a                   | n/a             |
| Is there significant evidence that the mean concentration is less than the screening value ( $\mu < C_c$ )? |                | n/a                                         | YES                     | n/a                 | NO                          | NO                      | n/a                           | n/a                         | NO                            | NO                | n/a                            | n/a                   | n/a               | n/a                             | YES                  | n/a                   | n/a             |
| Level of Evidence (p <sub>1</sub> , %)                                                                      |                | n/a                                         | 99                      | n/a                 | <51                         | 81                      | n/a                           | n/a                         | 93                            | 74                | n/a                            | n/a                   | n/a               | n/a                             | 99                   | n/a                   | n/a             |

NB: 1) values shown in bold exceed the critical concentration (adopted generic screening value); 2) Non-detects have been entered as the limit of detection for that substance and these values are shown in italics.

## APPENDIX XIV

### Gas Monitoring Results

**RECORD OF MEASUREMENTS FOR GAS MONITORING BOREHOLES**

Client Name: Bellway Homes

Date of Sampling: 5/8/2011

Site Name: Polar Ford Extension Site

Job Number: SH10753

| Borehole Ref. | CH <sub>4</sub><br>% by Volume | CO <sub>2</sub><br>% by Volume | O <sub>2</sub><br>% by Volume | Flow Rate<br>l/hr | Sample Type | Barometric Pressure<br>(mb) | Relative Pressure<br>(mb) | Depth to Water<br>(m bgl) |
|---------------|--------------------------------|--------------------------------|-------------------------------|-------------------|-------------|-----------------------------|---------------------------|---------------------------|
| BH1           | 0.0                            | 0.0                            | 19.6                          | 0.0               | Acc.        | 997                         | -0.02                     | DRY @ 8.5m                |

Atmospheric Pressure: As indicated

Instrument Used: Infrared GA 2000

Pressure Trend: n/a

Sample Type: As indicated

Weather: Warm and sunny

Operator: M Kelly

|        |  |
|--------|--|
| Notes: |  |
|--------|--|

**RECORD OF MEASUREMENTS FOR GAS MONITORING BOREHOLES**

Client Name: Bellway Homes

Date of Sampling: 9/9/2011

Site Name: Polar Ford Extension Site

Job Number: SH10753

| Borehole<br>Ref. | CH <sub>4</sub><br>% by<br>Volume | CO <sub>2</sub><br>% by<br>Volume | O <sub>2</sub><br>% by<br>Volume | Flow<br>Rate<br>l/hr | Sample<br>Type | Barometric<br>Pressure<br>(mb) | Relative<br>Pressure<br>(mb) | Depth to<br>Water<br>(m bgl) |
|------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------|----------------|--------------------------------|------------------------------|------------------------------|
| BH1              | 0.0                               | 1.9                               | 18.5                             | -0.1                 | Acc.           | 991                            | +2.32                        | 7.43                         |

Atmospheric Pressure: As indicated

Instrument Used: Infrared GA 2000

Pressure Trend: Falling

Sample Type: As indicated

Weather: Warm and sunny

Operator: J A Shaw

|        |  |
|--------|--|
| Notes: |  |
|--------|--|

**RECORD OF MEASUREMENTS FOR GAS MONITORING BOREHOLES**

Client Name: Bellway Homes

Date of Sampling: 12/9/2011

Site Name: Polar Ford Extension Site

Job Number: SH10753

| Borehole<br>Ref. | CH <sub>4</sub><br>% by<br>Volume | CO <sub>2</sub><br>% by<br>Volume | O <sub>2</sub><br>% by<br>Volume | Flow<br>Rate<br>l/hr | Sample<br>Type | Barometric<br>Pressure<br>(mb) | Relative<br>Pressure<br>(mb) | Depth to<br>Water<br>(m bgl) |
|------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------|----------------|--------------------------------|------------------------------|------------------------------|
| BH1              | 0.0                               | 2.4                               | 18.4                             | +0.1                 | Acc.           | 977                            | -0.1                         | 7.39                         |

Atmospheric Pressure: As indicated

Instrument Used: Infrared GA 2000

Pressure Trend: n/a

Sample Type: As indicated

Weather: Windy

Operator: J A Shaw

|        |  |
|--------|--|
| Notes: |  |
|--------|--|

## APPENDIX XV

### Geotechnical Laboratory Results



## LABORATORY REPORT



4043

**Contract Number:** PSL11/1970

**Client's Reference:**

**Report Date:** 16 August 2011

**Client Name:** Wardell Armstrong  
Unit 4, Newton Business Centre  
Thorncliffe Park  
Chapelton  
Sheffield  
S35 2PH

**For the attention of:** Mike Kelly

**Contract Title:** Polar Ford Extension Site, Dodworth Road, Barnsley

**Date Received:** 10-August-11

**Date Commenced:** 10-August-11

**Date Completed:** 16-August-11

**Notes:** Observations and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

**Checked and Approved Signatories:**

  
R Gunson  
(Director)

A Watkins  
(Director)

M Beastall  
(Laboratory Manager)

5 - 7 Hexthorpe Road, Hexthorpe,  
Doncaster DN4 0AR  
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awatkins@prosoils.co.uk

Page 1 of

## SUMMARY OF LABORATORY SOIL DESCRIPTIONS

| Hole Number | Sample Number | Sample Type | Depth m   | Description of Sample                                       |
|-------------|---------------|-------------|-----------|-------------------------------------------------------------|
| BH1         | 2             | B           | 0.50-1.20 | MADE GROUND dark grey very sandy very silty gravel.         |
| BH1         | 4             | D           | 2.30      | MADE GROUND dark brown slightly gravelly sand.              |
| BH1         | 8             | D           | 4.40      | Brown mottled grey gravelly CLAY.                           |
| BH1         | 10            | B           | 4.80-5.80 | Grey mottled brown gravelly slightly sandy very silty CLAY. |
| BH2         | 3             | B           | 1.00-2.00 | MADE GROUND dark brown gravelly sand.                       |
| BH2         | 6             | B           | 3.00-4.00 | MADE GROUND dark grey very sandy very silty gravel.         |
| BH2         | 11            | D           | 6.40      | Brown sandy CLAY.                                           |
| BH2         | 13            | D           | 7.60      | Brown weathered MUDSTONE.                                   |
| BH2         | 15            | D           | 8.30      | Brown weathered MUDSTONE.                                   |
| BH2         | 17            | D           | 9.20      | Brown weathered MUDSTONE.                                   |
| TP302       |               | B           | 1.40      | Brown mottled grey very gravelly very sandy CLAY. <i>MG</i> |
| TP304       |               | B           | 1.00      | Brown mottled grey very gravelly very sandy CLAY. <i>MG</i> |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |
|             |               |             |           |                                                             |

|                                                                                     |                                                        |          |                    |          |                    |            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------|----------|--------------------|----------|--------------------|------------|
|  | Compiled by                                            | Date     | Checked by         | Date     | Approved by        | Date       |
|                                                                                     | <i>[Signature]</i>                                     | 16/08/11 | <i>[Signature]</i> | 16/08/11 | <i>[Signature]</i> | 16/08/11   |
|                                                                                     | POLAR FORD EXTENSION SITE,<br>DODWORTH ROAD, BARNSELY. |          |                    |          | Contract No:       | PSL11/1970 |
|                                                                                     |                                                        |          |                    |          | Client Ref:        | SH10753    |

## SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

[illegible]

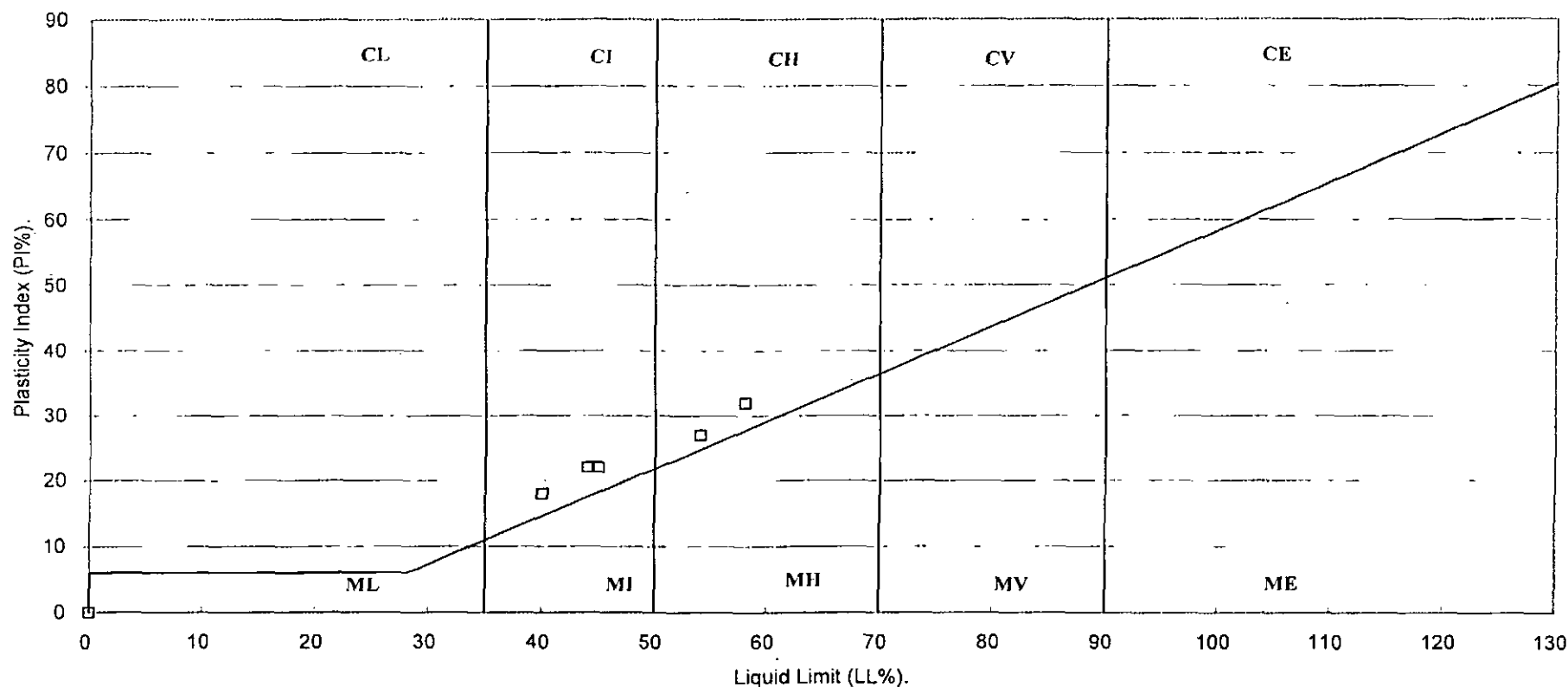
**SYMBOLS :** NP : Non Plastic

\* : Liquid Limit and Plastic Limit-Wet Sieved.

|                                                                                     |                                                                                       |          |                                                                                       |          |                                                                                       |            |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|------------|
|  | Compiled by                                                                           | Date     | Checked by                                                                            | Date     | Approved by                                                                           | Date       |
|                                                                                     |  | 16/08/11 |  | 16/08/11 |  | 16/08/11   |
|                                                                                     | POLAR FORD EXTENSION SITE,<br>DODWORTH ROAD, BARNSELY.                                |          |                                                                                       |          | Contract No:                                                                          | PSL11/1970 |
|                                                                                     |                                                                                       |          |                                                                                       |          | Client Ref:                                                                           | SH10753    |

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



| Compiled by                                             | Date     | Checked by         | Date     | Approved by        | Date       |
|---------------------------------------------------------|----------|--------------------|----------|--------------------|------------|
| <i>[Signature]</i>                                      | 16/08/11 | <i>[Signature]</i> | 16/08/11 | <i>[Signature]</i> | 16/08/11   |
| POLAR FORD EXTENSION SITE,<br>DODWORTH ROAD, BARNSELEY. |          |                    |          | Contract No:       | PSL11/1970 |
|                                                         |          |                    |          | Client Ref:        | SH10753    |

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

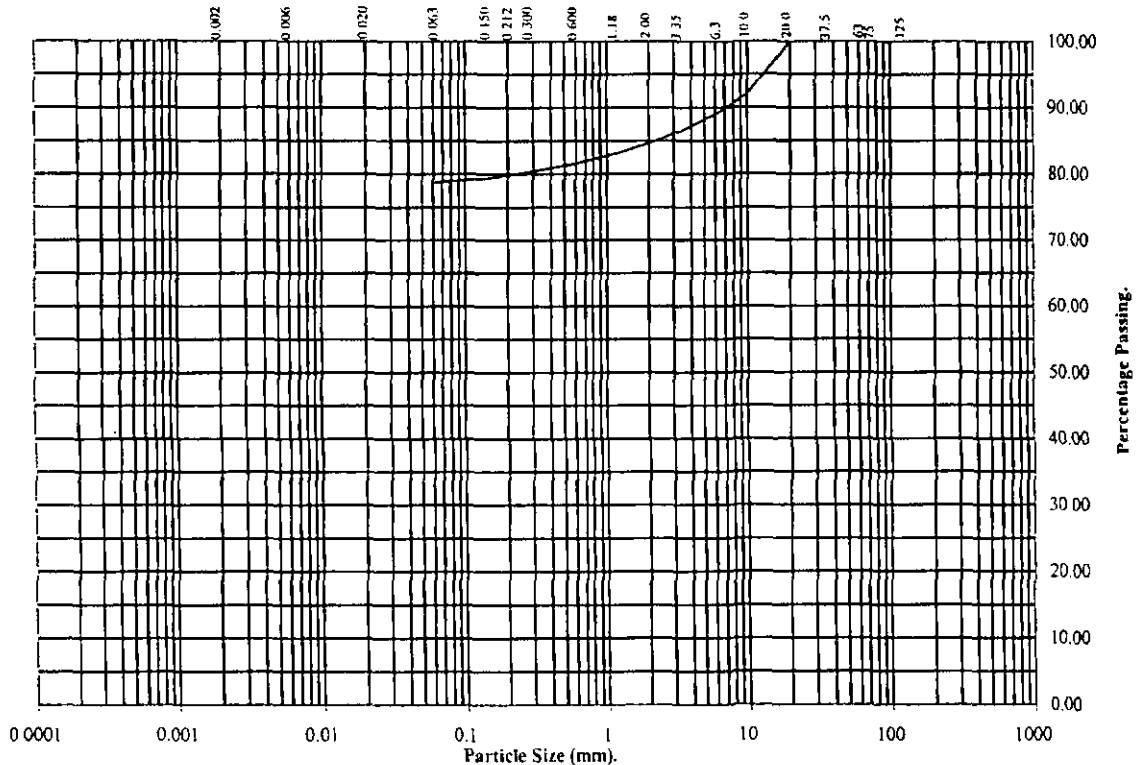
Wet Sieve, Clause 9.2

Hole Number: BH1

Depth (m): 4.80-5.80

Sample Number: 10

Sample Type: B



| BS Test Sieve | Percentage Passing |
|---------------|--------------------|
| 125           | 100                |
| 75            | 100                |
| 63            | 100                |
| 37.5          | 100                |
| 20            | 100                |
| 10            | 92                 |
| 6.3           | 89                 |
| 3.35          | 87                 |
| 2             | 85                 |
| 1.18          | 83                 |
| 0.6           | 82                 |
| 0.3           | 80                 |
| 0.212         | 80                 |
| 0.15          | 79                 |
| 0.063         | 79                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 0                |
| Gravel        | 15               |
| Sand          | 6                |
| Silt / Clay   | 79               |

## Remarks:

See summary of soil descriptions.

| Checked By | Date     | Approved By | Date     |
|------------|----------|-------------|----------|
| <i>RL</i>  | 16/08/11 | <i>RL</i>   | 16/08/11 |

**PSL**  
Professional Soils Laboratory

POLAR FORD EXTENSION SITE,  
DODWORTH ROAD, BARNSELY.

Contract No.:  
PSL11/1970

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

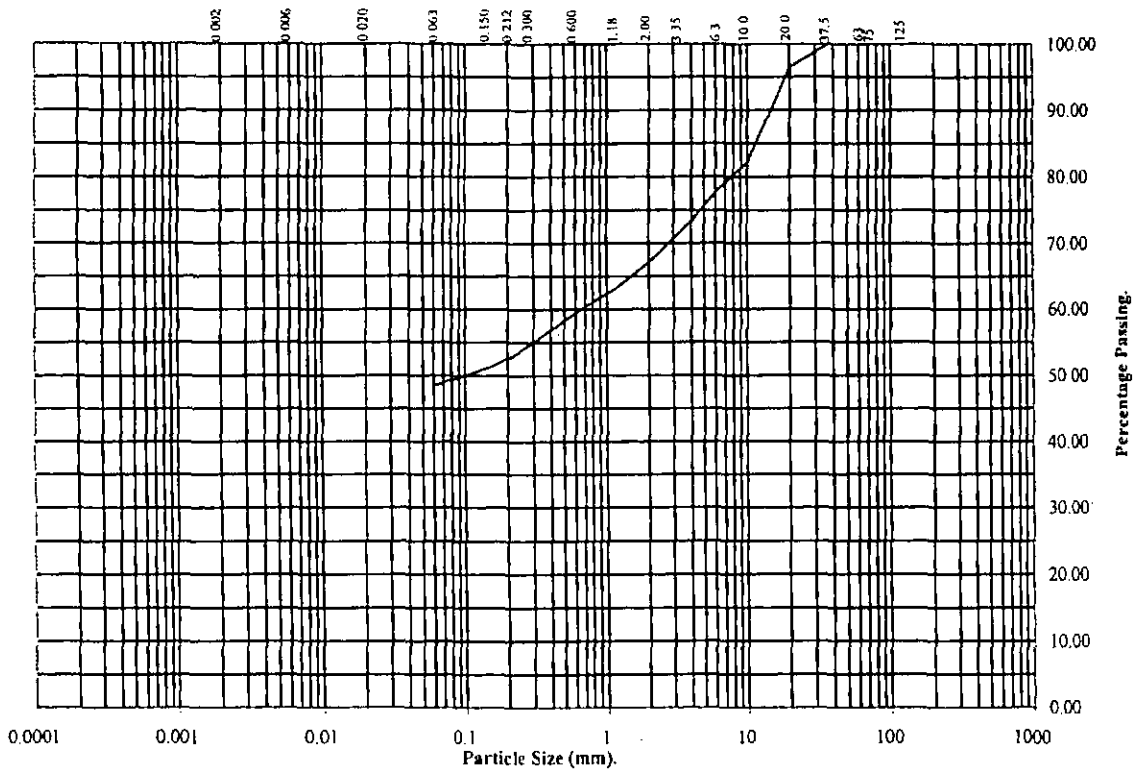
Wet Sieve, Clause 9.2

Hole Number: TP302

Depth (m): 1.40

Sample Number:

Sample Type: B



| BS Test Sieve | Percentage Passing |
|---------------|--------------------|
| 125           | 100                |
| 75            | 100                |
| 63            | 100                |
| 37.5          | 100                |
| 20            | 97                 |
| 10            | 82                 |
| 6.3           | 67                 |
| 3.35          | 59                 |
| 2             | 55                 |
| 1.18          | 53                 |
| 0.6           | 51                 |
| 0.3           | 49                 |
| 0.212         |                    |
| 0.15          |                    |
| 0.063         |                    |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 0                |
| Gravel        | 33               |
| Sand          | 18               |
| Silt / Clay   | 49               |

## Remarks:

See summary of soil descriptions.

| Checked By | Date     | Approved By | Date     |
|------------|----------|-------------|----------|
| R2         | 16/08/11 | R2          | 16/08/11 |

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POLAR FORD EXTENSION SITE,  
DODWORTH ROAD, BARNSELY.

Contract No.:  
PSL11/1970

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

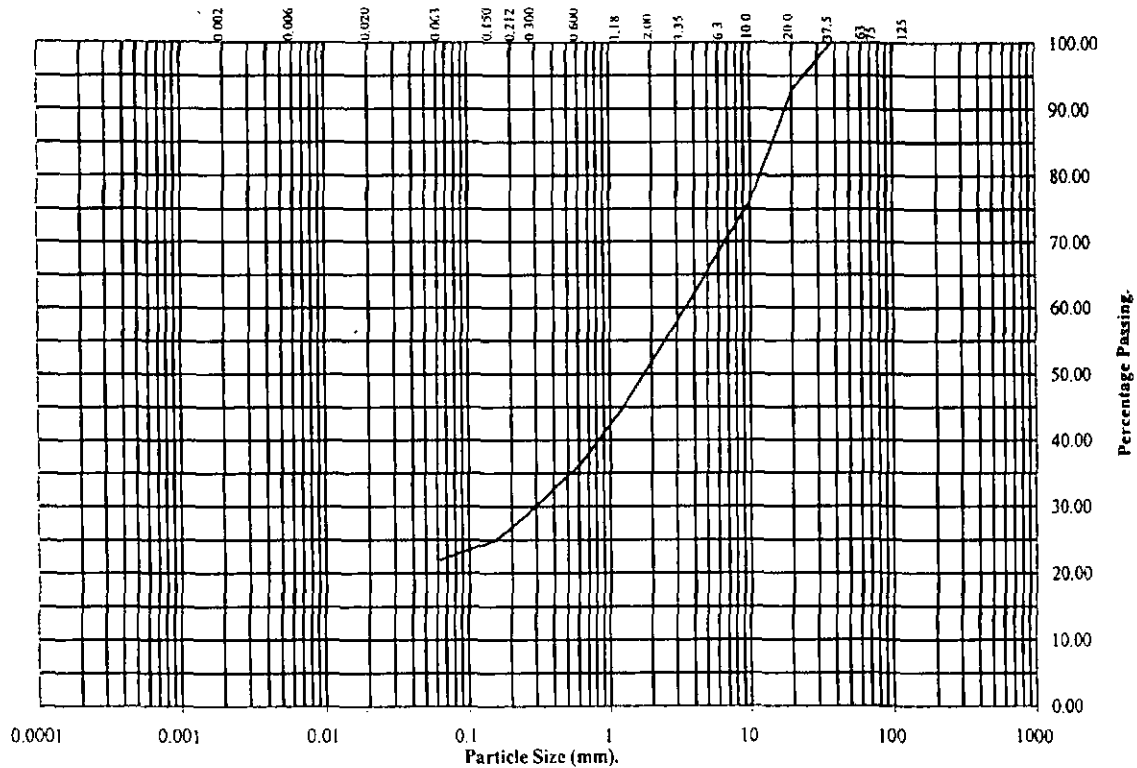
Wet Sieve, Clause 9.2

Hole Number: BH2

Depth (m): 3.00-4.00

Sample Number: 6

Sample Type: B



| BS Test Sieve | Percentage Passing |
|---------------|--------------------|
| 125           | 100                |
| 75            | 100                |
| 63            | 100                |
| 37.5          | 100                |
| 20            | 93                 |
| 10            | 76                 |
| 6.3           | 69                 |
| 3.35          | 60                 |
| 2             | 52                 |
| 1.18          | 44                 |
| 0.6           | 36                 |
| 0.3           | 30                 |
| 0.212         | 27                 |
| 0.15          | 25                 |
| 0.063         | 22                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 0                |
| Gravel        | 48               |
| Sand          | 30               |
| Silt / Clay   | 22               |

## Remarks:

See summary of soil descriptions.

| Checked By | Date     | Approved By | Date     |
|------------|----------|-------------|----------|
| <i>RE</i>  | 16/08/11 | <i>RE</i>   | 16/08/11 |

**PSL**  
Professional Soils Laboratory

POLAR FORD EXTENSION SITE,  
DODWORTH ROAD, BARNSELY.

Contract No.:  
PSL11/1970

# Particle Size Distribution Test

BS1377 : Part 2 : 1990

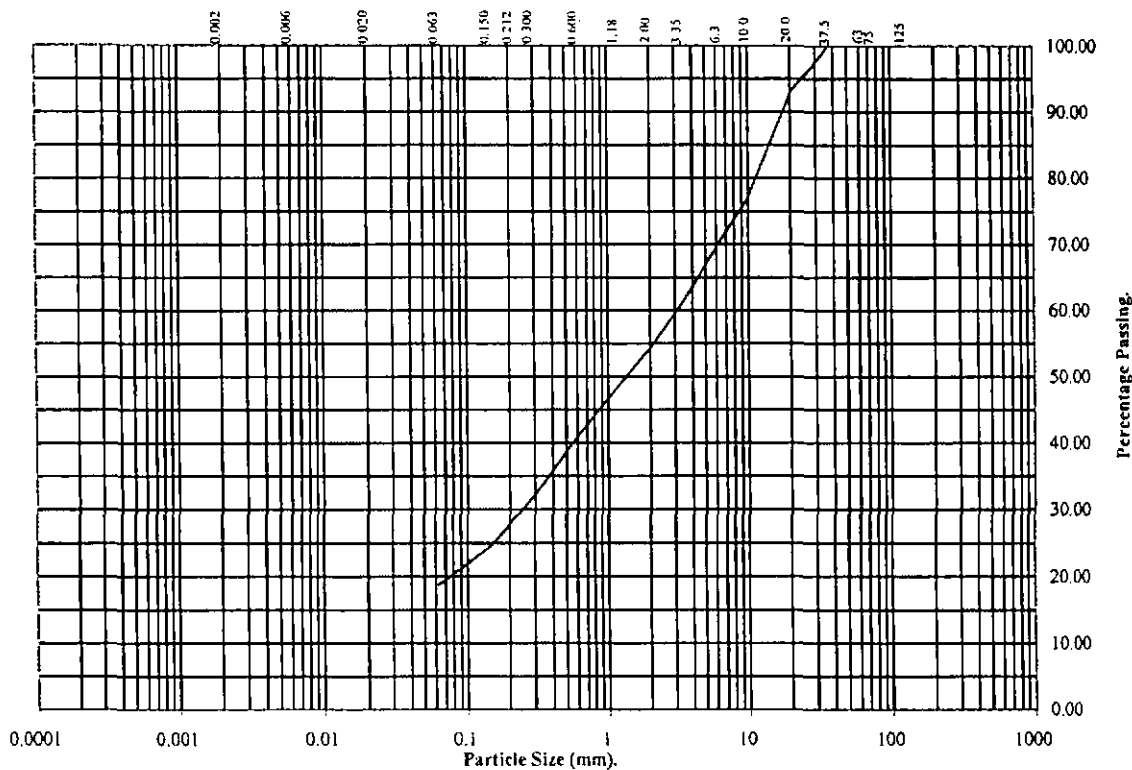
Wet Sieve, Clause 9.2

Hole Number: BH1

Depth (m): 0.50-1.20

Sample Number: 2

Sample Type: B



| BS Test Sieve | Percentage Passing |
|---------------|--------------------|
| 125           | 100                |
| 75            | 100                |
| 63            | 100                |
| 37.5          | 100                |
| 20            | 93                 |
| 10            | 77                 |
| 6.3           | 70                 |
| 3.35          | 61                 |
| 2             | 54                 |
| 1.18          | 49                 |
| 0.6           | 41                 |
| 0.3           | 32                 |
| 0.212         | 28                 |
| 0.15          | 25                 |
| 0.063         | 19                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 0                |
| Gravel        | 46               |
| Sand          | 35               |
| Silt / Clay   | 19               |

## Remarks:

See summary of soil descriptions.

| Checked By | Date     | Approved By | Date     |
|------------|----------|-------------|----------|
| <i>R2</i>  | 16/08/11 | <i>R2</i>   | 16/08/11 |



POLAR FORD EXTENSION SITE,  
DODWORTH ROAD, BARNSELY.

Contract No.:  
PSL11/1970

\* Please note there are likely to be glass fragments in most samples \*



# LABORATORY SOIL TESTING SCHEDULE

Contaminated Site : \* Yes/ ~~No~~/ ~~Unknown~~ *Predominantly ash* \*Delete as appropriate.

|                                     |                            |
|-------------------------------------|----------------------------|
| Date Issued:                        | Schedule Number:           |
| Results Required By:                | Sheet <u>1</u> of <u>1</u> |
| Date Received by lab:               | Sample Storage Period:     |
| Project Engineer: <u>MIKE KELLY</u> | LD's                       |

| SAMPLE DETAILS |               |             |           | CLASSIFICATION TESTS |                  | COMPACTION TESTS           |                  |                |               | CONSOLIDATION TESTS |                  | TRIAXIAL TESTS                       |                    |                 |                      |                   |                             | SHEAR BOX TESTS           |                 |                             | CHEMICAL TESTS            |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|----------------|---------------|-------------|-----------|----------------------|------------------|----------------------------|------------------|----------------|---------------|---------------------|------------------|--------------------------------------|--------------------|-----------------|----------------------|-------------------|-----------------------------|---------------------------|-----------------|-----------------------------|---------------------------|------------------------|-----------------|---------------------------|----------------------|------------------------|--------------------------------|-------------------------------|---------------------------------|-----------------|------------------|--|--|
| BH/TP Number.  | Sample Number | Sample Type | Depth (m) | Density              | Moisture Content | Atterberg Limits *4 points | Particle Density | Sieve *Wet/Dry | Sedimentation | 2.5kg Compaction    | 4.5kg Compaction | C.B.R. (*2.5/4.5kg) *Unsoaked/Soaked | Misc Tests/Remarks | One-Dimensional | Pressure Range (kPa) | 3 x 38mm Diameter | Single Stage 102mm Diameter | Multistage 102mm Diameter | Quick Undrained | Consolidated Undrained (CU) | Consolidated Drained (CD) | Lateral Pressure (kPa) | Quick Undrained | Consolidated Drained (CD) | CD Peak and Residual | Normal Pressures (kPa) | pH and SO <sub>4</sub> of Soil | pH and 2:1 soil/water extract | pH and SO <sub>4</sub> of Water | Organic Content | Chloride Content |  |  |
| BH1            | 1             | D           | 0.4       |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 2             | B           | 0.5-1.2   |                      | X                |                            |                  | X              |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 3             | D           | 2.1       |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 4             | D           | 2.3       |                      | X                |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 6             | B           | 2.5-3.5   |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 8             | D           | 4.4       |                      | X                | X                          |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 10            | B           | 4.8-5.8   |                      | X                | X                          |                  | X              |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 12            | D           | 6.4       |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 14            | D           | 7.5       |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                |               |             |           |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
| BH2            | 1             | D           | 0.45      |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 3             | B           | 1.0-2.0   |                      | X                |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 6             | B           | 3.0-4.0   |                      |                  |                            |                  | X              |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 9             | B           | 5.0-6.0   |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 11            | D           | 6.4       |                      | X                | X                          |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 13            | D           | 7.6       |                      | X                | X                          |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 15            | D           | 8.3       |                      | X                |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                | 17            | D           | 9.2       |                      | X                |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
|                |               |             |           |                      |                  |                            |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
| TP302          | B             | 1.4         |           |                      | X                | X                          |                  | X              |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |
| TP304          | B             | 1.0         |           |                      | X                | X                          |                  |                |               |                     |                  |                                      |                    |                 |                      |                   |                             |                           |                 |                             |                           |                        |                 |                           |                      |                        |                                |                               |                                 |                 |                  |  |  |

PROJECT ENGINEER: MIKE KELLY

LOCATION: POLAR FORD EXTENSION SITE, DODWORTH RD, BARNLEY

CONTRACT NUMBER: SH10753

All tests are carried out to BS1377:1990 unless otherwise stated.

## APPENDIX XVI

### Capping Layer Calculation

# CAPPING LAYER CALCULATION



Job Number: SH10753

Job Name: Former Polar Ford adjacent site, Dodworth Road, Barnsley

Assessor: J Lymer

Date: 26/08/2011

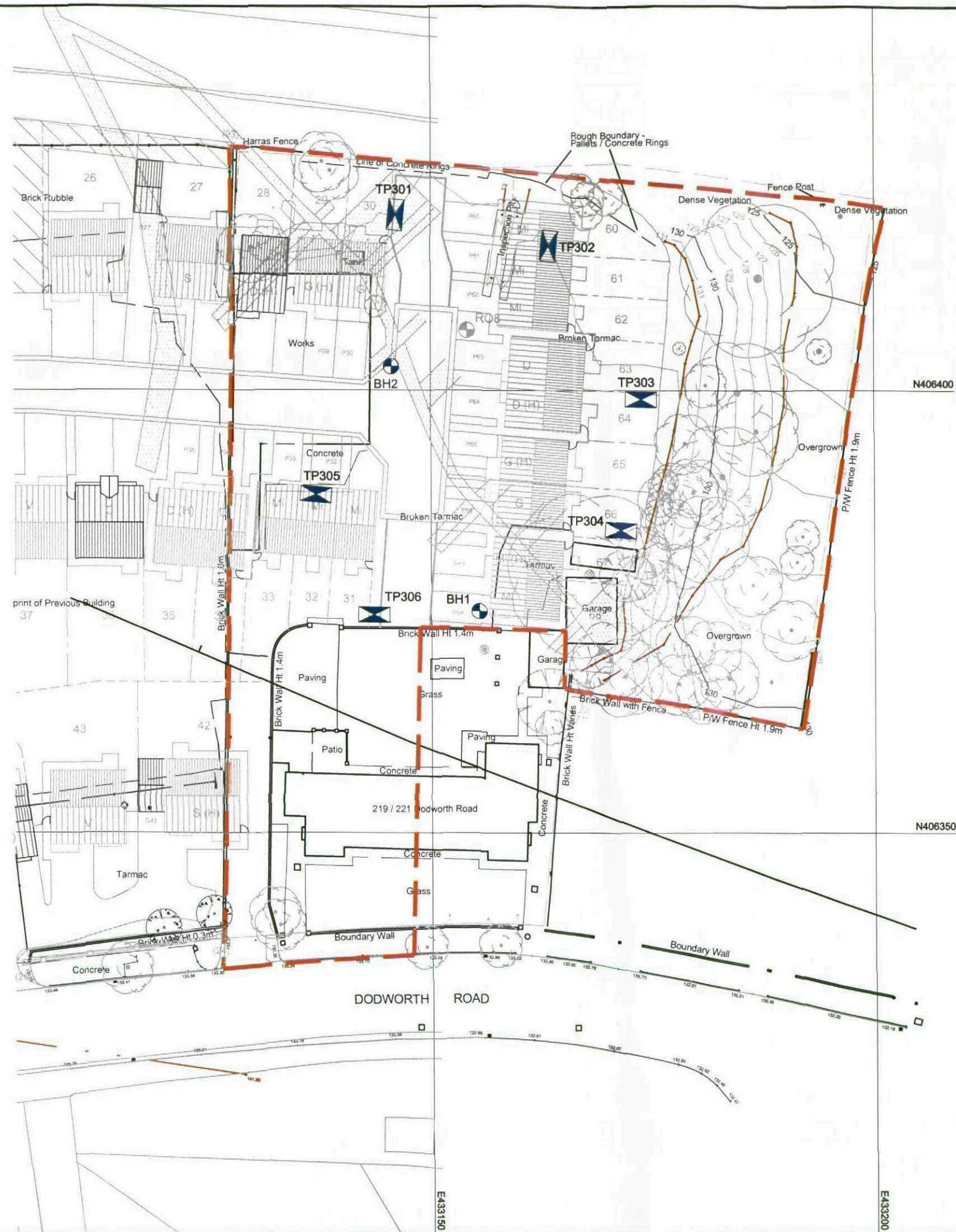
| Contaminant           | Max detected Contaminant concentration | Assessment Criteria | Cg     | Cc  | X (mm)  |
|-----------------------|----------------------------------------|---------------------|--------|-----|---------|
| Arsenic               | 129                                    | 32                  | 4.031  | 0.5 | 515.044 |
| Lead                  | 1380                                   | 450                 | 3.067  | 0.5 | 483.117 |
| Benz(a)anthracene     | 19                                     | 4.7                 | 4.043  | 0.5 | 515.315 |
| Benzo(a)pyrene        | 19.5                                   | 0.94                | 20.745 | 0.5 | 585.181 |
| Benzo(b)fluoranthene  | 13.4                                   | 6.5                 | 2.062  | 0.5 | 407.882 |
| Benzo(k)fluoranthene  | 13.4                                   | 9.6                 | 1.396  | 0.5 | 265.116 |
| Chrysene              | 16.8                                   | 8                   | 2.100  | 0.5 | 412.500 |
| Dibenz(a,h)anthracene | 2.08                                   | 0.86                | 2.419  | 0.5 | 443.636 |
| Indeno(123-cd)pyrene  | 9.48                                   | 3.9                 | 2.431  | 0.5 | 444.622 |

|                                    |          |                           |         |
|------------------------------------|----------|---------------------------|---------|
| Cover Thickness                    | X (mm) = | <b>585.181</b>            | Maximum |
| Mixed Zone                         | M (mm) = | 600                       |         |
| Contaminant concentration of cover | Cc       | 50% of Generic Assessment |         |

Calculation based on Cover Systems for Land Regeneration - Thickness of cover systems for contaminated land, NHBC

## DRAWINGS





DO NOT SCALE FROM THIS DRAWING

REFERENCE

SITE BOUNDARY



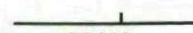
OLD WORKINGS AS RECORDED BY CA



SITE INVESTIGATION BOREHOLES (AFTER SIRIUS)



FAULT (AFTER BGS)



TRIAL PIT



BOREHOLE



A First Issue

BELLWAY HOMES LIMITED (YORKSHIRE)

POLAR FORD EXTENSION SITE

SITE PLAN SHOWING INVESTIGATION LOCATIONS

DRG No SH10753-002 SCALE 1:500 DATE 05/08/11

DRAWN BY DP CHECKED BY JL APPROVED BY GW

STOKE-ON-TRENT (HEAD OFFICE) TEL 0845 111 7777  
NEWCASTLE (ON-TIME) TEL 0191 232 0043  
WEST BROMWICH TEL 0121 580 0999  
LONDON TEL 020 7287 2872  
CARDIFF TEL 029 2072 9191  
LEIGH TEL 01642 260101  
SHEFFIELD TEL 0114 245 6244  
EDINBURGH TEL 0131 555 3311  
LIVERPOOL TEL 0151 404 5431

