

pwa

Geo-Environmental Ltd

Consulting Geo-Environmental Engineers

Phase 2
GEO-
ENVIRONMENTAL
INVESTIGATION
of land at
Ward Green
Barnsley

Calls Wharf
2 The Calls
Leeds
West Yorkshire
LS2 7JU
T.0113 2372929
F.0113 2372701

site@pwageo.co.uk
www.pwageo.co.uk



ISO 9001
FS 560612



CONTRACTORS HEALTH & SAFETY ASSESSMENT SCHEME
Accredited Contractor
www.chas.gov.uk

Report No. 10225/G/2
April 2011

Report No: 10225/G/2
Project Details: Ward Green, Barnsley
Date: April 2011



Client

Harron Homes
Carlton House
Temple Point,
Bullerthorpe Lane
Swillington
Leeds
LS15 9JL

Documents Revision Status

REVISION	DATE	COMMENTS
—	April 2011	

Ward Green, Barnsley - Summary

The site is a disused school located in the Ward Green district of Barnsley. PWA Geo-Environmental Ltd were commissioned by Harron Homes Ltd to provide a geo-environmental appraisal of the site in connection with a *planning application to re-develop the site with new housing*. A summary of salient geo-environmental issues is provided in the table below.

Issue	Remarks
Former uses	The site was occupied by a farm from the 1850s until the 1960s. A pump, well and tank are shown on the historic plans relating to the farm development. A building of unknown use is shown in the south of the site during the early 1960s. By the 1970s the site had been redeveloped with a school constructed on the site. The site has remained unchanged until the present day.
Ground Conditions	The site is underlain by made ground between 0.1 m and 1.0 m in depth across much of the site. It comprises predominantly of reworked in-situ materials (mudstone and clay) with additional foreign inclusions such as gravel of mixed lithologies, ash, clinker, brick fragments, glass and metal. No glacial drift deposits were encountered although shown on the geological map. The solid geology was confirmed as Coal Measures consisting of weathered mudstone present directly below the made ground.
Mining & Quarrying	Rotary drilling on site did not encounter any evidence of coal seams or shallow abandoned mineworkings.
Ground Gas and Radon	Investigations have confirmed the ground gas conditions fall into CS1 and the site is not in a radon area. No ground gas or radon protection measures are required.
Contamination	Elevated concentrations of PAH were recorded in the made ground, associated with ash and clinker.
Remediation Works	The PAH presents a potential risk to site workers during development as well as longer term potential risks to new site users. Risks to construction workers may be addressed by site management controls and PPE to minimise exposure. Risks to new site users may be remediated by off-site disposal of the PAH contaminated made ground or the provision of clean covers. There are considered to be no pollution linkages in relation to controlled water.
Foundations	Reinforced strip footings bearing onto the weathered Coal Measures strata are recommended for the proposed two storey houses.
Flooding & Drainage	The site does not lie within an Environment Agency Flood Zone.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

Table of Contents

1. INTRODUCTION	1
1.1 The Commission and Brief	1
1.1 The Proposed Development	1
1.2 Report Format and Limitations	2
2 SITE DESCRIPTION	2
2.1 General	2
2.2 Site Features	2
2.3 Site Operations	3
3 SITE HISTORY	3
4 ENVIRONMENTAL SETTING	4
5 PRELIMINARY CONCEPTUAL SITE MODEL	5
6 GROUND INVESTIGATION	7
6.1 Sampling Strategy	7
6.2 Site Works	7
7. GROUND CONDITIONS AND IN-SITU TESTING	7
7.1 Top Soil and Made Ground	7
7.2 Weathered Residual Soil	8
7.3 Coal Measures Strata	8
7.4 Mine Workings	8
7.4 Groundwater	9
8 CONTAMINATION ANALYSIS	9
8.1 Analytical Strategy	9
8.2 Results of Chemical Analysis - Soils	9
8.4 Results of Ground Gas Monitoring	13
9 RISK ASSESSMENT AND REVISED CONCEPTUAL SITE MODEL	13
9.1 Introduction	13
9.2 Identified Sources	14

9.3	Receptors.....	14
9.4	Qualitative Risk Assessment and Conceptual Site Model	15
10	CONCLUSIONS AND RECOMMENDATIONS	17
10.1	Contamination Risks	17
10.3	Foundations	18
10.5	Potential Development Constraints	19
11	REFERENCES	20

APPENDICES

Appendix A – Legal Framework

Appendix B - General Notes

01	Environmental Setting
----	-----------------------

Appendix C – Drawings

Drawing No.	Title
10225/G/152A	Site Investigation Layout
10225/G/151A	Revised Conceptual Site Model

Appendix D - Photographs

Appendix E – Logs

Appendix F – Chemical Analysis Results

Appendix G – Ground Gas Monitoring Data

Appendix H – Protocol for Importation of Soil for Clean Covers

FOREWORD (Geo-environmental Investigation Report)

This report has been prepared for the sole use and reliance of the Client named above and cannot be relied upon by any other parties without the express written authorisation of PWA Geo-Environmental Ltd. Any unauthorized third party relies on this report at their own risk and the authors owe them no duty of care.

The report presents observations and factual data obtained during our site investigation, and provides an assessment of geo environmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from PWA Geo-Environmental Ltd prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. PWA Geo-Environmental Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in any Desk Study section of the report (including review of any third party reports) are based on information obtained from the sources listed, which PWA Geo-Environmental Ltd understands are reliable. All reasonable skill, care and diligence has been applied in examining the information obtained. However, PWA Geo-Environmental Ltd accept no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

PWA Geo-Environmental Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

PHASE 2 GEO-ENVIRONMENTAL INVESTIGATION

of land at

Ward Green, Barnsley

1. INTRODUCTION

1.1 The Commission and Brief

PWA Geo-Environmental Ltd (PWAG), were commissioned by Harron Homes Ltd to carry out a Phase II geo-environmental investigation of land at Ward Green, Barnsley (the site). The site is currently a disused single storey school with associated asphalt surfaces and grassed landscaping. The purpose of the study is to support a planning application for the redevelopment of a series of low rise residential dwellings, and to determine ground conditions.

A preliminary investigation report (Ref. 1) was prepared in December 2010 which recommended intrusive investigation works. These were subsequently undertaken during the period March 2011 to April 2011 and the results are provided in this report. The preliminary investigation report should be read in conjunction with this report.

The scope of work comprises:

- An assessment of the land use history;
- Determination of the site's environmental setting;
- Excavation of 8 no. trial pits;
- Drilling of 4 no. rotary boreholes;
- Drilling of 8 no. dynamic percussion boreholes;
- Monitoring of ground gas and groundwater levels;
- Assessment of ground conditions;
- Chemical analysis of soil and groundwater samples;
- Development and refinement of the conceptual site model;
- Environmental risk assessment and risk mitigation measures, and;
- Assessment of anticipated foundation and engineering issues associated with redevelopment for a residential end use.

1.1 The Proposed Development

It is understood that consideration is being given to redevelopment of the site for a small low rise housing development, consisting of detached and semi-detached houses. The existing school on-site will be demolished and all associated services disconnected.

The existing access road off High Ridge Road is anticipated to stay in the same location; however, the alignment will change in accordance with the housing layout.

1.2 Report Format and Limitations

Standard definitions, procedures and guidance are contained within Appendix B, which includes background, generic information on assessment of the site's environmental setting.

The Preliminary Investigation (Ref.1) comprised an inspection of historical and geological maps and information provided by the Local Council, Landmark, The Environment Agency, British Geological Survey and the Coal Authority.

General notes and limitations relevant to all PWA Geo-Environmental Ltd investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2 SITE DESCRIPTION

2.1 General

The site location is shown on Drawing Number 10225/G/150 presented in Appendix C to report 10225/G/1. Site details are summarised in the table below.

Detail	Remarks
Location	Approximately 1.5km south of Barnsley town centre
NGR	NGR SE 34780 04330
Area	0.71 Ha
Known services	Underground sewer, overhead telecoms (underground electricity, gas and water also likely)

2.2 Site Features

Existing salient features are summarised in the table below.

Feature	Remarks
Current Access	Off High Ridge Road, Worsbrough, Barnsley
Topography	Generally falling to the south. Embankments and split levels across the site.
Approximate areas	7163 m ² – boundary 1600 m ² – school building
Nature of boundaries	North – Brick wall (high) West – Hedge East – Wooden fencing South – Block wall and hedging
Surrounding land uses	North – commercial South – residential East – High Ridge Road and commercial West – public open space
Nearest watercourse	Snape Ske approx. 115 m north-east of the site.

2.3 Site Operations

The school is currently disused and the building boarded-up.

3 SITE HISTORY

In order to investigate the development history, previous land uses and immediate surrounding land, site centred extracts from Ordnance Survey (OS) plans dating back to 1855 were reviewed. These plans are presented in Appendix E of Ref.1.

The table below provides a summary of the history of the site. Significant former uses/operations are highlighted in bold text.

Date(s)	On -Site	Surrounding Land
1855	A farm is shown on the site with the farm buildings concentrated in the southern part of the site. A pump is shown in the central part of the site.	The surrounding land is shown as mostly undeveloped agricultural land with a small hamlet 100m to the north of the site.
1892-1894	The farm is named as Ward Green Farm. An unmarked building has been constructed in the west of the site.	Two wells are shown 100m to the north east of the site. A colliery is shown 800m to the north east of the site and sandstone quarries are shown 900m and 1km to the north and north east.
1906-1907	A well is shown in the centre of the site and a tank is shown in the south east of the site.	A reservoir is shown 300m to the south west of the site. Air shafts and old shafts are indicated to be present 600m to the east, 900m to the south east and 600m to the west.
1931	The well is no longer shown.	A residential estate has been constructed to the north of the site.
1948	No significant changes.	An unmarked building has been constructed to the east of the site. More residential properties have been constructed to the south east of the site.
1958	No significant changes.	An unmarked building has been constructed immediately to the north east of the site.
1960-1966	The farm buildings are no longer shown and an unmarked building has been constructed in the central southern part of the site.	A school and allotments are shown to the east of the site with further residential properties constructed to the south. A community park is shown to the west of the site with slopes shown indicating significant level changes. A garage has been constructed immediately to the north of the site and a church to the east. A stream is shown 115m to the north east of the site. The reservoir to the south west of the site is no longer shown.
1973-1978	The building in the south of the site is no longer shown. A school has been constructed on the site.	More residential properties are shown to the south of the site.

1993	The school is shown as Wordsborough Manor Infant's school.	No significant changes.
2000	No significant changes.	An air shaft is shown 250m to the south west of the site.

4 ENVIRONMENTAL SETTING

The site's environmental setting has been ascertained from a variety of data sources, and are summarised in the table below. Notes describing how the site's environmental setting has been assessed are included in Appendix B to this report. The responses received from the Coal Authority, The Local Council, the BGS and the Environment Agency are included as Appendix D of Ref.1.

In consideration of the site's proximity to controlled waters, its hydrogeology and end use the site's sensitivity is considered to be MODERATE.

Subject	Data Source	Summary
Geology	1:50,000 BGS map	Drift – None present. Solid – Pennine Middle Coal Measures (undifferentiated mudstone, siltstone and sandstone). Inferred coal seam outcrop – Lower Beamshaw coal seam in the north-eastern extremity of the site with potential of Kent's Thin seam present at shallow depth. Faults – none anticipated as affecting the site.
Mining	Coal Authority Report	According to records obtained from the Coal Authority the site is in the zone of likely influence from workings in five seams of coal at depths ranging from 100m to 460m, last worked in 1970. Any ground movement from these coal workings should have ceased by now.
Quarrying	Local Authority search Historical OS Plans	Nearest quarry – sandstone approx. 400 m north of the site.
Radon	BRE Report BR211	No protective measures required
Hydrogeology	Environment Agency Groundwater Vulnerability map Envirocheck Report	Source Protection Zone - none recorded Aquifer – Secondary (Minor of variable permeability) – Middle Coal Measures (Solid). Soil leaching potential – High (default due to the urban setting). Groundwater abstractions – none within the vicinity of the site.
Flood Risk	Environment Agency	The site does not lie within 50m of an Environment Agency Flood Zone The site is in an area defined as having a risk of groundwater flooding.

Landfills and Waste Sites

One historical and registered landfill site is located approximately 100m to the south west of the site. It was operational between 1981 and 1989, and licensed to accept inert, industrial and commercial waste including demolition, horticultural and landscape industrial waste. No other waste facilities exist within the locality of the site.

Regulated Industrial Activities

No current trade industries are recorded as active within 250 m of the site.

The nearest historic trade industry is recorded as a printers approximately 159 m south of the site. This historical activity is not anticipated as having the potential to affect the site.

5 PRELIMINARY CONCEPTUAL SITE MODEL

A preliminary conceptual site model was constructed on the basis of the preliminary investigation data in accordance with current good practice (Ref.2). Potential contaminant sources, pathways and receptors were evaluated as follows.

The historical plans show that the site has been occupied by a single storey school and caretakers bungalow since the 1970's. Prior to this the land had been used as a farm and associated land prior to the first Ordnance Survey map of 1855. The farm is recorded as having a nearby well and tank of unknown usage. Both these features fall within the site's boundary.

Potential contaminants that may pose a risk to current and future receptors include:

- Contaminated made ground inclusions;
- Impacted natural sub-soils affected by leaching from the made ground and possible spills;
- Fuel and lubricating oil leaks and spills from grass cutting equipment on-site;
- Ground gas from made ground and/or coal seams beneath the site and an off-site historical landfill;
- Fuel oil and solvent contamination associated with the off-site former garage immediately to the north of the site.

Potential receptors include future site users, construction workers, new buildings and services, and groundwater.

Pathways between the potential sources and receptors comprise contact, ingestion and inhalation by humans, and leaching through the soil profile.

The Coal Authority Report states that the site is in the likely zone of influence of five seams of coal between 100 m and 460 m depth, however; the report goes on to say that any movement should have ceased by now. Also the site is in an area which may be

affected by shallow coal workings.

In consideration of these factors a preliminary conceptual site model was prepared, identifying plausible potential pollutant linkages and provided in Drawing 10225/G/151 (Included in Ref.1). These formed the basis and justification for the intrusive site investigation works subsequently undertaken.

Ground Investigation Strategy

Exploratory holes	Purpose
Trial Pits	To observe the nature, distribution and thickness of made ground, evidence of any contamination, biodegradable matter, old foundations, sub-surface tanks etc. And to take samples for chemical analysis.
Boreholes.	To investigate ground conditions at depth and obtain samples for geotechnical testing.
	To install monitoring wells across the site in order to determine groundwater levels and monitor for hazardous gas.
Rotary Boreholes	To locate possible unrecorded shallow mine workings.

6 GROUND INVESTIGATION

6.1 Sampling Strategy

The principal objectives of the study were to examine the ground conditions and assess the site suitability for the proposed development, identifying any potential environmental risks. The site investigation layout was designed in relation to the proposed building position to target potential sources of contamination. In addition, sampling points were selected on a random basis within the development area. The locations are shown on Drawing 10225/G/152A

6.2 Site Works

Eight dynamic boreholes were drilled and 8 no. machine-dug trial pits were excavated on 11th March 2011. Also, 4 no. rotary percussion boreholes were drilled on 21st March 2001. The boreholes and trial pits were logged by a geotechnical engineer in accordance with BS 5930 (Ref. 3) and Eurocode 7 (Ref. 4) requirements.

Each pit was photographed (Appendix D), and representative samples taken from both boreholes and trial pits for chemical analysis under chain of custody to NLS laboratories Leeds.

Five wells were installed in the dynamic percussion boreholes and ground gas and groundwater levels monitored on four occasions between 14th March 2010 and 8th April 2011.

The exploratory logs, chemical analysis results and gas monitoring data are included as Appendix E, F and G respectively.

7. GROUND CONDITIONS AND IN-SITU TESTING

7.1 Top Soil and Made Ground

Made ground was recorded at all locations with a thickness ranging between 0.1 m (TP3) and 1.0 m (TP 2). The material consisted predominantly of reworked insitu soil with inclusions in varying fractions of gravel of mixed lithologies, ash, clinker, glass, brick fragments and rare metal. Tree roots were also recorded.

Trial pits 1, 2, 4 and 6 and dynamic boreholes WS4, 5 and 7 were identified as containing a discrete horizon of ash and clinker. No olfactory evidence of contamination was noticed during the investigation.

The reworked natural made ground consisted of (generally) a sandy gravelly clay soil.

7.2 Weathered Residual Soil

The natural deposits underlying the made ground were found typically to consist of weathered mudstone in the form of a stiff to very stiff sandy gravelly clay from 0.1 m below ground level (mbgl) to 1.0 mbgl extending down to depths ranging between 0.93 m and 1.95 mbgl.

Standard penetration testing (SPT) was performed at every metre of penetration or on refusal of the cutting shoe. Results of the SPT testing within the residual soil horizon (clay) recorded 'N' values ranging from 13 to 35, with a mean average result of 18.9 N. This would confirm the empirical evaluation of the clay soil as generally stiff to very stiff.

7.3 Coal Measures Strata

The horizon below the residual sandy gravelly clay soil to the weathered Coal Measures bedrock ranged from 0.93 mbgl to 1.95 mbgl as stated above. The transition from the residual soil was typically to an extremely weak thinly to thickly laminated iron stained mudstone (in ordered lithorelics) returning on excavation as tabular gravel and cobbles.

SPT testing within this horizon resulted in 'refusals' ($N \geq 50$) generally between 0.5 m to 1.0 of penetration.

Refusal within the SPT testing ranged in depth between 1.44 m (WS01 in the north of the site) and 2.41 m (WS04 in the centre of the site).

7.4 Mine Workings

The Phase I Desk Study Report highlighted the possibility of shallow mine workings due to two potentially shallow (< 30 m) seams of coal. These were the Lower Beamshaw coal seam (0.46m to 0.61m thick) which is recorded on the geological map as sub-cropping at the north eastern corner of the site and the Kents Thin coal seam (0.62m to 1.52m thick) indicated to be present to the south east of the site.

Sirius Drilling Services Ltd. carried out the drilling of 4 no. rotary percussion boreholes on 21st March 2011 in order to investigate the presence of the coal or coal workings.

Three of the boreholes (RBH01, 02 & 03) were located in the north-east corner of the site to investigate the potential presence of the Lower Beamshaw Coal, and RBH04 was located in the centre of the site. The boreholes ranged in depth from 8 m to 30 m, encountering clay, mudstone and siltstone. No coal seams or evidence of workings were recorded during the investigation.

7.4 Groundwater

No groundwater was encountered during the trial pitting phase of the investigation.

Five standpipe groundwater monitoring wells were installed during the dynamic borehole drilling stage of the investigation. The wells were installed to depths ranging from 1.87 m to 2.07 m and subsequently monitored on four separate occasions between 14th March and 8th April 2011 in order to determine standing groundwater levels.

Boreholes WS03 & 05 were dry on each monitoring occasion. The remaining wells (boreholes WS06, 07 & 08) recorded groundwater levels ranging between 1.45 m and 1.90 m bgl fluctuating up to a maximum of 250 mm in WS06 over a 3 week period.

8 CONTAMINATION ANALYSIS

8.1 Analytical Strategy

Representative soil samples were taken from the boreholes and trial pits for laboratory chemical analysis at the Environment Agency laboratories (NLS) in Leeds. The suite of determinands was selected with consideration given to the potential contamination sources listed in the preliminary conceptual site model. The analysis therefore comprised heavy metals, inorganic compounds, speciated PAH, banded petroleum hydrocarbons and asbestos.

8.2 Results of Chemical Analysis - Soils

Six samples of the made ground and four samples of the underlying weathered coal measures strata deposits were analysed. The results have been screened in relation to tier 1 contaminated land risk assessment criteria which are currently in use by the industry.

Five of the six samples of made ground contain Polycyclic Aromatic Hydrocarbons (PAH) in excess of the screening value (40 mg/kg), with total concentrations ranging from 41.3 mg/kg to 70.5 mg/kg. Benzo (a) pyrene (BaP) concentrations of between 2.6 mg/kg to 5.3mg/kg were recorded in these samples.

One sample of the weathered coal measures yielded a BaP value of 1.2 mg/kg which marginally exceeds the tier 1 screening value of 1.12 mg/kg. This is likely to be attributable to the natural organic content of the mudstone and shale strata.

The remaining samples did not record any determinands at concentrations greater than their respective tier 1 screening values.

The results of the screening are summarised in the following tables and the test results are provided in Appendix G.

Project No. 10225/G/2
 Project Details. Ward Green, Barnsley
 Date. April 2011

Tier 1 Screening Results for Inorganic Determinands

				Concentrations in mg/kg unless otherwise stated: Tier 1 screening values assume a residential with gardens end-use.														
	Sample Location	Depth (m)	Stratum		pH [#]	As (32) ^{\$}	Cd (♣ \$)	Cr (130) ^{\$}	Pb (450) ^{\$}	Hg (1) ^{\$}	Se (350) ^{\$}	B (3)*	Cu (♣ x)	Ni (130) ^{\$}	Zn (♣ x)	CN (20) ⁰	Total SO ₄ (2,400) ⁰	Asbestos
	TP1 – ES2	0.5	Made Ground		8.4	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	TP1- ES3	1.0	Coal Measures		8.1	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	TP4 – ES1	0	Made Ground		8.6	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	TP5 – ES2	0.4	Made Ground		8	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	TP6 – ES1	0	Made Ground		7.9	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	TP7 – ES1	0.3	Made Ground		8.6	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	WS01 – ES1	0.47	Coal Measures		8.7	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	WS04 – ES1	0.5	Coal Measures		8	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	WS05 – ES1	0.3	Coal Measures		8	-	-	-	-	-	-	-	-	-	-	-	-	Not Present
	WS07 – ES1	0.3	Made Ground		7.8	-	-	-	-	-	-	-	-	-	-	-	-	Not Present

Project No. 10225/G/2
 Project Details. Ward Green, Barnsley
 Date. April 2011



Key		Source of Tier 1 Values	
-	Parameter tested for but not found to be in excess of trigger concentration	\$	DEFRA and the EA Contaminated Land Exposure Assessment (CLEA) – March '02
	Parameter not tested for	x	MAFF – The Soil Code (Rev. 1998)
		◇	BRE Special Digest 1, Concrete in aggressive ground (2005)
#	All pH results listed to confirm which soil guideline values are to be used in CLEA assessment	o	Dutch Intervention Levels
+	Tier 1 Value is pH dependent	*	ICRCL Guidance Note 59/83, Second Edition (1987) – (Boron Phytotoxic only)

Tier 1 Screening Results for Organic Determinands

Concentrations in mg/kg unless otherwise stated. Tier 1 screening values assume a residential with gardens end-use.				
Sample location	Depth	Stratum	PAH (Total) (40)	Benzo-a-pyrene (1.12)
TP1 – ES2	0.5	Made Ground	51.9	3.9
TP1- ES3	1.0	Coal Measures	-	-
TP4 – ES1	0	Made Ground	57.3	3.7
TP5 – ES2	0.4	Made Ground	-	-
TP6 – ES1	0	Made Ground	50	2.6
TP7 – ES1	0.3	Made Ground	41.3	2.9
WS01 – ES1	0.47	Coal Measures	-	-
WS04 – ES1	0.5	Coal Measures	-	-
WS05 – ES1	0.3	Coal Measures	-	1.2
WS07 – ES1	0.3	Made Ground	70.5	5.3

8.4 Results of Ground Gas Monitoring

Monitoring wells were installed in five boreholes with response zones within the natural deposits to rockhead or in the made ground.

Measurements of carbon dioxide, oxygen and methane were taken from the monitoring wells on four separate occasions over a two month period. The data are presented in Appendix H.

The maximum concentration of carbon dioxide was 2.3% v/v recorded at borehole WS03. Flow measurements detected a zero rate of flow. Methane was not detected in any borehole.

These values are considered to be representative of typical made ground, and fall into Characteristic Situation 1 presenting a very low risk (Ref. 5).

9 RISK ASSESSMENT AND REVISED CONCEPTUAL SITE MODEL

9.1 Introduction

Environmental Risk has been addressed by adopting a site-specific qualitative approach to identify the risk of environmental harm. The guiding principle of this approach is an attempt to establish connecting links between a hazardous source, via an exposure pathway to a potential receptor. This is in accordance with the Department of Environment, Transport and Regions (DETR) guidance on Contaminated Land (Ref.6) and the Construction Industry Research and Information Association (Ref. 7).

By considering where a viable pathway exists, which connects a source with a receptor, this assessment will identify where pollutant linkages may exist. A pollutant linkage is the term used by the DETR in their standard procedure on risk assessment. If there is no pollutant linkage, then there is no risk. Our risk assessment is based on the redevelopment of the site with a commercial end-use.

Contaminated land risk assessment is based on development of a conceptual model for the site. This is representation of the relationship between contaminant sources, pathways and receptors developed on the basis of hazard identification.

9.2 Identified Sources

The following sources of contamination have been identified from the work carried out on site.

On Site Sources

Made ground is present at the site and elevated levels of PAH (including BaP) were recorded in five samples of the six made ground samples analysed. The made ground was noted to contain ash and clinker and it is concluded that the PAH contamination is associated with these materials. This source of contamination may be regarded as having a potential impact on the proposed development.

Off Site Sources

A former garage was present adjacent to the northern site boundary. However, no evidence of contamination was identified during the investigation which may impact the site.

9.3 Receptors

The following receptors have been identified who may be adversely affected by the PAH contamination during and post development works:

- Future site users; and
- Construction workers during redevelopment works.

The following pathways link the identified PAH contamination with the potential receptors:

- Dermal contact;
- Inhalation of outdoor dust; and
- Ingestion of soil particles due to disturbance of made ground containing ash and clinker.

The revised Site Conceptual Model is shown on Drawing No. 10225/G/151 presented in Appendix C.

9.4 Qualitative Risk Assessment and Conceptual Site Model

A qualitative risk assessment has been undertaken for these potential source-pathway-receptor linkages. This is based on consideration of both:

- *The likelihood of an event (probability – takes into account both the presence of the hazard and receptor and the integrity of the pathway);*
- *The severity of the potential consequence (takes into account both the potential severity of the hazard and the sensitivity of the receptor).*

The risk assessment has been based on redevelopment of the site with a proposed residential end use.

Report No: 10225/G/2
 Project Details: Ward Green, Barnsley
 Date: April 2011



Environmental Risk Assessment & Conceptual Site Model– Proposed Residential End Use

Source	Pollutant / Hazard	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Potential Risk
Made ground beneath site (On Site).	Material containing ash and clinker with elevated PAH – carcinogens	Future Site Users	Dermal contact, inhalation and ingestion of outdoor dust following disturbance of made ground.	Effect on human health (Moderate to Severe)	Likely – made ground is present over much of site and could remain at shallow depth beneath garden and soft landscape areas. These could be disturbed during gardening activities.	Medium
		Construction Workers	Dermal contact, inhalation and ingestion of outdoor dust following disturbance of made ground.	Effect on human health (Moderate)	Likely - construction and maintenance workers may come into direct contact with made ground but exposure duration will be short.	Low to Medium

10 CONCLUSIONS AND RECOMMENDATIONS

The geo-environmental assessment undertaken for the site has identified:

- The site is currently occupied by a disused school building with associated hard surfaced play ground and peripheral grassed landscape areas.
- The site is located in a residential area and was historically occupied by a farm before a school was constructed in the 1970s.
- The ground conditions comprise made ground between 0.1m to 1.0m in thickness, overlying weathered Coal Measures mudstone strata.
- The Coal Measures strata are weathered to a stiff gravelly clay with cobbles and boulders of mudstone to around 2.0mbgl *becoming more competent with depth*.
- The made ground contains ash and clinker and gravel to cobble sized fragments of brick, sandstone and concrete. Tree roots were also recorded.
- Elevated concentrations of PAH (including BaP) were recorded in the made ground
- With the exception of PAH, no elevated concentrations of potential contaminants were recorded in the soil samples analysed, in the context of a future residential end-use.
- The surrounding land use is mainly residential and commercial. It is considered unlikely that these present any potential sources of contamination which might feasibly impact the site.
- No evidence of shallow abandoned mineworkings was recorded by the rotary boreholes.
- Ground gas results fall into CS 1 indicating no ground gas protection measures are necessary for incorporation into new buildings.

10.1 Contamination Risks

With respect to historic land contamination, Planning Policy Guidance: Planning and Pollution Control (PPS 23) (Ref.8) states that ground

contamination is a material planning consideration. Local planning authorities must take account of such issues in determining applications for planning permission. In addition, building work is regulated under the Building Regulations 1991. Schedule 1 (Ref. 9) requires 'precautions shall be taken to avoid danger to health and safety caused by substances found on, or in the ground covered by the building'.

It is concluded that the presence of ash and clinker with elevated PAH in the made ground at shallow depth represents a potential source of contamination which may impact the redevelopment of the site. Remediation options include removal of the source or the exposure pathways in order to break the relevant pollutant linkages.

It is, therefore, recommended that the made ground is either excavated and removed from site, or alternatively, isolated from site users by the provision of a clean cover. This would comprise the provision of a minimum depth of 600mm of clean soil to new gardens and openspace / landscape areas. Please refer to Appendix I for further information on clean covers.

The decision to remove or isolate PAH contamination will be dependent on final site levels to some extent.

Short-term risks to site construction and maintenance workers may be addressed through normal good practice in the adoption of good personal hygiene standards, eating in designated mess areas and the wearing of PPE etc as detailed in advice provided by the Health and Safety Executive (Ref 10) and in CIRIA report R132 (Ref 11).

Works should be carried out with proper regard to current statutory requirements.

10.3 Foundations

Made ground is not generally considered a suitable founding material as it variable in composition and has unpredictable load-bearing and settlement characteristics. It is generally advisable for foundations to be taken through it, into underlying natural in-situ strata of adequate bearing capacity.

The proposed development comprises two storey residential dwellings. Foundation recommendations assume that development line loads will not exceed 60kN/m run. If this is not the case significant alteration to these recommendations will be required.

It is considered that strip footings will be the most suitable foundation solution for two storey houses constructed on the weathered Coal Measures strata.

Assuming a strip foundation of 8m length and 0.6m width, founding at 0.75 m

depth, the strata are generally considered to have a safe bearing capacity of at least 120kN/m^2 .

With respect to the above foundation geometry and a maximum line load of 60kN/m run, settlements in the order of 15mm would be anticipated, which is considered likely to be acceptable.

Reinforcement of footings is recommended as a precaution against differential settlement due to the variation in rock mass weathering across the site. Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2.

In order to minimise softening and swelling of cohesive soils it is recommended that as soon as formation level is reached, it should be blinded. The blinding should consist of concrete with as low a water:cement ratio as possible.

A suspended floor construction should be used wherever the depth of made ground or infill beneath a plot exceeds 600mm .

Based on the results of the investigation it is unlikely that significant groundwater inflows will be encountered in shallow excavations.

Excavations in natural ground should remain stable in the short term but if left open for any significant period of time, may require shoring.

Sub-surface concrete in contact with the natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1.

10.5 Potential Development Constraints

The underground services on site (in particular the combined sewer) present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.

Utility companies may seek to restrict changes in site level if the depth of cover above their services were adversely affected by any development proposals. This aspect requires further clarification.

There is also a former well within the site identified on old OS maps which may present a risk of instability to new buildings. It is likely that the well was infilled prior to the development of the school, however, it is recommended that the position is investigated and, if necessary, secured appropriately once demolition and site clearance has taken place.

11 REFERENCES

1. PWA Geo-Environmental Report 10224/G/1 July 2010.
2. Department of the Environment, Transport and the Regions and Environment Agency, Model Procedures for the Management of Land Contamination. Contaminated Land Report 11.
3. BS 5930 1999: Code of Practice for Site Investigations.
4. Eurocode 7: Geotechnical Design- Part 2 Ground Investigation and testing.
5. Assessing risks posed by hazardous ground gases to buildings. CIRIA C659/665, 2007.
6. Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.
7. Construction Industry Research and Information Association (CIRIA). Contaminated Land Risk Assessment. A Guide to Good Practice. CIRIA C552 2001.
8. OPDM Planning Policy Statement 23: Planning and Pollution Control. Annex 2 Development on Land Affected by Contamination.
9. Approved Document C – Site Preparation and Resistance to Contaminants and Moisture (Relating to Building Regulations 2000 (SI 2000/2531).
10. Protection of Workers and the General Public during the Development of Contaminated Land. Health and Safety Executive 1991.
11. A Guide for Safe Working on Contaminated Sites. CIRIA R132 1996.

Report No. 10225/G/2
Project Details: Ward Green, Barnsley
Date: April 2011



APPENDIX A

Legal Framework

Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source – pathway - target relationship in accordance with the approach set out in the 1995 Environment Act, The Contaminated Land (England) Regulations 2000 and the DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land. Contaminated land is defined within the legislative framework as land which is in such condition by reason of substance in, on or under the land that:

- a) significant harm is being caused or there is a significant possibility of such harm being caused;
- b) significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- Source: Substances that are potential contaminants or pollutants that may cause harm;
- Pathway: A potential route by which contaminants can move from the source to the receptor; and
- Receptor or target: A receptor that may be harmed, for example the waters environment, humans, water, flora and fauna.

Where a source, pathways and target are all present a pollutant linkage exists and there is potential for harm to be caused. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm.

The nature and importance of both pathways and receptors, which are relevant to a particular site, will vary according to the intended use of the site, its characteristics and its *surroundings*.

The key principle which underpins this approach is the "suitable for use" criterion. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and appropriate and cost effective remediation techniques exist, taking into account the actual or intended use of the site.

Guidance

PWA Geo-Environmental Ltd (PWAG) is part of a registered Engineering Practice which is a member of the Association of Consulting Engineers (ACE).

This report has been prepared in accordance with:

- CLR11 – Model Procedures
- Contamination and Environmental Matters – Their implications for Property Professionals (2nd Edition RICS Nov 2003)
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002
- DEFRA and Environment Agency (EA) publications CLR7 – 10, (subsequently withdrawn) supported by the TOX guides and SGV guides, dated March 2002
- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002

And any other protocols advised by DEFRA and the EA and guidance's prepared by BSI, CERTA, BURA, and other industry advisory bodies including BS5930 and BS10175.

Judicial Precedents and Legislation

The following non-exhaustive list of the legislative framework documents has been considered in the compliance of this document.

- The Environment Act (1995)
- The Environment Protection Act (1990)
- The Water Resources Act (1991)
- The Radioactive Substances Act (1993)
- The Pollution Prevention and Control (England and Wales) Regulations (2000)
- The Contaminated Land (England) Act (2000)
- The Environment Act 1995 (Commencement No.16 and Saving Provision) (England) Order (2000)
- The Contaminated Land (England) (Amendment) Regulations (2001)
- The Landfill Regulations (England and Wales) Regulations (2002)
- The Landfill (England and Wales) (Amendment) Regulations (2004)
- Rylands v Fletcher – Private Nuisance, Escape
- Health and Safety at Work Act
- The Building Regulations 1991, Part C of Schedule 1
- The Controlled Waste Regulations 1992
- Special Waste Regulations 1996

Neither the list of guidance nor the list of judicial precedents and legislation should be considered exclusive or comprehensive. There are approximately 85 individual items of legislation regulating contaminated land work. PWAG makes every effort to ensure that all are adhered to in the preparation and presentation of this report.

Technical Competence

PWAG is a leading specialist multi-disciplinary engineering practice working in the contaminated land market. Most of the workload undertaken by PWAG is within the property development market dealing with brownfield re-development and associated environmental and geotechnical issues.

Established in 2009 PWAG is at the forefront of environmental asset management providing expertise in environmental risk assessments, environmental site investigations, geotechnical site investigations and remediation strategies.

PWAG's staff come from a wide variety of backgrounds within the geotechnical and environmental sectors and are all degree qualified. Specialists include geotechnical engineers, geologists, chartered environmentalists and chartered engineers.

PWAG's technical protocols are described in our reports and are strictly adhered to by quality control checks in the field and in the laboratory. PWAG only uses UKAS and MCERTS accredited laboratories for all methods used to derive determinant concentrations.

PWAG is working towards a quality assurance process under ISO9001:2000 which facilitates rigorous in-house administrative and technical protocols. PWAG also initiates a robust health and safety program for each site and ensures the regular training of staff in new guidance's and techniques.

APPENDIX B

General Notes

Generic Notes – PWAG Geo-environmental Investigations

Environmental Setting

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the Correspondence Appendix of this Geoenvironmental Report.

Geology, Mining & Quarrying

In order to establish the geological setting of a site, PWAG refer to BGS maps for the area, and the relevant geological memoir.

A coal mining report is obtained from the Coal Authority. Further information is sourced from the Local Authority and by reference to current and historical OS plans.

Landfills

PWAG obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, PWAG refer to BRE Report BR211, 1999: *"Radon: guidance on protective measures for new dwellings"*.

BR211 provides a preliminary indication of the measures required for a particular site, but it is also often necessary to request a Stage 2 Protective Measures Site Report from the BGS.

The level of protection needed is site-specific and is determined by reference to the radon potential map for the area followed by a geological assessment of the site. This information is contained in the Annexes of BR211.

Annex A – derived from statistical analysis of radon measurements in existing houses carried out by the NRPB and grouped on a 5km grid.

Annex B - based on an assessment of the same radon measurements grouped by geological units. The maps show the 5km grid squares underlain completely or in part, by geological units which potentially exceed the action levels for radon protective measures. The grid squares are coded according to the highest potential within the square. In many cases the actual geological radon potential varies considerably within a grid square.

PWAG adopt the following procedure when assessing risk associated with radon.

Firstly, Annex A maps are reviewed to see whether the site requires full, basic or no measures. If the site is in a dark brown square, full radon protection measures are required. If the site is in a light brown square, reference should be made to Annex B.

Secondly, Annex B maps are reviewed to see whether a further geological assessment is required which may result in upgrading the result from Annex A. If a site lies within a shaded square, it may require radon protection, and PWAG request a Stage 2 Protective Measures Site Report from the BGS.

If the site is in a square that is not coloured or shaded in either set of maps then no radon protection is needed and therefore a BGS Report is not normally necessary.

The BGS geological assessment involves checking whether the site is on or close to a geological unit that has statistically been found to have elevated radon potential. The geological assessment is based on either 1:50,000 or the 1:250,000 scale data. The search area specified as part of the request is increased by 50m in areas where 1:50,000 data is available and by 500m in areas with 1:250,000 scale data to allow for potential inaccuracies in the position of boundaries. The BGS report indicates the highest level of protection required within the search area and its buffer zone.

When requesting a BGS report, PWAG select the search radius carefully, since too large a search radius may result in the inclusion of areas underlain by geological units of a higher radon potential, thereby giving rise to recommending too high a level of protection.

The report also includes (where available), a list of the geological units included in the assessment. PWAG check that these actually underlie the site, rather than the buffer zone only.

On the basis of radon measurements in dwellings and on their geological interpretation, the BGS report stipulates the level of protective measures required for the proposed development site, and this could be:

1. no measures,
2. basic measures, or
3. full measures.

Details of these measures are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

PWAG obtain information from the Environment Agency (EA) and the Landmark Information Group with respect to:

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

Reference is also made to the EA document *"Policy and Practice for the Protection of Groundwater"* (1998) and the relevant Groundwater Vulnerability Map.

Bedrock and any overlying granular Drift deposits are classified by the EA:-

- **Major aquifers:** *“Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public water supply and other purposes”.*
- **Minor aquifers:** *“Fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Although these aquifers will seldom produce large quantities of water for abstractions, they are important both for local supplies and in supplying base flow to rivers”.*
- **Non-aquifers:** *“Formations which are generally regarded as containing insignificant quantities of groundwater. However groundwater flow through such rocks, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants. Some non-aquifers can yield water in sufficient quantities for domestic use”.*

Groundwater vulnerability is determined by 4 variables:

1. The presence and nature of overlying soil (the weathered zone affected by living organisms; soil in the UK can extend up to 2m in depth). Physical properties of the soil affect the downward passage of water and it's ability to attenuate pollutants. The EA make reference to a three-fold classification of soil types:-
 - Soils of **low** leaching potential are defined as *“soils in which the pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants”.*
 - Soils of **intermediate** leaching potential are defined as *“soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer”.*
 - Soils of **high** leaching potential are defined as *“soils with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater”.*

In urban areas and restored mineral workings the soil information is based on fewer observations than elsewhere. A worst-case vulnerability (H) is therefore assumed for these areas and for current mineral workings by the EA. All are given a designation of **HU** unless proved otherwise.

2. The presence and nature of Drift, which often overlies bedrock. Where Drift is of substantial thickness and low permeability, it can provide an effective barrier to surface pollutant migration. Permeable Drift is classified as a Minor Aquifer except where it is in probable hydraulic continuity with a Major Aquifer, where it is regarded as part of the Major Aquifer unless proven otherwise by site investigation.
3. The nature of the geological strata (bedrock). Rocks that contain groundwater in exploitable quantities are called aquifers.
4. The depth of the unsaturated zone; ie that part of the aquifer which lies above the water table

The EA have also designated Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

PWAG obtain information from the Environment Agency and the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are six GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps provide show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map:

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year (or 1 in 200 year as appropriate), areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas

shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

COMAH & Explosive Sites

PWAG obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. PWAG's report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary Conceptual Ground Model

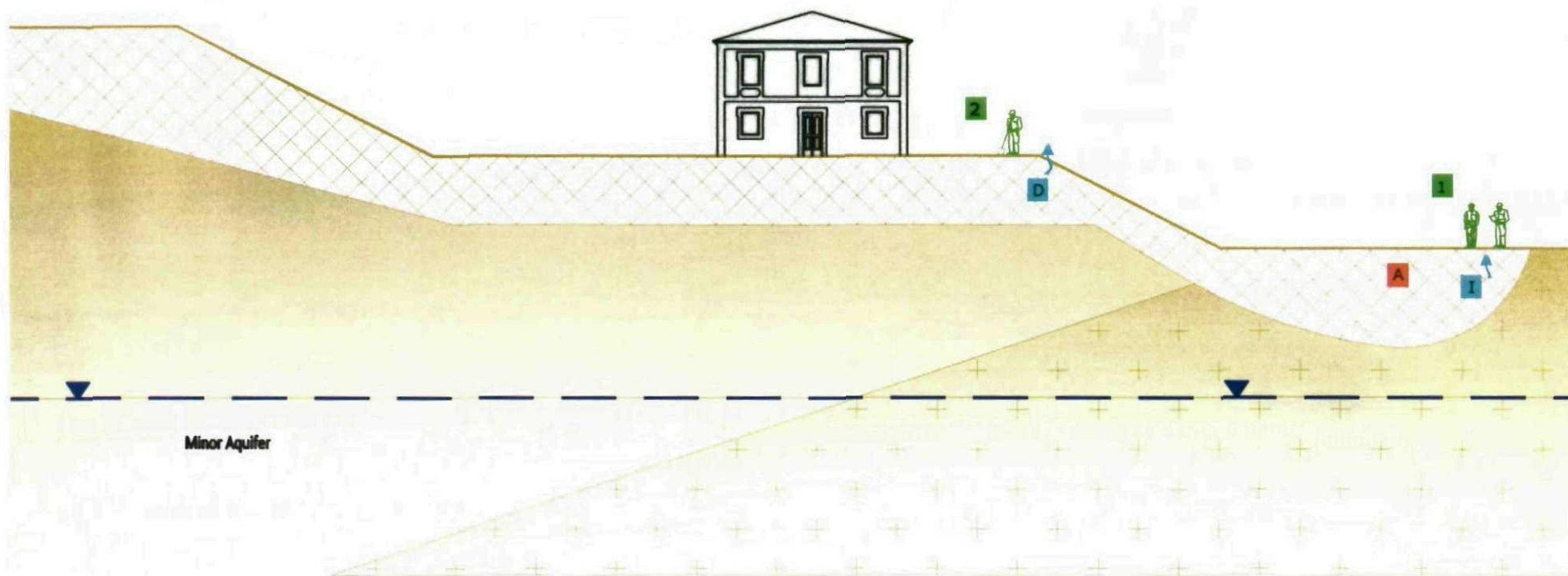
The site's environmental setting (and proposed end use) is used by PWAG to assess the significance of any contamination encountered during the subsequent ground investigation

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

APPENDIX C

Drawings



KEY	
	Made ground
	Coal Measures strata
	Kent's Rock Sandstone
	Groundwater

SOURCES	
	PAH in Made Ground

PATHWAYS	
	Inhalation and ingestion of dust
	Dermal contact

RECEPTORS	
	Human Health: Residents/End Users
	Human Health: Construction Workers

A Conceptual Site Model updated		25/04/11		RD	PJW
No Remarks		Site	By	Check	
Consulting Civil, Structural & Geo-Environmental Engineers 2000 House, Barton Way, The Grange, Gillingham, Kent, ME10 7JW T: 01633 810000 F: 01633 810002					
2000 House, Barton Way, The Grange, Gillingham, Kent, ME10 7JW T: 01633 810000 F: 01633 810002					
HARRON HOMES LTD RESIDENTIAL DEVELOPMENT WARD GREEN BARNESLEY REVISED CONCEPTUAL SITE MODEL					
08/12/10	PMO	PJW	10225-G-151		A
PRELIMINARY	NTS	AS	Drawing Number		

APPENDIX D

Photographs.



Plate 1: Trial Pit 1



Plate 2: Trial Pit 2



Plate 3: Trial Pit 3



Plate 4: Trial Pit 4



Plate 5: Trial Pit 5



Plate 6: Trial Pit 6

Report No: 10225/G/2
Project Details: Ward Green Primary School, Barnsley
Date: April 2011



Plate 7: Trial Pit 7

Report No: 10225/G/2
Project Details: Ward Green Primary School, Barnsley
Date: April 2011



Plate 8: Trial Pit 8

APPENDIX E

Logs

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

WS01

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: multicoloured sandy limestone gravel.	G.L.	0.47		ES1 @ 0.47 - 0.60 m
Very stiff grey and brown mottled fine to medium angular gravelly CLAY. (WEATHERED MUDSTONE).	0.47	0.93	1.00	(1.000 - 1.440) N = 50
Extremely weak iron stained grey and brown mottled thickly to thinly laminated weathered MUDSTONE.	0.93	1.00	2.00	
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

WS03

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: dark soft slightley gravelly clay. Note; 30 mm plyboard at the base of this stratum	G.L.	0.17		ES1 @ 0.3 - 0.6 m
MADE GROUND: yellowish white limestone gravel.	0.17	0.25	1.00	(1.000 - 1.450) N = 23
Very stiff brown nd grey mottled slightley sandy slightley gravelly CLAY. Gravel consists of mudstone increasing in fraction with depth to very gravelly clay. (WEATHERED MUDSTONE).	0.25	1.63	2.00	(2.000 - 2.240) N = 50
Extremely weak light brown thinly to thickly laminated MUDSTONE.	1.63	2.00	3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.
50 mm standpipe installed.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm or refusal
HSV = Hand Shear Vane (kPa)

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	BC		

Exploratory hole number

WS04

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: black sandy / ashy fine to medium gravel of mixed lithologies and clinker including occasional glass.	G.L.	0.30		
MADE GROUND: yellowish white limestone gravel.	0.30	0.40		ES1 @ 0.5 - 0.7 m
Stiff brown and grey mottled sandy slightly fine to medium gravelly CLAY. Gravel is very angular to sub-rounded increasing to gravelly with depth. (WEATHERED MUDSTONE).	0.40	1.26	1.00	(1.000 - 1.450) N = 13
Very stiff greyish brown gravelly CLAY. (WEATHERED MUDSTONE).	1.26	1.50		
Extremely weak light brown and grey mottled slightly clayey gravel of MUDSTONE. Note: recovered as ordered lithorelics.	1.50	2.00	2.00	(2.000 - 2.410) N = 50
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm or refusal
HSV = Hand Shear Vane (kPa)

Sheet 1 of 1

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

WS05

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: black sandy / ashy fine to medium gravel of mudstone and clinker.	G.L.	0.16		ES1 @ 0.3 - 0.6 m
MADE GROUND: yellowish white limestone gravel.	0.16	0.26		
Very stiff black, green and brown mottled sandy very gravelly CLAY. (WEATHERED MUDSTONE).	0.26	0.92	1.00	(1.000 - 1.450) N = 14
VERY stiff brown sandy very gravelly CLAY. (WEATHERED MUDSTONE).	0.92	1.60		
Extremely weak brown thinly to thickly laminated MUDSTONE.	1.60	2.00	2.00	(2.000 - 2.335) N = 50
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.
50 mm standpipe installed.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm or refusal
HSV = Hand Shear Vane (kPa)

Window Sample Log



Client: Harron Homes					Exploratory hole number WS06
Site: Ward Green					
Equipment: Archway Competitor Dynamic Sampling Rig					
Start Date	03/03/2011	Logged By	Checked By	Approved By	
End Date	03/03/2011	DC			

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: grassed dark brown slightly sandy humic clay.	G.L.	0.25		
MADE GROUND: firm brown sandy fine to medium gravelly clay.	0.25	0.44		ES1 @ 0.5 - 0.8 m
Gravel consists of mixed lithologies.				
Firm to very stiff grey and brown mottled sandy slightly fine to medium gravelly CLAY. (WEATHERED MUDSTONE).	0.44	1.95	1.00	(1.000 - 1.450) N = 15
			2.00	(2.000 - 2.330) N = 50
Extremely weak light brown thinly to thickly laminated MUDSTONE.	1.95	2.00		
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No offactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.
50 mm standpipe installed.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm or refusal
HSV = Hand Shear Vane (kPa)

Window Sample Log



Client: Harron Homes					Exploratory hole number WS07
Site: Ward Green					
Equipment: Archway Competitor Dynamic Sampling Rig					
Start Date	03/03/2011	Logged By	Checked By	Approved By	
End Date	03/03/2011	DC			

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: grassed dark brown slightly sandy humic clay.	G.L.	0.17		
MADE GROUND: stiff dark sandy gravelly clay. Gravel consists of sandstone and mudstone with occasional ash and glass fragments.	0.17	0.73		ES1 @ 0.3 - 0.6 m
MADE GROUND: brown coarse gravel of sandstone.	0.73	0.84	1.00	
Stiff grey and brown mottled sandy slightly fine to medium gravelly CLAY. (WEATHERED MUDSTONE).	0.84	1.40		(1.000 - 1.450) N = 35
Extremely weak brown slightly sandy GRAVEL OF MUDSTONE.	1.40	1.70		
Note; recovered as ordered lithorelics.			2.00	
Extremely weak light brown thinly to thickly laminated MUDSTONE.	1.70	2.00		(2.000 - 2.100) N = 50
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks No olfactory evidence of contamination. No groundwater encountered. Terminated due to refusal of penetration. 50 mm standpipe installed.	Sample Type Key ES = Environmental sample B = Bulk sample D = Hand Sample N = SPT 'n' value for 300 mm or refusal HSV = Hand Shear Vane (kPa)
---	---

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

WS08

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth/test
MADE GROUND: grassed dark brown slightly sandy humic clay.	G.L.	0.16		
MADE GROUND: firm brown sandy fine to medium gravelly clay.	0.16	0.43		
Stiff grey and brown mottled fine to medium gravelly sandy CLAY. (WEATHERED MUDSTONE).	0.43	1.80		ES1 @ 0.5 - 0.8 m
			1.00	(1.000 - 1.450) N = 13
Extremely weak light brown thinly to thickly laminated MUDSTONE.	1.80	2.00	2.00	(2.000 - 2.135) N = 50
			3.00	
			4.00	
			5.00	
			6.00	
			7.00	
			8.00	
			9.00	
			10.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.
50 mm standpipe installed.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm or refusal
HSV = Hand Shear Vane (kPa)

Window Sample Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	Archway Competitor Dynamic Sampling Rig			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	pc		

Exploratory hole number

WS02

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth/test
MADE GROUND: dark soft slightly gravelly clay over 30 mm plyboard. Stiff to very stiff green and grey mottled fine to medium gravelly CLAY. Gravelly consists predominantly of fine angular black mudstone.	G.L.	0.18	ES1 @ 0.2 - 0.3 m
	0.18	1.00	(1,000 - 1,350) N = 50
			1.00
			2.00
			3.00
			4.00
			5.00
			6.00
			7.00
			8.00
			9.00
			10.00

Remarks

No olfactory or visual evidence of contamination.
 No groundwater encountered.
 Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
 B = Bulk sample
 D = Hand Sample
 N = SPT 'n' value for 300 mm or refusal
 HSV = Hand Shear Vane (kPa)

Sheet 1 of 1

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

TP2

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed brown humic very gravelly sandy clay with occasional tree roots. Gravel is medium round of mixed lithologies.	G.L.	0.35	ES1 @ 0.1 - 0.2 m
MADE GROUND: orange medium sand with occasional fine gravel.	0.35	0.65	ES2 @ 0.6 - 0.8 m
MADE GROUND: black very ashy / sandy gravelly clay with high cobble content of sandstone.	0.65	1.00	ES3 @ 1.0 - 1.1 m
Stiff light brown and grey mottled gravelly CLAY becoming very gravelly with depth with ordered lithorelics. (WEATHERED MUDSTONE).	1.00	2.90	
			1.00
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

TP3

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed dark brown humic slightly fine gravelly and fine sandy clay with frequent roots.	G.L.	0.10	ES1 @ 0.0 - 0.1 m
Stiff light brown and grey mottled slightly fine sandy gravelly (becoming very gravelly and fissile with depth) CLAY with rare cobble of mudstone. (WEATHERED MUDSTONE). Note; base depth values (2.9m & 1.5m) were measured from the north and the south of the trial pit respectively. The trial pit was located within an embankment.	0.10	2.9m & 1.5m	ES2 @ 0.5 - 0.6 m
			B3 @ 1.0 - 1.5 m
			1.00
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory or visual evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client: Harron Homes					Exploratory hole number: TP4
Site: Ward Green					
Equipment: JCB 3CX with 600 mm toothless bucket.					
Start Date	03/03/2011	Logged By	Checked By	Approved By	
End Date	03/03/2011	DC			

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed dark brown humic fine sandy humic clay.	G.L.	0.23	ES1 @ 0.00 - 0.23 m
MADE GROUND: multicoloured clayey sandy / ashy gravel with high cobble content of sandstone, mudstone and brick. Also rare mudstone boulders.	0.23	0.60	
Stiff light brown and grey mottled slightly fine sandy gravelly (becoming very gravelly and fissile with depth) CLAY with rare cobble of mudstone. (WEATHERED MUDSTONE).	0.60	2.0m & 1.6m	ES2 @ 0.6 - 0.7 m
Note; base depth values (2.0m & 1.6m) were measured from the north and the south of the trial pit respectively. The trial pit was located within an embankment.			1.00
			2.00
			3.00
			4.00
			5.00

Remarks No olfactory or visual evidence of contamination. No groundwater encountered. Terminated due to refusal of penetration.	Sample Type Key ES = Environmental sample B = Bulk sample D = Hand Sample N = SPT 'n' value for 300 mm HSV = Hand Shear Vane (kPa)
---	--

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	dc		

Exploratory hole number

TP5

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed dark brown humic slightly sandy gravelly clay with low cobble content.	G.L.	0.40	ES1 @ 0.00 - 0.20 m
MADE GROUND: brown gravelly very sandy clay. Gravel consists of mudstone with rare brick and coal fragments.	0.40	0.77	ES2 @ 0.4 - 0.7 m
Light brown clayey sandy GRAVEL of mudstone with high mudstone cobble content.	0.77	1.70	
			1.00
			B3 @ 1.4 - 1.60 m
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory or visual evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

TP6

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed brown humic gravelly clay. Gravel consists of mudstone and brick fragments.	G.L.	0.40	ES1 @ 0.00 - 0.35 m
MADE GROUND: black sandy / ashy gravel of clinker.	0.35	0.45	ES2 @ 0.35 - 0.45 m
Light brown clayey sandy GRAVEL of mudstone with high mudstone cobble content.	0.45	1.80	
			1.00
			B3 @ 1.10 - 1.30 m
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	By	Logged By	Checked By
End Date	03/03/2011	By	DC	

Exploratory hole number

TP6

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed brown humic gravelly clay. Gravel consists of mudstone and brick fragments.	G.L.	0.40	ES1 @ 0.00 - 0.35 m
MADE GROUND: black sandy / ashy gravel of clinker.	0.35	0.45	ES2 @ 0.35 - 0.45 m
Light brown clayey sandy GRAVEL of mudstone with high mudstone cobble content.	0.45	1.80	
		1.00	
			B3 @ 1.10 - 1.30 m
		2.00	
		3.00	
		4.00	
		5.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

pwr
Geoenvironmental

Client:					Harron Homes				
Site:					Ward Green				
Equipment:					JCB 3CX with 600 mm toothless bucket.				
Start Date		03/03/2011		Logged By	Checked By	Approved By			
End Date		03/03/2011		pc					

Exploratory hole number

TP7

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)		Sample type/depth
MADE GROUND: grassed dark brown humic sandy gravelly clay with high cobble content and occasional boulders of sandstone. Also rare strip steel clay drainage pipe fragment and fragment of pitch.	G.L.	0.60		
				ES1 @ 0.30 - 0.50 m
Soft dark brown and grey mottled gravelly CLAY. Gravel is fine to coarse very angular to angular of mudstone. (WEATHERED MUDSTONE).	0.60	1.00		
				ES2 @ 0.60 - 1.00 m
			1.00	
Light brown and grey clayey sandy gravelly tabular cobbles of mudstone. (WEATHERED MUDSTONE).	1.00	1.50		
			2.00	
			3.00	
			4.00	
			5.00	

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket.			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	pc		

Exploratory hole number

TP8

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed dark brown humic slightly fine sandy clay.	G.L.	0.17	ES1 @ 0.00 - 0.17 m
Stiff becoming extremely weak rock brown and grey mottled clayey sandy GRAVEL of mudstone with low cobble content increasing in quantity and size with depth. (WEATHERED MUDSTONE)	0.17	1.70	ES2 @ 0.60 - 0.80 m
@ 1.5 m boulder of mudstone			
			1.00
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory or visual evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)

Trial Pit Log



Client:	Harron Homes			
Site:	Ward Green			
Equipment:	JCB 3CX with 600 mm toothless bucket			
Start Date	03/03/2011	Logged By	Checked By	Approved By
End Date	03/03/2011	DC		

Exploratory hole number

TP1

Strata Description	Depth to Top of Strata (m)	Depth to Base of Strata (m)	Sample type/depth
MADE GROUND: grassed brown humic gravelly clay with numerous tree roots. Gravel consists of fine to medium angular to subangular sandstone and brick fragments.	G.L.	0.40	ES1 @ 0.1 - 0.2 m
MADE GROUND: multicoloured very clayey sandy gravel of mixed lithologies and brick fragments with occasional ash. Note; lens of black ashly clinker at 0.50m to 0.56m.	0.40	0.68	ES2 @ 0.5 - 0.6 m
Stiff grey and light brown mottled fine to medium gravelly sandy CLAY with low cobble content and rare boulder. Gravel, cobbles and boulder consist of mudstone. (WEATHERED COAL MEASURES). Note; borehole terminated due to boulder obstruction in the northern 70% of the trial pit at a depth of 0.86m bgl.	0.68	1.10	ES3 @ 1.0 - 1.1 m B4 @ 0.7 - 1.1 m
			1.00
			2.00
			3.00
			4.00
			5.00

Remarks

No olfactory evidence of contamination.
No groundwater encountered.
Terminated due to refusal of penetration.

Sample Type Key

ES = Environmental sample
B = Bulk sample
D = Hand Sample
N = SPT 'n' value for 300 mm
HSV = Hand Shear Vane (kPa)





BOREHOLE RECORD

BH No: **BHR02**
Sheet 1 of 1

Site: Ward Green, Barnsley

Contract No:
SDS2315

Client: Paul Waite Associates

Dates:
21/03/2011

Method: Beretta T44 rotary drill rig utilising water flush.

Scale **1:150**

SAMPLE DETAILS

STRATA RECORD

Logged By: JC | Checked By: MB
Driller: GL

Depth (m) | Level (mAOD) | Legend | Well

Groundwater (Casing)

Description

Brown sandy CLAY.

Brown SILTSTONE.

End of Borehole at 8.00 m

Remarks and Water Observations

1. No groundwater encountered.
2. All strata records given are based on driller's descriptions.
3. Rotary probe hole terminated at 8.00m bgl.
4. Borehole backfilled with a mixture of bentonite grout and arisings on completion.

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

Fig. No.
BHR02





BOREHOLE RECORD

BH No. **BHR04**

Sheet 1 of 1

Site: Ward Green, Barnsley

Contract No:

SDS2315

Client: Paul Waite Associates

Dates:

21/03/2011

Method: Beretta T44 rotary drill rig utilising water flush.

Scale 1:150

SAMPLE DETAILS

STRATA RECORD

Logged By: JC

Checked By: MB

Driller: GL

Depth
(m)

Level
(mAOD)

Legend

Well

MADE GROUND: Tarmac.

Brown CLAY.

Brown silty MUDSTONE.

End of Borehole at 8.00 m

Remarks and Water Observations

1. No groundwater encountered.
2. All strata records are based on driller's description.
3. Borehole drilled at an angle of 35° to the vertical.
4. Borehole terminated at 8.00m bgl.
5. Borehole backfilled with a mixture of bentonite grout and arisings.

GL (mAOD)

Easting:

Northing:

Fig. No.

BHR04

Ward green school,high ridge ,Barnsley.03/03/11- SPT Results

WS1

1m 11,11/12,14,15,9 for 40mm

WS2

1m 8,14/16,17,17 for 50mm

WS3

1m 4,4/5,6,6,6 (23)

2m 14,11 for 30mm/ 50 for 60mm

Well 2m 1pl

WS4

1m 3,2/3,3,3,4 (13)

2m 10,11/14,20,16 for 60mm

WS5

1m 3,2/3,3,3,5 (14)

2m 18,7 for 10mm/ 35,15 for 25mm

Well 2m 1pl

WS6

1m 4,4/3,4,3,5 (15)

2m 10,12/15,20,15 for 30mm

Well 2m 1pl

WS7

1m 3,3/6,7,9,13 (35)

2m 25 for 40mm/50 for 60mm

Well 2m 1pl

WS8

1m 2,2/3,3,3,4 (13)

2m 25 for 70mm/ 25,25 for 65mm

Well 2m 1pl

APPENDIX F

Chemical Analysis Results



Reported on:
24-Mar-2011

Philip Waine
PWA Geo-Environmental Ltd
Summit House, Riparian Way
The Crossings
Cross Hills
Keighley
West Yorkshire
BD20 7BW

Dear Phil

Please find attached the results for the batch of samples described below.

Samples Registered on:	09-Mar-2011
Results for Batch Number	20027429
Your Purchase Order Number:	None Supplied

You will be invoiced shortly by our accounts department.

If we can be of further assistance then please do not hesitate to contact us.

Yours sincerely

William Fardon
Customer Services Team Leader
Tel: (0113) 231 2177
nls@environment-agency.gov.uk

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation. Details of analytical procedures and performance data are available on request. The date of sample analysis is available on request.

The Environment Agency carries out analytical work to high standards and within the scope of its UKAS accreditation, but has no knowledge of whether the circumstances or the validity of the procedures used to obtain the samples provided to the laboratory were representative of the need for which the information was required.

The Environment Agency and/or its staff does not therefore accept any liability for the consequences of any acts or omissions made on the basis of the analysis or advice or interpretation provided.

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfai House
19 Penyfai Lane
Furnace, Llanelli
Carns SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY

Client: PWA Geo-Environmental Ltd
Folder No: 001549160
Comments: TP1 - ES2 (0.50-0.56)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

<u>Analyte</u>	<u>Result</u>	<u>Units</u>	<u>MRV</u>	<u>Accred</u>	<u>Lab ID</u>	<u>Testcode</u>
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	38.8	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.42	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	1.14	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	10.7	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	8.08	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.616	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	16.3	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	34.4	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	68.4	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	19.4	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	13.3	mg/kg	1	None	LE	914
Zinc : Dry Wt	45.0	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	1200	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<51.9	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	352	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	131	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	1710	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	4380	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	3940	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	3950	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	2070	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	2290	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	4210	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<100	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	924	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	8930	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	563	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	2090	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	1570	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	7330	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	7360	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435



0754



Reported on:
24-Mar-2011

Asbestos Report

No asbestos detected.

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248.

Dry Solids @ 30°C	85.7	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number:1549160

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1350g in total.
The sample appeared to be dark brown sticky clay with stones and brick.

171.94g of the sample was taken for drying at <30degC which gave 148.20g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.



Client: PWA Geo-Environmental Ltd
Folder No: 001549161
Comments: TP1 - ES3 (1.0-1.1)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	36.9	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.13	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	<1	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	<1	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	3.77	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.724	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	29.6	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	33.1	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	21.1	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	33.4	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	21.0	mg/kg	1	None	LE	914
Zinc : Dry Wt	74.2	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	203	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- (Polynuclear Aromatic Hydrocarbons)	<0.380	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	1.53	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	<1	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	10.3	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	<30	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<100	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	<3	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	33.0	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	<10	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	<30	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	10.7	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	24.4	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	26.3	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- (Brown Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- (White Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- (Blue Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435



Asbestos Report

Report

Text

UKAS

LE

435

No asbestos detected.

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248

Dry Solids @ 30°C

83.2

%

0.5

None

LE

1130

Accreditation Assessment

3

No.

1

None

LE

924

Sample Preparation

Report

Text

None

LE

924

Folder Number:1549161

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1465g in total.

The sample appeared to be orange/brown sticky clay.

125.25g of the sample was taken for drying at <30degC which gave 105.10g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.



Client: PWA Geo-Environmental Ltd
Folder No: 001549162
Comments: TP4 - ES1 (0.0-0.23)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	24.7	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.64	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	1.18	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	10.2	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	7.36	mg/kg	1	None	LE	914
Cadmium : Dry Wt	1.06	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	24.4	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	32.0	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	79.2	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	22.9	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	16.9	mg/kg	1	None	LE	914
Zinc : Dry Wt	115	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	1060	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- (Polynuclear Aromatic Hydrocarbons)	<57.3	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	187	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	419	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	2440	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	4750	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	3750	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	3680	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	1740	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	2570	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	4300	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<200	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	823	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	11200	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	1080	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	1880	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	687	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	9480	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	8110	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- (Brown Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- (White Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- (Blue Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfael House
19 Penyfael Lane
Furnace, Llanelli
Carmar SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY



Asbestos Report

No asbestos detected.

Report

Text

UKAS

LE

435

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01: based on HSG248

Dry Solids @ 30°C	80.8	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number: 1549162

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1376g in total.
The sample appeared to be dark brown sticky clay loam with stones and roots:

128.98g of the sample was taken for drying at <30degC which gave 105.25g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.





0754



Reported on:
24-Mar-2011

Client: PWA Geo-Environmental Ltd
Folder No: 001549163
Comments: TP5 - ES2 (0.4-0.7)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	11.1	mg/kg	5	MCertS	LE	909
pH : Solid sample	7.96	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	1.01	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	5.21	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	5.22	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.516	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	18.6	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	17.7	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	30.9	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	18.2	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	12.7	mg/kg	1	None	LE	914
Zinc : Dry Wt	78.9	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	487	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<3.60	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	13.7	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	12.3	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	49.7	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	298	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	247	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	382	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	192	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	193	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	308	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<300	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	50.4	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	505	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	16.1	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	169	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	107	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	300	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	452	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfael House
19 Penyfael Lane
Furnace, Llanelli
Carmar SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY



0754



Reported on:
24-Mar-2011

Asbestos Report	Report	Text	UKAS	LE	435
No asbestos detected.					
No asbestos detected signifies no asbestos fibres were found in the sample examined.					
The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248					
Dry Solids @ 30°C	85.3	%	0.5	None	LE 1130
Accreditation Assessment	3	No.	1	None	LE 924
Sample Preparation	Report	Text	None	LE	924

Folder Number: 1549163

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1586g in total.
The sample appeared to be medium brown sticky loamy clay with stones.

157.89g of the sample was taken for drying at <30degC which gave 135.48g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.



Client: PWA Geo-Environmental Ltd
Folder No: 001549164
Comments: TP6 - ES1 (0.0-0.35)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	23.0	mg/kg	5	MCertS	LE	909
pH : Solid sample	7.94	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	2.04	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	21.7	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	8.71	mg/kg	1	None	LE	914
Cadmium : Dry Wt	1.21	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	23.4	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	53.7	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	152	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	24.7	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	15.1	mg/kg	1	None	LE	914
Zinc : Dry Wt	171	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	1360	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<29.5	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	63.1	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	151	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	554	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	2630	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	2590	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	3070	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	1510	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	1750	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	2610	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<200	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	555	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	4800	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	140	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	1430	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	944	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	2590	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	3950	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435



Asbestos Report	Report	Text	UKAS	LE	435
No asbestos detected.					
No asbestos detected signifies no asbestos fibres were found in the sample examined.					
The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248					
Dry Solids @ 30°C	75.9	%	0.5	None	LE 1130
Accreditation Assessment	3	No.	1	None	LE 924
Sample Preparation	Report	Text	None	LE	924

Folder Number:1549164

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1165g in total.
The sample appeared to be dark brown sticky loam.

130.43g of the sample was taken for drying at <30degC which gave 100.28g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.





Client: PWA Geo-Environmental Ltd
Folder No: 001549165
Comments: TP7 - ES1 (0.30-0.50)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	25.0	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.64	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	<1	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	13.8	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	6.34	mg/kg	1	None	LE	914
Cadmium : Dry Wt	1.17	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	47.4	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	32.6	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	64.6	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	22.8	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	17.6	mg/kg	1	None	LE	914
Zinc : Dry Wt	143	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	868	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- (Polynuclear Aromatic Hydrocarbons)	<41.3	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	393	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	58.1	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	1150	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	3190	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	2950	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	3370	ug/kg	20	MCertS	LE	918
Benzo(g,h,i)perylene : Dry Wt	1950	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	1730	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	3340	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<200	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	672	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	8100	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	393	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	1840	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	413	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	5020	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	6520	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- (Brown Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- (White Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- (Blue Asbestos)	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfael House
19 Penyfael Lane
Furnace, Llanelli
Carns SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY



0754



Reported on:
24-Mar-2011

Asbestos Report

No asbestos detected.

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248

Dry Solids @ 30°C	82.9	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number: 1549165

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1714g in total.
The sample appeared to be medium brown sticky loamy clay with stones.

128.34g of the sample was taken for drying at <30degC which gave 107.34g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.





0754



Reported on:
24-Mar-2011

Client: PWA Geo-Environmental Ltd
Folder No: 001549166
Comments: WS01 - ES1 (0.47-0.60)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	47.4	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.74	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	<1	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	4.83	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	5.06	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.434	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	26.7	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	24.6	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	13.9	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	34.4	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	11.4	mg/kg	1	None	LE	914
Zinc : Dry Wt	74.9	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	307	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<0.661	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	3.48	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	<1	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	29.0	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	46.2	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	40.8	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	53.7	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	29.1	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	23.7	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	49.2	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<100	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	6.89	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	94.6	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	<10	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	<30	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	<10	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	55.9	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	77.5	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfael House
19 Penyfael Lane
Furnace, Llanelli
Carmar SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY

Asbestos Report

No asbestos detected.

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248

Dry Solids @ 30°C	86.4	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number:1549166

The sample was received in a 1ltr glass pot weighing approx. 1286g in total.
The sample appeared to be grey/brown sticky clay with stones.

166.38g of the sample was taken for drying at <30degC which gave 144.55g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.

Client: PWA Geo-Environmental Ltd
Folder No: 001549167
Comments: WS04 - ES1 (0.5-0.7)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	162	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.05	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	<1	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	2.78	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	4.84	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.958	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	28.9	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	28.0	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	24.6	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	25.3	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	26.4	mg/kg	1	None	LE	914
Zinc : Dry Wt	62.5	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	481	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<0.351	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	1.20	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	<1	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	<6	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	<30	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<100	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	<3	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	<10	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	<30	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	<10	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	<20	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

Asbestos Report

No asbestos detected.

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248

Dry Solids @ 30°C	83.0	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number: 1549167

The sample was received in a 1ltr glass pot weighing approx. 1166g in total.
The sample appeared to be orange/grey/brown sticky clay.

165.58g of the sample was taken for drying at <30degC which gave 138.28g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.



Client: PWA Geo-Environmental Ltd
Folder No: 001549168
Comments: WS05 - ES1 (0.3-0.6)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	84.1	mg/kg	5	MCertS	LE	909
pH : Solid sample	8.04	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	1.50	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	7.46	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	6.89	mg/kg	1	None	LE	914
Cadmium : Dry Wt	0.752	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	19.3	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	27.3	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	53.2	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	21.3	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	16.4	mg/kg	1	None	LE	914
Zinc : Dry Wt	96.2	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	759	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<18.1	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	131	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	268	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	791	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	1490	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	1220	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	1370	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	660	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	535	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	1440	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<100	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	253	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	2950	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	432	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	880	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	289	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	2920	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	2330	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435

NLS Leeds
Olympia House
Gelderd Lane
Gelderd Road
Leeds LS12 6DD

NLS Llanelli
Penyfael House
19 Penyfael Lane
Furnace, Llanelli
Carmar SA15 4EL

NLS Nottingham
Meadow Lane
Nottingham
NG2 3HN

NLS Starcross
Staplake Mount
Starcross
Exeter
EX6 8PE



ENVIRONMENT
AGENCY



Asbestos Report	Report	Text	UKAS	LE	435
No asbestos detected.					

No asbestos detected signifies no asbestos fibres were found in the sample examined.

The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248

Dry Solids @ 30°C	84.2	%	0.5	None	LE	1130
Accreditation Assessment	3	No.	1	None	LE	924
Sample Preparation	Report	Text		None	LE	924

Folder Number: 1549168

The sample was received in a 1ltr plastic pot and 120ml glass pot weighing approx. 1576g in total.
The sample appeared to be dark brown sticky gritty clay.

139.42g of the sample was taken for drying at <30degC which gave 118.30g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30degC.



Client: PWA Geo-Environmental Ltd
Folder No: 001549169
Comments: WS07 - ES1 (0.30-0.60)
Quote No: 7264

Project: Ward Green Barnsley
Sampled on: Date Not Supplied

Matrix: Soil

Analyte	Result	Units	MRV	Accred	Lab ID	Testcode
Cyanide : Total : Dry Wt as CN	<1	mg/kg	1	MCertS	LE	903
Sulphate : Dry Wt	66.4	mg/kg	5	MCertS	LE	909
pH : Solid sample	7.78	pH Units	0.2	MCertS	LE	908
Phenols : Monohydric : Dry Wt	<2	mg/kg	2	MCertS	LE	905
Boron, Boiling water soluble : Dry Wt	1.13	mg/kg	1	MCertS	LE	899
Arsenic : Dry Wt	4.61	mg/kg	1	MCertS	LE	914
Boron : Dry Wt	3.28	mg/kg	1	None	LE	914
Cadmium : Dry Wt	2.42	mg/kg	0.1	None	LE	914
Chromium : Dry Wt	25.8	mg/kg	0.1	MCertS	LE	914
Copper : Dry Wt	38.4	mg/kg	0.1	MCertS	LE	914
Lead : Dry Wt	57.2	mg/kg	1	MCertS	LE	914
Mercury : Dry Wt	<2	mg/kg	2	MCertS	LE	914
Nickel : Dry Wt	32.5	mg/kg	0.3	MCertS	LE	914
Selenium : Dry Wt	59.1	mg/kg	1	None	LE	914
Zinc : Dry Wt	226	mg/kg	0.5	MCertS	LE	914
Sulphate - Acid Ext : Dry Wt as SO4	553	mg/kg	10	MCertS	LE	939
PAH : Total : Dry Wt :- {Polynuclear Aromatic Hydrocarbons}	<70.5	mg/kg	0	UKAS	NLS	864
Hydrocarbon Screen >C5-C44 : Dry Wt	<50	mg/kg	50	MCertS	LE	1079
Acenaphthene : Dry Wt	197	ug/kg	0.1	MCertS	LE	918
Acenaphthylene : Dry Wt	307	ug/kg	1	MCertS	LE	918
Anthracene : Dry Wt	2680	ug/kg	20	MCertS	LE	918
Benzo(a)anthracene : Dry Wt	5900	ug/kg	20	MCertS	LE	918
Benzo(a)pyrene : Dry Wt	5330	ug/kg	20	MCertS	LE	918
Benzo(b)fluoranthene : Dry Wt	6690	ug/kg	20	MCertS	LE	918
Benzo(ghi)perylene : Dry Wt	3180	ug/kg	6	MCertS	LE	918
Benzo(k)fluoranthene : Dry Wt	2980	ug/kg	20	MCertS	LE	918
Chrysene : Dry Wt	5570	ug/kg	30	MCertS	LE	918
Coronene : Dry Wt	<300	ug/kg	10	None	LE	918
Dibenzo(ah)anthracene : Dry Wt	1160	ug/kg	3	MCertS	LE	918
Fluoranthene : Dry Wt	13500	ug/kg	20	MCertS	LE	918
Fluorene : Dry Wt	433	ug/kg	10	MCertS	LE	918
Indeno(1,2,3-cd)pyrene : Dry Wt	2950	ug/kg	30	MCertS	LE	918
Naphthalene : Dry Wt	400	ug/kg	10	MCertS	LE	918
Phenanthrene : Dry Wt	8130	ug/kg	20	MCertS	LE	918
Pyrene : Dry Wt	10800	ug/kg	20	MCertS	LE	918
Asbestos : Actinolite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Amosite :- {Brown Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Anthophyllite	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Chrysotile :- {White Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Crocidolite :- {Blue Asbestos}	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Fibres detected	Absent	Pres/Abs	0	UKAS	LE	435
Asbestos : Tremolite	Absent	Pres/Abs	0	UKAS	LE	435



Asbestos Report	Report	Text	UKAS	LE	435
No asbestos detected.					
No asbestos detected signifies no asbestos fibres were found in the sample examined.					
The analysis was carried out by method LE P Asbestos (Microscopy) 01, based on HSG248					
Dry Solids @ 30°C	83.0	%	0.5	None	LE 1130
Accreditation Assessment	3	No.	1	None	LE 924
Sample Preparation	Report	Text	None	LE	924

Folder Number: 1549169

The sample was received in a 1ltr glass pot weighing approx. 1082g in total.
The sample appeared to be medium brown sticky gritty sandy clay with stones.

129.99g of the sample was taken for drying at <30degC which gave 108.82g of dried sample (weights include tray weight).

The sample was sieved to <10mm before being crushed using a jawcrusher.

No waste was discarded after sieving at 10mm.

The sample was then crushed until it passed through a 2mm sieve.

The sample was received unpreserved.

All parameters are determined on the air-dried (<30degC) portion except those requiring a wet sample fraction where as received (wet) sample was used.

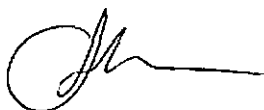
Dry Weight (DW) results are reported as determined at <30degC.



Method Description Summary for all samples in batch Number 20027429

Testcode Method Reference and Description

- 435 LE P Asbestos (Microscopy) 01 - type identification by polarised light microscopy; HSG 248 methodology
864 Parameter by calculation
899 LE I Metals (ICPOES) 01 - Boron - hot water extracted; hot filtered; determined by ICPOES
903 LE I Cyanide (CFA) 01 - (total) - NaOH extr; UV digest; colorimetric autoanalysis; from "as received" sample
905 LE I Monohydric Phen (CFA) 01 - NaOH extr.; distilled; 4AMP; colorimetric autoanalysis; "as received" sample
908 LE I pH & EC 01 - pH, Conductivity - water extracted; using specific electrode; from "as received" sample
909 LE I Halides 01 - Cl, Br, SO₄ - water extracted; Ion Chromatography analysis; from "as received" sample
914 LE I Metals (ICPOES) 01 - digestion block aqua regia extracted under reflux; determined by ICPOES
918 LE O MR Solid (GCMS) 01-03 - Organics DCM extracted; hexane xch, determined by GCMS (Scan mode)
924 Sample Preparation; Dry Solids (30°C); from "as received" sample
939 LE M Acid Extr.SO₄ (ICPOES) 01 - digestion block aqua regia extracted under reflux; determined by ICPOES
1079 LE O EPH >C5-C44 (GC-FID) 01 - Hydrocarbon screen by GC-FID from "as received" sample.
1130 LE P Soil Preparation 01: Air-dried at <30°C in a controlled environment to constant weight.



Chris Hunter
Laboratory Site Manager

All reporting limits quoted are those achievable for clean samples of the relevant matrix. No allowance is made for instances when dilutions are necessary owing to the nature of the sample or insufficient volume of the sample being available. In these cases higher reporting limits may be quoted and will be above the MRV.

Solid sample results are determined on a "dried" sample fraction except for parameters where the method description identifies that "as received" sample was used.

Please note all samples will be retained for thirty working days after reporting unless otherwise agreed with Customer Services

The NLS holds MCertS Accreditation for analysis but bears no responsibility for MCertS accreditation of sampling

Key to Accreditation: UKAS = Methodology accredited to ISO/IEC 17025:2005, MCertS = Methodology accredited to MCertS Performance Standard for testing of soils, none = Methodology not accredited

Key to Lab ID: LE = Leeds, LL = Llanelli, NM = Nottingham, SX = Starcross, SC = Sub-Contracted outside NLS, FI = Field Data, NLS = Calculated

END OF TEST REPORT

APPENDIX G

Ground Gas Monitoring Data

GAS MONITORING SHEET

pwa
Geo-Environmental

Notes:

Key:	ND	None Detected
	NR	Not Recorded
	POS	Positive Flow
	NEG	Negative Flow
	SWL	Standing Water Level

GAS MONITORING SHEET

pwa
Geo Environmental

[illegible]

Notes:

Key:	ND	None Detected
	NR	Not Recorded
	POS	Positive Flow
	NEG	Negative Flow
	SWL	Standing Water Level

GAS MONITORING SHEET

pwa
Geo Environmental

Notes: 1-13-82, 21-82, 28-82, 29-82, 30-82, 31-82, 1-83, 2-83, 3-83, 4-83, 5-83, 6-83, 7-83, 8-83, 9-83, 10-83, 11-83, 12-83, 1-84, 2-84, 3-84, 4-84, 5-84, 6-84, 7-84, 8-84, 9-84, 10-84, 11-84, 12-84, 1-85, 2-85, 3-85, 4-85, 5-85, 6-85, 7-85, 8-85, 9-85, 10-85, 11-85, 12-85, 1-86, 2-86, 3-86, 4-86, 5-86, 6-86, 7-86, 8-86, 9-86, 10-86, 11-86, 12-86, 1-87, 2-87, 3-87, 4-87, 5-87, 6-87, 7-87, 8-87, 9-87, 10-87, 11-87, 12-87, 1-88, 2-88, 3-88, 4-88, 5-88, 6-88, 7-88, 8-88, 9-88, 10-88, 11-88, 12-88, 1-89, 2-89, 3-89, 4-89, 5-89, 6-89, 7-89, 8-89, 9-89, 10-89, 11-89, 12-89, 1-90, 2-90, 3-90, 4-90, 5-90, 6-90, 7-90, 8-90, 9-90, 10-90, 11-90, 12-90, 1-91, 2-91, 3-91, 4-91, 5-91, 6-91, 7-91, 8-91, 9-91, 10-91, 11-91, 12-91, 1-92, 2-92, 3-92, 4-92, 5-92, 6-92, 7-92, 8-92, 9-92, 10-92, 11-92, 12-92, 1-93, 2-93, 3-93, 4-93, 5-93, 6-93, 7-93, 8-93, 9-93, 10-93, 11-93, 12-93, 1-94, 2-94, 3-94, 4-94, 5-94, 6-94, 7-94, 8-94, 9-94, 10-94, 11-94, 12-94, 1-95, 2-95, 3-95, 4-95, 5-95, 6-95, 7-95, 8-95, 9-95, 10-95, 11-95, 12-95, 1-96, 2-96, 3-96, 4-96, 5-96, 6-96, 7-96, 8-96, 9-96, 10-96, 11-96, 12-96, 1-97, 2-97, 3-97, 4-97, 5-97, 6-97, 7-97, 8-97, 9-97, 10-97, 11-97, 12-97, 1-98, 2-98, 3-98, 4-98, 5-98, 6-98, 7-98, 8-98, 9-98, 10-98, 11-98, 12-98, 1-99, 2-99, 3-99, 4-99, 5-99, 6-99, 7-99, 8-99, 9-99, 10-99, 11-99, 12-99, 1-00, 2-00, 3-00, 4-00, 5-00, 6-00, 7-00, 8-00, 9-00, 10-00, 11-00, 12-00, 1-01, 2-01, 3-01, 4-01, 5-01, 6-01, 7-01, 8-01, 9-01, 10-01, 11-01, 12-01, 1-02, 2-02, 3-02, 4-02, 5-02, 6-02, 7-02, 8-02, 9-02, 10-02, 11-02, 12-02, 1-03, 2-03, 3-03, 4-03, 5-03, 6-03, 7-03, 8-03, 9-03, 10-03, 11-03, 12-03, 1-04, 2-04, 3-04, 4-04, 5-04, 6-04, 7-04, 8-04, 9-04, 10-04, 11-04, 12-04, 1-05, 2-05, 3-05, 4-05, 5-05, 6-05, 7-05, 8-05, 9-05, 10-05, 11-05, 12-05, 1-06, 2-06, 3-06, 4-06, 5-06, 6-06, 7-06, 8-06, 9-06, 10-06, 11-06, 12-06, 1-07, 2-07, 3-07, 4-07, 5-07, 6-07, 7-07, 8-07, 9-07, 10-07, 11-07, 12-07, 1-08, 2-08, 3-08, 4-08, 5-08, 6-08, 7-08, 8-08, 9-08, 10-08, 11-08, 12-08, 1-09, 2-09, 3-09, 4-09, 5-09, 6-09, 7-09, 8-09, 9-09, 10-09, 11-09, 12-09, 1-10, 2-10, 3-10, 4-10, 5-10, 6-10, 7-10, 8-10, 9-10, 10-10, 11-10, 12-10, 1-11, 2-11, 3-11, 4-11, 5-11, 6-11, 7-11, 8-11, 9-11, 10-11, 11-11, 12-11, 1-12, 2-12, 3-12, 4-12, 5-12, 6-12, 7-12, 8-12, 9-12, 10-12, 11-12, 12-12, 1-13, 2-13, 3-13, 4-13, 5-13, 6-13, 7-13, 8-13, 9-13, 10-13, 11-13, 12-13, 1-14, 2-14, 3-14, 4-14, 5-14, 6-14, 7-14, 8-14, 9-14, 10-14, 11-14, 12-14, 1-15, 2-15, 3-15, 4-15, 5-15, 6-15, 7-15, 8-15, 9-15, 10-15, 11-15, 12-15, 1-16, 2-16, 3-16, 4-16, 5-16, 6-16, 7-16, 8-16, 9-16, 10-16, 11-16, 12-16, 1-17, 2-17, 3-17, 4-17, 5-17, 6-17, 7-17, 8-17, 9-17, 10-17, 11-17, 12-17, 1-18, 2-18, 3-18, 4-18, 5-18, 6-18, 7-18, 8-18, 9-18, 10-18, 11-18, 12-18, 1-19, 2-19, 3-19, 4-19, 5-19, 6-19, 7-19, 8-19, 9-19, 10-19, 11-19, 12-19, 1-20, 2-20, 3-20, 4-20, 5-20, 6-20, 7-20, 8-20, 9-20, 10-20, 11-20, 12-20, 1-21, 2-21, 3-21, 4-21, 5-21, 6-21, 7-21, 8-21, 9-21, 10-21, 11-21, 12-21, 1-22, 2-22, 3-22, 4-22, 5-22, 6-22, 7-22, 8-22, 9-22, 10-22, 11-22, 12-22, 1-23, 2-23, 3-23, 4-23, 5-23, 6-23, 7-23, 8-23, 9-23, 10-23, 11-23, 12-23, 1-24, 2-24, 3-24, 4-24, 5-24, 6-24, 7-24, 8-24, 9-24, 10-24, 11-24, 12-24, 1-25, 2-25, 3-25, 4-25, 5-25, 6-25, 7-25, 8-25, 9-25, 10-25, 11-25, 12-25, 1-26, 2-26, 3-26, 4-26, 5-26, 6-26, 7-26, 8-26, 9-26, 10-26, 11-26, 12-26, 1-27, 2-27, 3-27, 4-27, 5-27, 6-27, 7-27, 8-27, 9-27, 10-27, 11-27, 12-27, 1-28, 2-28, 3-28, 4-28, 5-28, 6-28, 7-28, 8-28, 9-28, 10-28, 11-28, 12-28, 1-29, 2-29, 3-29, 4-29, 5-29, 6-29, 7-29, 8-29, 9-29, 10-29, 11-29, 12-29, 1-30, 2-30, 3-30, 4-30, 5-30, 6-30, 7-30, 8-30, 9-30, 10-30, 11-30, 12-30, 1-31, 2-31, 3-31, 4-31, 5-31, 6-31, 7-31, 8-31, 9-31, 10-31, 11-31, 12-31, 1-32, 2-32, 3-32, 4-32, 5-32, 6-32, 7-32, 8-32, 9-32, 10-32, 11-32, 12-32, 1-33, 2-33, 3-33, 4-33, 5-33, 6-33, 7-33, 8-33, 9-33, 10-33, 11-33, 12-33, 1-34, 2-34, 3-34, 4-34, 5-34, 6-34, 7-34, 8-34, 9-34, 10-34, 11-34, 12-34, 1-35, 2-35, 3-35, 4-35, 5-35, 6-35, 7-35, 8-35, 9-35, 10-35, 11-35, 12-35, 1-36, 2-36, 3-36, 4-36, 5-36, 6-36, 7-36, 8-36

Key:	ND	None Detected
	NR	Not Recorded
	POS	Positive Flow
	NEG	Negative Flow
	SWL	Standing Water Level

GAS MONITORING SHEET

Contract No:	10225	 	
Contract Name:	Ward Green Barnsley		
Date:	01 April 2011		Visit No: 3
Weather:	Dry, overcast		

Ambient Readings:	O ₂ % v/v		CO ₂ % v/v		CH ₄ % v/v		PID (VOC) ppm	N/A	
Atmospheric Pressure:	Start:	1001	Finish:	1000	Regional Trend:		Steady		
Instrument Details:	Gas Data GFM 430	Last Calibration:	01/07/2010	Operator:		SIRIUS			

[illegible]

Notes:

Key:	ND	None Detected
	NR	Not Recorded
	POS	Positive Flow
	NEG	Negative Flow
	SWL	Standing Water Level

GAS MONITORING SHEET

Contract No: 10225		Contract Name: Ward Green, Barnsley		Date: 23 March 2011		Visit No. 2		Geo Environmental		Weather: Dry Sunny 15 Degrees C	
Ambient Readings:		CO ₂ % v/v		CO ₂ % v/v		CH ₄ % v/v		PID (VOC) ppm		N/A	
Atmospheric Pressure:		Start:		1027		Finish:		1029		Regional Trend:	
Instrument Details:		Gas Data GFM 430		Last Calibration:		19/02/2010		Operator:		P/JW	

[illegible]

Notes:

Key:	ND	None Detected
	NR	Not Recorded
	POS	Positive Flow
	NEG	Negative Flow
	SWL	Standing Water Level

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: PWA
Site: Ward Green, Barnsley
Date: 08/04/2011

Job No: SDS2315
Visit No: 2 of 2
Operator: Ian Bagshaw

Project Manager: Jess Cheesman

	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				WATER DATA		Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		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)		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady					
WS1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Damaged	
WS3	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	21.1	21.1	NR	NR	ND	ND		ND	NA	DRY	
WS5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21.1	21.1	NR	NR	ND	ND		ND	NA	DRY	
WS6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20.9	20.9	NR	NR	ND	ND		ND	NA	1.45	
WS7	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	21.1	21.1	NR	NR	ND	ND		ND	NA	1.77	
WS8	ND	ND	ND	ND	0.2	0.1	ND	ND	ND	ND	21.0	21.0	NR	NR	ND	ND		ND	NA	1.89	
Max	ND	ND	ND	ND	0.2	0.1	ND	ND	ND	ND	21.1	21.1	NR	NR	ND	ND		ND	NA	1.89	
Min	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20.9	20.9	NR	NR	ND	ND		ND	NA	1.45	

ND - Not detected

NR - Not recorded

NB Monitoring wells perged prior to gas monitoring

METEOROLOGICAL AND SITE INFORMATION:

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

State of ground: ☒ Dry ☐ Moist ☐ Wet ☐ Snow ☐ Frozen
Wind: ☐ Calm ☒ Light ☐ Moderate ☐ Strong
Cloud cover: ☒ None ☐ Slight ☐ Cloudy ☐ Overcast
Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy
Time monitoring performed: 17:00 Start 17:45 End
Barometric pressure (mbar): 1014 Start 1015 End
Pressure trend: ☐ Falling ☒ Steady ☐ Rising

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM 430

Gas concentration: CH₄ 0.2% @ 5%, 1.0% @ 30%, 3.0% @ 100%

CO₂ 0.1% @ 10%, 3.0% @ 30%, 3.0% @ 100%

O₂

0.50%

Gas Range: CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%

Gas Flow range: +100/-50 l/hour

Differential Pressure: (+/-) 1000 Pa

Date of last calibration: 01/07/2010

Date of next calibration: 01/07/2011

APPENDIX H

Protocol for Importation of Soil for Clean Covers

Introduction.

Isolation of made ground in garden and landscaped areas beneath a cover of "clean" subsoil, and topsoil is often recommended on residential developments where made ground is left in-situ. Most notably when the made ground contains some inorganic contaminants at concentrations above guidance threshold values for an end use that includes domestic gardens. A cover solution is not generally appropriate for organic contamination (fuels, solvents etc); removal or treatment will probably be required.

The cover blocks potential linkages between the contaminated fill and future residents. Such a cover is only required in proposed garden and landscaped areas underlain by made ground (i.e. not beneath plots or hardstand).

The thickness of cover is dependent on the nature and degree of contamination (and often the Local Authority whose area the site lies within), but typically between 600mm and 1,000mm is required. However, if the made ground is essentially "clean", but contains materials generally considered undesirable as a near-surface material in garden areas (colliery spoil, construction\demolition rubble etc) then a 300mm thick cover, in accordance with NHBC Standards, Chapter 9.2, should be adequate. If the made ground is essentially "clean" and comprises reworked natural soil, the only cover likely to be required is topsoil.

The **CML initiative**, which came into force on 1st April 2003, requires house builders to submit to NHBC (or other warranty providers) a validation report confirming the thickness and quality (ie contaminant-free) of the soil cover. Validation reports are normally prepared by independent geoenvironmental consultants.

Soil **quality** is best determined by sampling of the **source** at least 6 working days before importation to the development site. Further, on-site (post-placement) quality testing should not usually be necessary.

Soil **thickness** can only be checked after placement, but should be done before turfing, fencing etc. Thickness could be checked via the excavation of an appropriate number of inspection pits (say every 5th garden) or by survey carried out prior to and immediately after the placement of cover material.

Soil cover is usually placed towards the end of the construction phase, usually many weeks after completion of the preparatory\remedial works, and issue of the associated Validation\Completion Report. Consequently, site visits to generate supplementary letter reports are typically required immediately after soil cover is placed in the gardens of each plot, or set of plots.

Failure to submit cover validation reports (a **RED** item) promptly will delay NHBC finalling plots – this will delay the release of mortgage funds and hence legal completion – ie the financial implications are very significant.

Cover material can sometimes be sourced on-site from foundation\drainage excavations in natural in-situ strata. However, it is often necessary to import cover material and where this is necessary, the following protocol is recommended.

Protocol (Testing at Source)

The materials should be inspected by a suitably qualified Geoenvironmental Engineer at source.

Soil material should:

- be clean and free of foreign debris, building waste materials or contaminants;
- not have a stone content of greater than 20% by dry weight and
- have a maximum stone size of 150mm in any one direction.
- not have been sourced from an area within 7m laterally, or 3m vertically, of Japanese Knotweed plants, and not contain any Japanese Knotweed fragments (rhizomes, leaves, stems etc).

The Geoenvironmental Engineer should take representative samples of the subsoil material from the proposed source. The number of samples taken will be dependant on the nature of the source and the quantity of material to be imported. However, as a guide, a **minimum** of 6 samples of each subsoil type should be tested, with a further sample for each 300m³ where the quantity exceeds 1,800m³.

A less frequent sampling rate may be appropriate for soils from a greenfield source or where large volumes (say > 5,000m³) of soil are imported from a single, relatively homogenous source.

Each sample taken should be forwarded to an analytical laboratory for testing in accordance with the following schedule:

pH, total metals (copper, nickel, zinc, chromium, arsenic, mercury, selenium, cadmium, and lead), water soluble boron and water-soluble sulphate.

Additional determinands could be scheduled, although if considered necessary, would probably suggest the material is unlikely to be suitable for use as clean cover in gardens.

The analytical testing should be undertaken on a 3 or 5-day turnaround and the Client\Contractor should be notified of the soil's suitability (or otherwise) immediately after receipt of the results. Chemical assessment (Tier 1) criteria for imported soils are tabulated on page iv.

On receipt of written confirmation from the Geoenvironmental Engineer, the Client should instruct his Contractor to commence importation. It will probably be necessary to stockpile the cover prior to placement in garden\landscaped areas. The Geoenvironmental Engineer should inspect the stockpiled material prior to placement, to confirm that it is the same material as previously tested, or the Contractor should provide the Client with appropriate haulage notes. Further, on-site quality testing should not normally be necessary.

Validation letter reports should be issued by the Geoenvironmental Engineer as each plot, or set of plots, is completed.

Imported **topsoil** should be subject to the above protocol, wherever it is *not* being sourced from an approved supplier. In addition, some analysis in accordance with BS3882 may be appropriate.

Protocol (Testing after Placement)

Clearly, if soil cover is imported and placed before confirmation of its suitability, we cannot guarantee that our validation work will yield the desired results. In which case, it may be necessary to excavate and export the placed soil cover and/or import further "clean" soil.

The materials should be inspected by a suitably qualified Geoenvironmental Engineer via inspection pits excavated through the entire thickness of placed cover material. Pits should be excavated at an interval of *approximately one pit per 300m³ of soil cover placed. For a standard residential garden comprising a total area of 100m² (front and rear), with a soil cover thickness of 600mm, one pit per 5 plots is required.*

Soil material should:

- be clean and free of foreign debris, building waste materials or contaminants;
- not have a stone content of greater than 20% by dry weight and
- have a maximum stone size of 150mm in any one direction.
- not have been sourced from an area within 7m laterally, or 3m vertically, of Japanese Knotweed plants, and not contain any Japanese Knotweed fragments (rhizomes, leaves, stems etc).

The Geoenvironmental Engineer should take representative samples of the subsoil material from each pit.

Each sample taken should be forwarded to an analytical laboratory for testing in accordance with the following schedule:

pH, total metals (copper, nickel, zinc, boron, chromium, arsenic, mercury, selenium, cadmium, and lead), and water-soluble sulphate.

Additional determinands could be scheduled, although if considered necessary, would probably suggest the material is unlikely to be suitable for use as clean cover in gardens.

The analytical testing should be undertaken on a 3 or 5-day turnaround and the Client/Contractor should be notified of the soil's suitability (or otherwise) immediately after receipt of the results. Chemical assessment (Tier 1) criteria for imported soils are tabulated on page iv.

Validation letter reports should be issued by the Geoenvironmental Engineer as each plot, or set of plots, is completed.

Placed **topsoil** should be subject to the above protocol, wherever it is *not* being sourced from a reputable supplier able to provide analytical certificates, in accordance with BS3882.

Chemical assessment criteria for imported soils to the above site to create the soil cover system

Contaminant	Source	Tier 1 Assessment Criteria (mg/kg)	Comments/Notes
		Resi with gdns	
pH	CLEA		Initial assessment only
As	CLEA	32	-
Cd	CLEA	1	pH variable
Cr	CLEA	130	-
Pb	CLEA	450	-
Hg	CLEA	1	-
Ni	CLEA	130	Assessment of human health risk only
Se	CLEA	350	-
B	ICRCL	3	-
Cu	MAFF	111	pH variable
Zn	MAFF	330	pH variable
Water soluble sulphate	BRE SD1	0.5	Units are g/l