ARP GEOTECHNICAL LTD

CHARTERED CONSULTING ENGINEERS

STAGE 2 GEO-ENVIRONMENTAL REPORT

AT THE

FORMER ARDSLEY HOUSE HOTEL
DONCASTER ROAD
BARNSLEY

ON BEHALF OF

ARNCLIFFE HOMES LTD

JUNE 2015

Report No: ACF/20r1	Name	Signature	Date
Prepared By:	J B Wilson BEng FGS P.P.		8/6/15
Reviewed By:	A Radcliffe BEng CEng MIStructE		8/6/15

ARP GEOTECHNICAL LTD: Northwest House, 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH
☎ 0113 2458498 🖷 0113 2443864 ✉ leeds@arpgeotechnical.co.uk 🌐 www.arpgeotechnical.co.uk

C O N T E N T S

		Page
1.0	Executive Summary	3
2.0	Terms of Reference	4 - 5
3.0	The Site	6
4.0	Environmental Setting	7 - 9
5.0	Site Investigation	10 - 11
6.0	Summary of Ground Conditions	12 - 15
7.0	Contamination Analysis	16 - 19
8.0	Updated Risk Assessment and Conceptual Model	20 - 21
9.0	Risk Based Assessment of Remedial Options	22 - 24
10.0	Geotechnical Testing	25 - 26
11.0	Comment and Conclusion	27 - 32

APPENDICES

Appendix A	Site Location Plan and Site Plan
Appendix B	Borehole and Trial Pit Location Plan and Logs
Appendix C	Percolation Test Results
Appendix D	Laboratory Test Certificates and Screening Values
Appendix E	Gas Monitoring Results
Appendix F	Proposed Remediation Method Statement
Appendix G	Indicative Proposed Development

1.0 EXECUTIVE SUMMARY

The pertinent conclusions of the report are tabulated below. However, the information below is not exhaustive, and it is recommended the report is read in its entirety.

Proposed Development	Residential dwellings with private gardens and soft landscaping.
Existing Site Description	Occupied by a disused hotel, with soft landscaping and car parking. Generally level and flat.
Site History	Ardsley House has been present on the site from before the 1850s.
Geology	Glass Houghton Rock (sandstone). No faults shown to affect the site.
Coal Mining	Coal Mining Report indicates site is stable with regard to coal mining. Possible small-scale excavation of a minor near-surface seam in west.
Hydrogeology	Site underlain by Secondary A Aquifer. No abstractions within 500m.
Hydrology	No watercourses or abstractions within 1km. No flood risk.
Radon & Ground Gas	No protection measures for either indicated on results so far.
Ground Conditions	Up to 1.2m thickness of made ground or topsoil (generally much less), over residual granular soils on most of site, and residual cohesive soils locally on the west and south. Bedrock (sandstone or mudstone) at depths from 0.6m to 2.50m.
Contamination	Locally very slightly elevated lead and dibenzo(a,h)anthracene in reworked (WS2 & WS8 only) topsoil. Ash and clinker fill contains elevated dibenzo(a,h)anthracene, and chrysotile fibres.
Remediation Strategy	Use of topsoil at WS2 on front gardens or landscaping, but if to be used in private rear gardens, further sampling and testing required. Topsoil at WS8 to be removed from site or covered by at least 300mm of clean topsoil, to max 1m combined thickness. Granular made ground containing ash and clinker will require the provision of a cover blanket of a minimum 0.6m thickness, with hard break beneath. Alternatively, retention below hardstanding or disposed off-site.
Foundations	Traditional strip or trench fill foundations.
Excavations	Likely to be stable with no significant water ingress.
Concrete	GEN 1 designation for unreinforced buried concrete.
Soakaways	May be possible in the south and east, but unlikely in north and west.

2.0 TERMS OF REFERENCE

2.1 Arncliffe Homes Ltd is considering developing the site at the former Ardsley House Hotel, Barnsley, with residential properties. It was considered appropriate to provide information to aid viability assessment and design of any subsequent development.

2.2 In November 2014, SLR Consulting Ltd issued a Stage 1 Desk Study Report (Reference 402-05154-00001-0001). This involved an assessment of the geological and coal mining aspects, Ordnance Survey archive maps, radon gas, indicative flood risk, hydrogeology, landfill, and other environmental issues, primarily by assessment of a GroundSure EnviroInsight Report. In addition to comments and conclusions on a range of environmental and geotechnical issues, the report also recommended intrusive investigation and assessment.

2.3 In April 2015, ARP Geotechnical Ltd were appointed by Arncliffe Homes Ltd to undertake the intrusive investigation, comprising trial pits and window sample boreholes to assess the subsoil conditions.

2.4 The investigation was implemented generally in accordance with BS 5930 : 1999 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency CLR 11 "Model Procedures for the Management of Land Contamination" and BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice". This report is limited to the data obtained as part of this investigation. It should be noted that there is a possibility of variation in ground conditions between test locations and interpretation of strata is given for guidance only. No liability is accepted for changes to site conditions, including groundwater levels, after the preparation of this report.

2.5 The findings or contents of the Stage 1 Desk Study Report are not reproduced here, and it is recommended that this report is read in conjunction with the Stage 1 Report.

2.6 The general observation and assessment of the ground surface, and the identification/classification of vegetation is made in general terms only. It would be

prudent for a specialist to undertake a more detailed survey, including for any invasive/harmful weeds.

2.7 The assessment of any topsoil is carried out in terms of potential chemical effects on human health only, and no account is taken of aesthetic or horticultural properties. Such considerations should be referred to a horticulturist or landscape architect.

2.8 The Stage 2 investigation was carried out from April to June 2015.

2.9 The report has been prepared for the sole use and reliance of the Client. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Geotechnical Ltd. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

3.0 THE SITE

Site Location

3.1 The site, which is centred on Ordnance Survey Grid Reference 438291,405534, is located to the south of Doncaster Road, in the Ardsley suburb of Barnsley.

3.2 A site location plan and site plan are presented in Appendix A.

Site Description

3.3 The site is currently occupied by a disused hotel, with external areas of soft landscaping and car parking. It extends to an area of approximately 1.45 hectares and is irregular in shape. The main site area is generally level and flat, but slopes downwards gradually in the south and west, towards the boundaries. The site is generally surrounded by woodland, except for some adjacent residential properties located to the northeast and northwest.

Site History

3.4 Ordnance Survey archive maps, obtained as part of the previous Stage 1 Desk Study, indicate that Ardsley House was present on the site from before the 1850s. The house was extended at various times during its history. It is understood that, from the 1970s to 2014, it operated as a hotel. The 1974 and 1981 OS maps show a tank to the southwest of the building. No further information regarding this tank, including its use, is available.

4.0 ENVIRONMENTAL SETTING

4.1 The environmental setting for the site was established by the Stage 1 Desk Study Report undertaken by SLR, under reference 402-05154-00001-0001 and dated November 2014 2015. The findings of the Desk Study Report, updated and amended where deemed appropriate, are summarised below.

Geology

4.2 The geological maps show the site to be underlain by Glass Houghton Rock, a sandstone unit. Undifferentiated Pennine Middle Coal Measures (MCM) - mudstone, siltstone and minor sandstones, are present approximately 55m to the southwest, beyond a coal seam outcrop. The outcrop and the undifferentiated strata are on lower ground, and will underlie the site. There are no faults shown to affect the site.

Coal Seams & Coal Mining

4.3 The geological maps show a conjectured coal seam to outcrop approximately 55m to the south west of the site. Based on site levels, it is anticipated that this seam will be present at approximately 10m below the site. Reference to the 1:10,000 scale geological map (referenced SE30NE, dated 1981) indicates the coal seam to be the Sharlston Low. This seam has a recorded thickness of between 0.30m and 0.48m. The Sharlston Low coal is part of a variable group of thin coals, known to have been opencast near the northern margin of the Barnsley district.

4.4 The Coal Mining Report indicates that the site is in the likely zone of influence from workings in 8No. seams of coal at between 270m to 700m depth, and last worked in 1990. Any ground movement from these coal workings should have stopped by now. The site is unaffected by any current or planned future underground coal mining. The site is not affected by any past, present, or future proposed opencast coal mining. There are no known coal mine entries within, or within 20 metres of, the site boundary. A damage notice or claim for alleged subsidence damage was made to the Coal Authority in May 1998 in relation to the property, but the claim was rejected.

4.5 It is evident from The Coal Authority report that the site is not considered to be at risk from mining instability, and The Authority has rejected a subsidence claim, despite the likely presence of a coal seam around 10m beneath the site. This is probably due to the relevant seam being no more than 0.48m thick, and therefore having sufficient rock cover above to arrest any void migration, which is normally based on a requirement for 10 times the seam thickness of rock cover to be present.

Hydrogeology

4.6 The Landmark Envirocheck Report indicates the Bedrock Aquifer Designation to be "Secondary A". These Aquifers comprise "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".

4.7 There are two, presumed active, groundwater abstractions within 1km of the site, at 554m to the east and 831m to the south east. Both abstractions are for general farming and domestic use. Neither is down the likely hydraulic gradient from the site, and they should be unaffected by any site activity.

4.8 The site is not within 500m of a groundwater Source Protection Zone.

Hydrology

4.9 There are no watercourses on or within 1km of the site. Any surface water run-off, which is not intercepted by drainage, may impact adjacent soft landscaping to the south or west of the site. The site is not in an area at risk from river flooding.

4.10 There are no surface water abstractions within 1km of the site.

Other Relevant Environmental Data

4.11 There are no closed or currently licensed landfills within 250m of the site.

4.12 The site is not within a radon affected area, and no radon protective measures are necessary on the site.

Potential Contamination Sources

4.13 There is no indication of any potentially contaminating use of the site. However, there is the possibility that contamination may be present in any fill material used on the existing hotel development, and also possibly localised contamination from the tank formerly located to the southwest of the existing building. There will also be the legacy of buried structures, foundations, services, and possibly basements and a swimming pool, from the existing and previous developments on the site. The following potential sources of contamination were, therefore, identified by the review of the Stage 1 Desk Study Report:

4.13.1 Possible made ground - metals, inorganics, TPH, PAH, phenol, asbestos.

4.13.2 Additional possible localised contamination due to the presence of a tank.

4.13.3 Ground gas due to possible shallow coal seam below the site.

4.13.4 Asbestos within existing buildings.

5.0 SITE INVESTIGATION

5.1 The purpose of the investigation undertaken from April 2015 to June 2015 was to produce an assessment of the site in accordance with BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice", and to provide geotechnical information to aid design of the development.

5.2 The site was gridded on an approximate 25m spacing and trial pits and boreholes were implemented and sampled on the grid, to satisfy the requirements of the British Standard, along with any targeted locations. Eight trial pits (TP1 to TP8 inclusive) were excavated, using a JCB 3CX wheeled backhoe excavator, to depths of between 1.75m and 2.60m, terminating in or on bedrock. In addition, 8No. window sample boreholes were drilled across the site, predominantly in areas inaccessible by the JCB 3CX. The trial pits and boreholes were organised, supervised and logged by an Engineer from ARP Geotechnical Ltd. Justifications for the trial pit locations are given below.

LOCATION	REASON
TP1 - TP8, WS1 - WS8	Part of grid / Site coverage
WS3	Also to target location of former tank*

* The location of the former tank was evident from an area of mossy grass corresponding to the tank location shown on archive maps. WS3 was positioned in the centre of this area.

5.3 Three gas monitoring wells were installed in WS2, WS6 and WS7, and subsequently monitored by ARP Geotechnical Ltd. The wells were installed to 2m depth, with the bottom 1m comprising slotted pipe with gravel surround, and the upper 1m comprising plain pipe with bentonite seal and lockable flush cover. WS2 was installed with the response zone (slotted section) of the well across a thin coal seam.

5.4 The trial pit and borehole logs are included in Appendix B, along with the site investigation plan.

5.5 Infiltration testing was undertaken in 4No. of the trial pits (TP1, TP2, TP3 and TP5). The test readings, curves and calculation are included in Appendix C.

5.6 Chemical analysis of 16No. soil samples for metals, inorganics, speciated PAH, TPH, phenols, and asbestos was undertaken by the UKAS accredited Derwentside Environmental Testing Services (DETS) laboratory in Consett. The test certificates are included in Appendix D.

5.7 Analysis for Atterberg Limits and moisture content was undertaken by the UKAS accredited Professional Soils Laboratory (PSL) in Doncaster. The test certificates are included in Appendix D. Geochemical testing (pH and water soluble sulphate) of samples of natural ground was undertaken by both DETS and PSL.

6.0 SUMMARY OF GROUND CONDITIONS

Strata and Groundwater

6.1 Bituminous surfacing ("bitmac"), up to approximately 0.10m thick, was proven below hardstanding in the eastern half of the site, and locally in the west (WS7). The bitmac was found to be underlain by a thin veneer of limestone sub base. Exploratory holes in landscaped areas typically encountered topsoil to depths of between 0.20m and 0.40m.

6.2 Locally, the sub base was underlain by slightly organic sandy clay, considered to be representative of previous near-surface material. In the easternmost part of the site (TP5), reworked relic topsoil was proven to a depth of 0.90m. In addition, reworked topsoil was proven from ground level to 0.70m depth in WS8, located in the north west. A thin layer of granular made ground containing ash, clinker and brick was encountered below the sub base in TP1 (in the north), and TP3 and TP4 (in the southeast). Isolated areas of made ground were also identified in WS6, to 0.80m depth, and in WS7, to 1.20m depth. Reworked natural material was proven in TP1, between 0.40m and 1.00m depth, and also in TP2, between 0.60m and 1.00m. In the vicinity of TP1, in the northernmost part of the site, based on the surrounding topography, it is evident that ground levels have been raised.

6.3 In most exploratory holes, the made ground was found to be underlain by natural granular strata: sandy gravel of sandstone, with cobble-sized pieces of sandstone which are more frequent with depth. Natural clay soils of firm and stiff consistency were encountered locally in the west and south.

6.4 A thin (0.2m) band of coal was encountered between 1.17m and 1.37m depth in WS2 (in the south west). The moderately weathered material was recovered as black, angular fine and medium-sized gravel of coal. This thin coal seam is considered to be an unnamed minor coal seam, above the Sharlston Low Coal, and unlikely to have been worked on the site.

6.5 Bedrock was proven at depths ranging from 0.6m (WS3, located in the south), and 2.5m (TP3, located in the south). The bedrock typically comprised fine to coarse grained sandstone, with mudstone locally in the west and south.

6.6 The trial pit excavations generally remained stable for the short period of exposure and the boreholes generally stayed open. All the trial pits and exploratory holes were backfilled with arisings on completion (including completion of any soakaway tests), with the exception of the 3No. boreholes in which wells were installed.

6.7 No groundwater was observed during the investigation or in standpipes during post-fieldwork monitoring. There was no visual or olfactory evidence of ground contamination at WS3, which was located in the position of a former tank.

Gas Assessment

6.8 The ground gas investigation was undertaken in accordance with BS 8576 : 2013 "Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)". Ground gas risk assessment was carried out in accordance with BS 8485 : 2007 "Code of practice for the characterization and remediation from ground gas in affected developments".

6.9 The monitoring, carried out on two fortnightly occasions to date, showed no methane (CH_4) to be present, a maximum carbon dioxide (CO_2) concentration of 1.8% v/v, and no detectable flow rate. However, a further 4No. visits, over a two month period are still to be carried out, and the full results will be reported by separate letter on completion.

6.10 BS 8485 : 2007 utilises the concept of hazardous gas flow rates (Q_{hg}), measured in litres per hour, which are obtained by multiplying the borehole flow rate by the concentration in the air stream of the particular gas being considered. Table 1 in Section 6.3 of the Standard allows the selection of a "Characteristic Gas Situation" based on the hazardous gas flow rates, using a numbering system of 1 to 6, where 1 equates to a very low hazard potential and 6 equates to a very high hazard potential.

6.11 A table summarising the Characteristic Gas Situations is provided below.

Characteristic Gas Situation (CS)	**NHBC Traffic Light**	**Hazard Potential**	**Characteristic Hazardous Gas Flow Rate, Q_{hgs} (l/hr)**	**Additional Factors**
1	Green	Very Low	<0.07	Typically <1% CH_4 and <5% CO_2, otherwise consider an increased Characteristic Gas Regime
2	Amber 1	Low	>0.07, <0.7	Typical Measured Flow Rate <70l/hr, otherwise consider an increased Characteristic Gas Regime
3	Amber 2	Moderate	>0.7, <3.5	
4	Red	Moderate to high	>3.5, <15	
5		High	>15, <70	
6		Very High	>70	

Based on Table 1 and Table 2 of BS 8485:2007

6.12 Therefore, for the gas regime identified on the site, where zero CH_4 and 1.8% CO_2 were detected, along with zero borehole flow rate, a maximum Q_{hg} of 0.0018 l/hr for CO_2 is the result. This equates to a Characteristic Gas Situation of 1, which is equivalent to Green under the NHBC traffic light system. No gas protection is, therefore, indicated to be required for proposed properties, although further monitoring has still to be carried out. No radon protection is stated to be required for the site.

Percolation Testing

6.13 Percolation testing was implemented in TP1, TP2, TP3 and TP5, using a 1,500 gallon tractor towed water bowser to discharge water quickly into each hole. The intention was to monitor the water levels for a period until either the level had fallen to below 25% of the maximum filled level, or the end of the working day had been reached. If time permitted, a further two tests were to be carried out in each pit. In TP1 and TP2, the

water level did not drop below 25% of the effective depth, and therefore the test was not repeated. In TP3 and TP5, the test was repeated twice in each pit.

6.14 The readings and graphs are presented in Appendix C. Infiltration rates were calculated generally in accordance with BRE Digest 365 "Soakaway Design" for each test. The results are summarised in the table below.

Exploratory Hole/Location	**Infiltration Test No.**	**Calculated Infiltration Rate (m/s)**	**Comment**
TP1	1	2.8×10^{-5}	Partial depth test
TP2	1	2.2×10^{-5}	Partial depth test
TP3	1	5.1×10^{-4}	Full depth test
	2	3.9×10^{-4}	Full depth test
	3	3.3×10^{-4}	Full depth test
TP5	1	1.1×10^{-4}	Full depth test
	2	8.1×10^{-5}	Full depth test
	3	1.1×10^{-4}	Partial depth test

6.15 The results of percolation testing indicate higher infiltration rates in the east (TP5) and south of the site (TP3). In the light of the above, it may be possible to use soakaways in the south and east, but less likely in the north. In addition, it is unlikely that soakaways would be practical in the west, where clay soils and mudstone bedrock have been proven.

7.0 CONTAMINATION ANALYSIS

Screening Values - Soils

7.1 There is presently conflicting opinion with regard to the appropriate generic assessment criteria, or screening values, for soils which should be used in contamination assessment for proposed development. In March 2014, DEFRA published Category 4 Screening Levels (C4SLs) for six contaminants: arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead. The values are based on the toxicological benchmark of a "low level of toxicological concern" (LLTC) rather than the previous regulatory approach of "minimal or tolerable level of risk". As the C4SLs are less protective of health than the previous approach, the Chartered Institute of Environmental Health (CIEH) has advocated an alternative approach based on minimal risk, but with some adjustment of exposure parameters to more realistic scenarios than those previously used. To this end, the CIEH has collaborated with Land Quality Management to publish "Suitable 4 Use Levels" (S4ULs) "The LQM/CIEH S4ULs for Human Health Risk Assessment", November 2014 (LQM/CIEH). However, DEFRA has reiterated its intention that the C4SLs should be used in generic risk assessment for proposed development, and there is indication that other parties will collaborate, in the near future, to extend the range of C4SL determinands beyond the six published so far.

7.2 In the absence of a final resolution to the debate, soil contamination test results in this report have been compared first against the more conservative S4UL, and where a C4SL exists for the same determinand, consideration given to the use of the C4SL for any exceedences of the S4UL, within the site specific context. Where no S4UL exists for a determinand, for example lead, the C4SL has been used. The LQM/CIEH screening values have been calculated for soil organic matter contents of 1% and 2.5%, as well as 6%, and the appropriate screening value is used for the organic matter content of the soil. All the C4SL values published are for a soil organic matter content of 6%.

7.3 A table showing the screening values utilised is included in Appendix D.

Soils Analysis

7.4 Sixteen soil samples were issued to DETS for the suite of testing. The testing comprised:

- 11No. samples of Topsoil (including Reworked Topsoil) or slightly organic made ground clays from TP2, TP5 to TP8, and WS1 to WS5 and WS8;
- 5No. samples of Made Ground from TP1, TP3, TP4, WS6 and WS7.

7.5 For each material, any determinand with exceedences of screening values were subjected to statistical analysis in accordance with the CIEH and CL:AIRE document "Guidance on Comparing Soil Contamination Data with Critical Concentrations", where sufficient samples allowed. For the made ground, the material was heterogeneous, and statistical analysis was deemed inappropriate. The spreadsheet package from the USEPA called "Pro UCL" (Version 4.00.05) was used to carry out the analysis. Each dataset was tested for outliers, and after removal of the outliers, assessed for "goodness of fit" to a normal distribution. Depending on the results, Upper Confidence Level (UCL) tests were carried out by either normal, gamma, log normal, or non-parametric methods. The results of the analysis are discussed below.

Topsoil (including slightly organic soils and Reworked Topsoil)

7.6 A results summary table for determinands, within the topsoil and organic soils, found to be above screening values is given on the following page. It can be seen that the concentrations of lead and dibenzo(a,h)anthracene, which are recorded above the relevant screening values, are outliers. Once the outliers are removed from the dataset, there are no exceedances. There was no evidence of any exceedances in WS3, the location of the former tank.

Determinand		Lead	Dibenzo(a,h) anthracene
Location	Depth (m)	mg/kg	mg/kg
TP2	0.30-0.60	17	< 0.1
TP5	0.4	70	< 0.1
TP6	0.3	30	< 0.1
TP7	0.30-0.50	49	< 0.1
TP8	0.3	83	< 0.1
WS1	0.10-0.30	84	< 0.1
WS2	0.10-0.30	210	< 0.1
WS3	0.10-0.30	65	< 0.1
WS4	0.10-0.30	83	< 0.1
WS5	0.10-0.20	60	< 0.1
WS8	0.20-0.50	97	0.8
	95% UCL^	79.0	<0.1
	Screening Level*	200	0.28

Exceedence
Outlier (and above screening value)
Acceptable (on removal of any outliers)
* Based on 2.5% organic matter
^ After removal of outliers

7.7 The topsoil in the location of WS2 was noted to contain gravel of coal and brick. The topsoil in the location of WS8 was also noted to have been reworked, with a thin layer of brick and limestone gravel (possibly a drainage layer installed).

Made Ground

7.8 A results summary table for determinands within the made ground found to be above screening values is given on the following page. Elevated concentrations of dibenzo(a,h)anthracene, encountered in the granular made ground containing ash and clinker, will need to be considered further in the risk assessment. In addition, chrysotile was recorded in all three samples of this material.

Determinand		Dibenzo(a,h) anthracene	Asbestos
Location	Depth (m)	mg/kg	Present?
TP1	0.15-0.40	0.7	Chrysotile
TP3	0.25-0.40	< 0.1	Chrysotile
TP4	0.25	0.7	Chrysotile
WS6	0.20-0.40	< 0.1	None
WS7	0.50-0.80	< 0.1	None
	Screening Level	0.3*	Fibres present

Statistical analysis not undertaken due to size of dataset and hetereogeneous nature of made ground
* Based on 6% organic matter

Water/Leachability Analysis

7.9 Based on the nature and recorded concentrations of contaminants, leachability testing was not considered necessary.

8.0 UPDATED RISK ASSESSMENT AND CONCEPTUAL MODEL

8.1 The conceptual model can be updated to take account of the findings of the site investigation and laboratory tests. The main refinements are given below:

8.1.1 The site is underlain by up to 1.2m thickness of made ground or topsoil (generally much less), overlying residual granular and cohesive subsoils derived from weathering of the underlying bedrock material.

8.1.2 The topsoil was locally found to contain a slightly elevated concentration of lead (210mg/kg), compared to the C4SL of 200mg/kg, and also dibenzo(a,h)anthracene (0.8mg/kg), compared to the S4UL of 0.28mg/kg. In both cases (WS2 and WS8), it was apparent that the topsoil had been reworked.

8.1.3 The granular made ground containing ash and clinker was found to contain elevated dibenzo(a,h)anthracene at a concentration of 0.7mg/kg. In addition, this type of made ground was found to contain chrysotile fibres.

8.2 The conceptual model needs to consider sources of contamination, pathways along which contaminants could migrate and the receptors, which may become exposed. Guidance published by the Environment Agency has been consulted with regard to pathways and receptors. The sources, pathways, and receptors, applicable to the proposed development are identified on the table below. Any pathways in italics are deemed not to be viable (and the reason given in brackets).

Source – Pathway – Receptor Matrix

Contamination Sources	Pathways	Receptors
Topsoil – localised slightly elevated lead, and also dibenzo(a,h)anthracene Ash and clinker made ground – dibenzo(a,h)anthracene and asbestos (chrysotile) fibres Asbestos within existing buildings	• Inhalation, ingestion and dermal contact with soil and dust • Fruit and vegetable intake (with soil) • *Vapour inhalation outdoor(identified contamination not volatile)* • *Vapour inhalation indoor (identified contamination not volatile)*	**Humans:-** • Future occupants • Construction workers • Maintenance workers • Adjacent residents and general public
	• *Migration in surface water(identified contamination too low to be significantly mobile in waters)* • *Migration in groundwater (identified contamination too low to be significantly mobile in waters)*	**Controlled waters:-** • Groundwater (Secondary A Aquifer, no abstractions within 500m) • No watercourses on or within 1km of the site, no abstractions within 1km)
	• Root uptake	**Vegetation:-** • Landscape areas • Private gardens
	• Migration	**Services/Utilities:-** • Potable water supply
Coal/mining – methane and carbon dioxide	• Asphyxiation • Explosive risk	• Construction/demolition workers • Future occupants • Buildings

8.3 It can be seen from the above matrix that several pathways to receptors are operative, and this may affect users of the finished development. Some form of remedial action is, therefore, considered necessary to allow residential development without excess risk.

9.0 RISK BASED ASSESSMENT OF REMEDIAL OPTIONS

9.1 The conceptual model has identified risks locally (WS2 and WS8) from the Made Ground Topsoil by lead of up to 210mg/kg and dibenzo(a,h)anthracene of up to 0.8mg/kg, risks from the and Ash and Clinker Made Ground, by dibenzo(a,h)anthracene of up to 0.7mg/kg, and chrysotile fibres. A coal seam is also present at shallow depth below the site (a potential source of ground gases), but monitoring so far indicates no protection measures are likely to be necessary with regard to ground gas. This will be confirmed by separate letter report on completion of the monitoring. Asbestos may also be present within the existing buildings.

Asbestos Within Existing Buildings

9.2 Provided an asbestos survey is carried out prior to any demolition or work on the existing buildings on the site, and any identified asbestos is removed and disposed to a licensed facility, then the risk to receptors is low. The work should be carried out by appropriately qualified Contractors.

Ingestion, Dermal Contact, and Dust Inhalation Pathways from the Topsoil

9.3 The elevated concentrations of lead and dibenzo(a,h)anthracene relate to topsoil currently located in soft landscaping in the locations of WS2 and WS8. The concentration of lead is below the C4SL for Residential without Home-grown Produce of 310mg/kg. Therefore, if the topsoil in the location of WS2 is retained in areas of future soft landscaping, then no remedial works would be required. However, if the material is to be used in private gardens, it is recommended that further sampling and testing of the topsoil material in this area is undertaken prior to development. The topsoil in the location of WS8, in which elevated dibenzo(a,h)anthracene was recorded, is currently isolated within a small existing landscaped area. The material is considered unsuitable to be used in future private gardens or be retained near the surface in future soft landscaping. Therefore, this isolated area of topsoil should either be removed from site, or covered by at least 300mm of clean topsoil if retained in future soft landscaping, to a maximum combined thickness of 1.0m.

Ingestion, Dermal Contact, and Dust Inhalation Pathways from the Ash and Clinker Made Ground

9.4 Provision of a cover blanket of a minimum 600mm thickness will reduce the risk to future users of the site to acceptable levels from these pathways. This assumes a worst case double dig scenario (i.e. 2 x spade depths). However, to prevent inadvertent future exposure to the chrysotile asbestos fibres, due to other forms of excavation such as tree planting or construction of ponds, provision of a hard break layer is recommended below the 0.6m cover of clean soils. Alternatively, the material could be retained below future hardstanding or disposed off-site.

Risks During Construction Period

9.5 It is also necessary to consider the effects of the contamination present on the site in relation to the risks to adjacent residents, construction workers and the general public during construction. This is assessed in the following matrix.

Source	Pathway	Potential risk	Risk after employing suitable Health and Safety plan.
Contaminated fill	Inhalation	Moderate	Damping down of the site during dry periods and timely placement of contaminated fill below barriers should reduce the risk to LOW.
	Ingestion	Moderate	Provision of washing facilities and a clean mess room from which work boots and overalls are excluded should reduce the risk to LOW. Site fencing will exclude access to members of the public and contaminated material will be contained within the site boundary, and placed below barriers as soon as possible.
	Contact	Moderate	Education of workers to use adequate hygiene and PPE should reduce the risk to LOW.
	Surface water	Moderate	Preventing surface water run off by minimising open exposure times of contaminated material and using bunds or cut off trenches as necessary will reduce the risk to LOW.
Asbestos within buildings	Inhalation	High	Provided an asbestos survey is carried out, and any identified asbestos is removed from site prior to any other works commencing, the risk is LOW.

9.6 Provision of all the above measures will ensure that all the identified pathways for the contamination will be blocked.

Summary

9.7 Provided that the following remedial measures are adopted then the risks to the identified receptors are deemed acceptable for the proposed development of residential properties with private gardens:

9.7.1 An Asbestos survey should be carried out prior to any demolition or work on the existing buildings, and any identified asbestos should be removed and disposed of at a licensed facility.

9.7.2 The topsoil in the location of WS2 could be used on front gardens or landscaping, but if it is to be used in private rear gardens, it will require further sampling and testing, prior to development. The topsoil in the location of WS8 should be removed from site, or covered by at least 300mm of clean topsoil in a communal soft landscaping area, to a maximum combined topsoil thickness of 1m.

9.7.3 The granular made ground containing ash and clinker will require the provision of a cover blanket of a minimum 0.6m thickness, with a hard break layer below. Alternatively, the material could be retained below future hardstanding or disposed off-site. Remedial measures are not considered necessary for the other types of made ground encountered on the site.

9.8 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

9.9 A Proposed Remediation Method Statement is included in Appendix F.

10.0 GEOTECHNICAL TESTING

10.1 Selected samples of the natural strata were delivered to PSL in Doncaster for testing with regard to plasticity indices and moisture content. Test certificates are presented in Appendix D and a summary of the results, including Modified Plasticity Indices, is given below.

Locn.	Depth (m)	MC	LL	PL	PI	<425mm	I'p
WS2	0.90	14	32	20	12	85	10.2
WS5	1.20	14	29	19	10	90	9.0
WS8	0.90	13	30	20	10	88	8.8
	No. of results	3	3	3	3		3
	Min.	13	29	19	10	85	8.8
	Max.	14	32	20	12	90	10.2

I'p	VCP
>40%	High
20% - <40%	Medium
10% - <20%	Low

MC= Moisture Content (%) LL= Liquid Limit (%) PL= Plastic Limit (%)
PI= Plasticity Index (%) I'p= Modified PI (%) VCP= NHBC Standard Chapter 4.2 Volume Change Potential

10.2 The plasticity test data shows the clay strata to be of low plasticity, in accordance with BS 5930 (1999) "Code of Practice for Site Investigations". When the percentage retained on the 425 micron BS sieve is considered, the Modified Plasticity Index, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees" is a maximum of 10.2. In accordance with the Standard, this equates to Low Volume Change Potential.

10.3 Geochemical testing (water soluble sulphate and pH) was undertaken on selected samples by DETS, comprising 16No. samples of made ground and 6No. samples of natural strata. In accordance with the BRE Special Digest 1 "Concrete in aggressive ground", the characteristic values for the two materials are given below:

Characteristic Values

Material	pH	SO_4
Made Ground	6.5	420
Natural Strata	6.9	134

SO_4 = Sulphate content in mg/l on a 2:1 water : soil extract pH = Acidity

10.4 The geochemical analyses show the strata on the site to have low water soluble sulphate content and near-neutral pH. The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1. Therefore the use of GEN 1 designated concrete will be satisfactory for unreinforced foundations.

11.0 COMMENT AND CONCLUSION

Site Description

11.1 At the time of the investigation, the site was occupied by a disused hotel, with external areas of soft landscaping and car parking. The main site area is generally level and flat, and slopes downwards gradually in the south and west, towards the boundaries.

11.2 The site is generally surrounded by woodland, except for some adjacent residential properties located to the northeast and northwest.

Site History

11.3 Ordnance Survey archive maps indicate that Ardsley House was present on the site from before the 1850s. The house was extended at various times during its history. It is understood that, from the 1970s to 2014, it operated as a hotel. The 1974 and 1981 OS maps show a tank to the southwest of the building.

Geology

11.4 The geological map shows the site to be underlain by Glass Houghton Rock, a sandstone unit. Undifferentiated Pennine Middle Coal Measures (MCM) - mudstone, siltstone and minor sandstones, are present approximately 55m to the southwest, beyond a coal seam outcrop. The outcrop and the undifferentiated strata are on lower ground, and will underlie the site. There are no faults shown to affect the site.

Coal Mining and Coal Recovery

11.5 The coal mining report indicates the site is stable with regard to coal mining. There are no known coal mine entries within 20 metres of the site.

11.6 A thin (0.2m) coal seam was encountered in the southwest during the ground investigation. Whilst it is unlikely that this minor seam will have been worked on a large

scale, the possibility of small-scale excavation of the seam cannot be entirely discounted. If any suspect features are encountered, they should be inspected by an appropriately qualified engineer.

11.7 There will be no significant arisings of coal during proposed development works, and it will not be economic to win any coal from the site by open excavation before development.

Environmental Data

11.8 The solid strata beneath the site are classed as a Secondary A Aquifer. There are no groundwater abstractions within 500m, and the site is not within 500m of a groundwater Source Protection Zone.

11.9 There are no watercourses on or within 1km of the site, and there are no surface water abstractions within 1km of the site.

11.10 The site is not in an area at risk from river flooding. The risks of flooding from other causes such as adverse topography or insufficient surface water drainage, are not considered here, and a separate specialist Flood Risk and Drainage Report should be commissioned if such risk needs to be quantified.

11.11 No radon protective measures are required for properties constructed on the site.

11.12 There are no landfills within 250m of the site. However, due to the presence of a shallow coal seam below the site, a programme of ground gas monitoring has been implemented. Gas monitoring undertaken to date has identified maximum methane and carbon dioxide concentrations of zero and 1.8% v/v, respectively. Risk assessment indicates CS1 conditions (equivalent to Green using the NHBC traffic light system), and therefore no gas protection of new properties is indicated to be required. However, this can only be confirmed on completion of a further 4No. visits, over a two month period. The full results will be reported by separate letter on completion.

Ground Conditions Encountered

11.13 The ground investigation revealed up to 1.2m thickness of made ground or topsoil (generally much less), overlying residual subsoils derived from weathering of the underlying bedrock material: either sandy gravel of sandstone, or stiff clay (encountered locally in the west and south). A 0.2m thick band of coal was encountered at around 1.2m depth in the southwest. Bedrock was proven at depths ranging from 0.6m to 2.5m. The bedrock typically comprised sandstone, with mudstone proven locally in the west and south.

Contamination Assessment

11.14 The contamination testing revealed the topsoil to contain localised slightly elevated concentration of lead (210mg/kg), compared to the C4SL of 200mg/kg, and also dibenzo(a,h)anthracene (0.8mg/kg), compared to the S4UL of 0.28mg/kg. In both cases (WS2 and WS8), the topsoil had been reworked. In addition, the granular made ground containing ash and clinker was found to contain elevated dibenzo(a,h)anthracene at a concentration of 0.7mg/kg, and also chrysotile fibres.

11.15 The contamination risk assessment confirmed the materials present on the site are compatible with the proposed residential usage provided that the following remedial measures are implemented:

11.15.1 An asbestos survey should be carried out prior to any demolition or work on the existing buildings, and any identified asbestos to be removed and disposed of at a licensed facility.

11.15.2 The topsoil in the location of WS2 could be used on front gardens or landscaping, but if it is to be used in private rear gardens, it will require further sampling and testing, prior to development. The topsoil in the location of WS8 should be removed from site, or covered by at least 300mm of clean topsoil in a communal soft landscaping area, to a maximum combined topsoil thickness of 1m.

11.15.3 The granular made ground containing ash and clinker will require the provision of a cover blanket of a minimum 0.6m thickness, with a hard break layer beneath. Alternatively, the material could be retained below future hardstanding or disposed off-site. Remedial measures are not considered necessary for the other types of made ground encountered on the site.

11.15.4 A proposed Remediation Method Statement is included in Appendix F.

11.16 This Report should be issued to the local water company for it to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

Foundations

11.17 Traditional strip/trench fill foundations will be the most appropriate foundation type for low-rise housing. It is anticipated that the founding strata for the majority of the site will comprise natural sand and gravel (completely weathered sandstone) of at least medium density, with the exception of the west and south, where firm and stiff clays, overlying mudstone, are present locally.

11.18 An allowable bearing pressure of 200kN/m^2 is considered applicable for the granular completely weathered sandstone material, and 120kN/m^2 for the clays of at least firm consistency. Greater allowable bearing pressures (>200kN/m^2) could be assumed for deeper foundations taken into/onto either the mudstone or sandstone bedrock.

11.19 For the majority of the site, the founding strata will be non-plastic, and, therefore, the minimum foundation depths given in NHBC Standard Chapter 4.2 "Building Near Trees" do not apply. However, to protect against fines washing subsidence in the event of a burst water supply pipe, it is recommended that a minimum foundation depth of 0.9m is adopted for the granular soils.

11.20 The clay soils have been shown to be of Low Volume Change Potential. Therefore, in accordance with NHBC Standard Chapter 4.2 "Building Near trees", in the absence of trees, a minimum foundation depth of 0.75m below existing or proposed ground level is

applicable, whichever is the lower. However, in the presence of any proposed, existing or removed trees, the foundation may need to be deepened, depending on the type of tree and its distance from the face of the foundation.

11.21 The whole plan area of the foundation should be placed on similar material. If bedrock is encountered on part of a foundation excavation, the rest of the plot should be deepened to ensure founding on similar material. The foundation should also be taken below the depth of any existing foundations or obstructions, onto natural ground.

Excavations

11.22 It is likely that excavations into the natural strata will remain stable in the short term, requiring minimal trench support, in accordance with the prevailing statutory guidance. However, instability may be anticipated within any made ground present on the site.

11.23 Shallow groundwater is not expected. Any groundwater encountered in excavations should be controllable by pumping from an artificial sump.

11.24 Excavations should be readily achieved using conventional hydraulic plant. However, excavations into intact bedrock or any buried foundations and structures are likely to require a hydraulic breaker.

Chemical Precautions

11.25 The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1 for both the natural strata and made ground. Therefore, the use of GEN 1 designated concrete will be satisfactory for unreinforced foundations, in accordance with BS 8500-1:2006.

Road Pavement Construction

11.26 For any areas of road pavement, including parking areas, the formation level is likely to comprise granular soils. Below any obvious loose areas, and at equilibrium moisture content, a design California Bearing Ratio (CBR) value of 40% is considered applicable.

Formation of roads on the made ground will not be acceptable and the use of granular capping material may be required under pavement construction, subject to levels. Formation on clays is considered unlikely, but if present, a design CBR value of 4% is considered applicable.

Soakaways

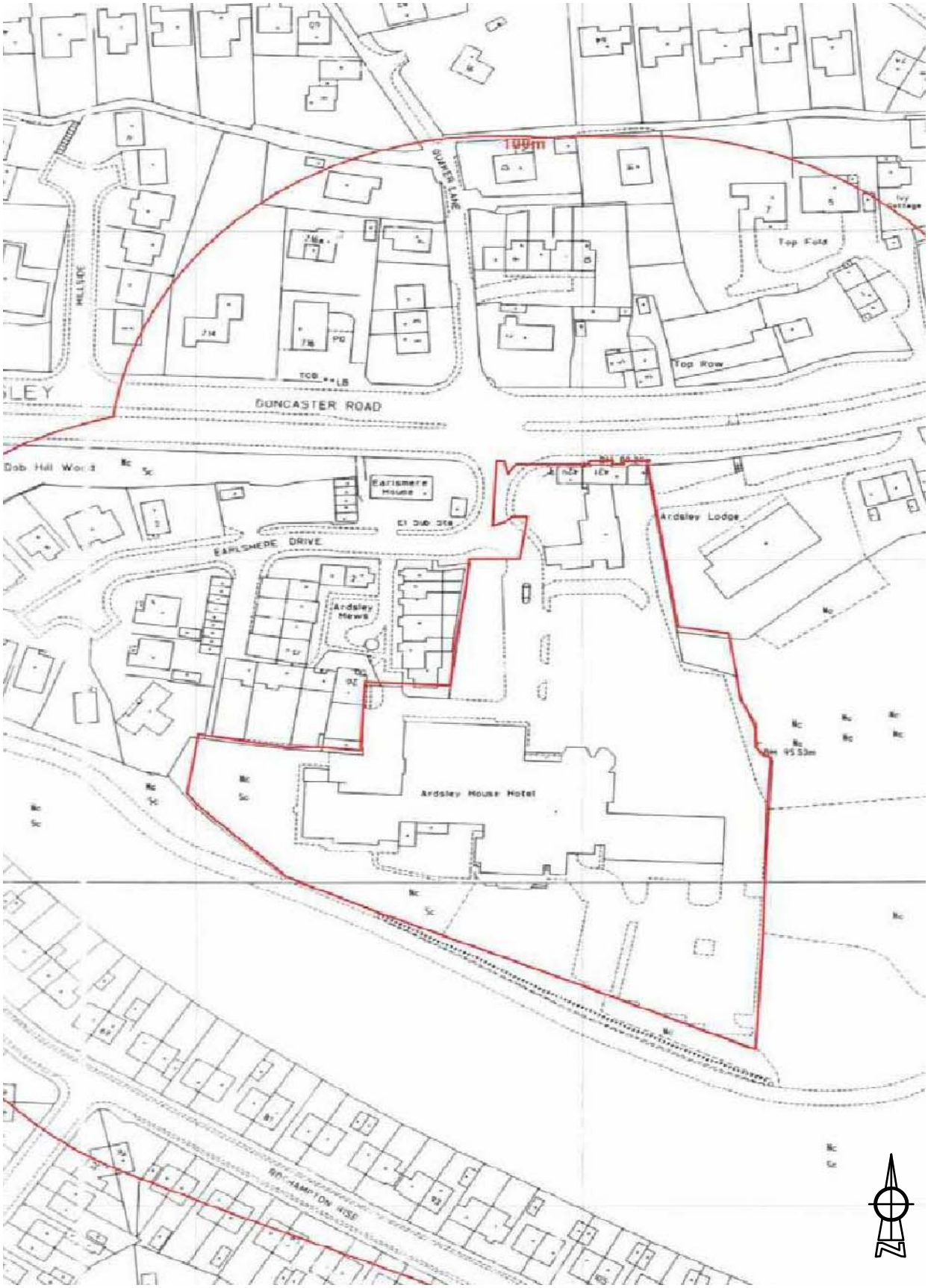
11.27 The disposal of surface water using soakaways may be possible in the south and east, but unlikely in the north. In addition, it is unlikely that soakaways would be practical in the west, where clay soils and mudstone bedrock have been proven.

A P P E N D I X A

SITE LOCATION PLAN AND SITE PLAN



Title SITE LOCATION PLAN	ARP GEOTECHNICAL LTD CHARTERED CONSULTING ENGINEERS Northwest House • 5/6 Northwest Business Park Servia Hill • Leeds LS6 2QH Telephone : 0113 245 8498 • Fax : 0113 244 3864 E-Mail : leeds@arpgeotechnical.co.uk	Scale NTS	Drawn FTH
		Date JUNE'15	Chk. JW
Project/ Client DONCASTER ROAD, BARNSLEY. ARNCLIFFE HOMES LTD.		Drg. No. ACF/20/SI.01	Rev.



Title

SITE PLAN

Project/ Client

DONCASTER ROAD, BARNSLEY.

ARNCLIFFE HOMES LTD.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House • 5/6 Northwest Business Park
Servia Hill • Leeds LS6 2QH
Telephone : 0113 245 8498 • Fax : 0113 244 3864
E-Mail : leeds@arpgeotechnical.co.uk

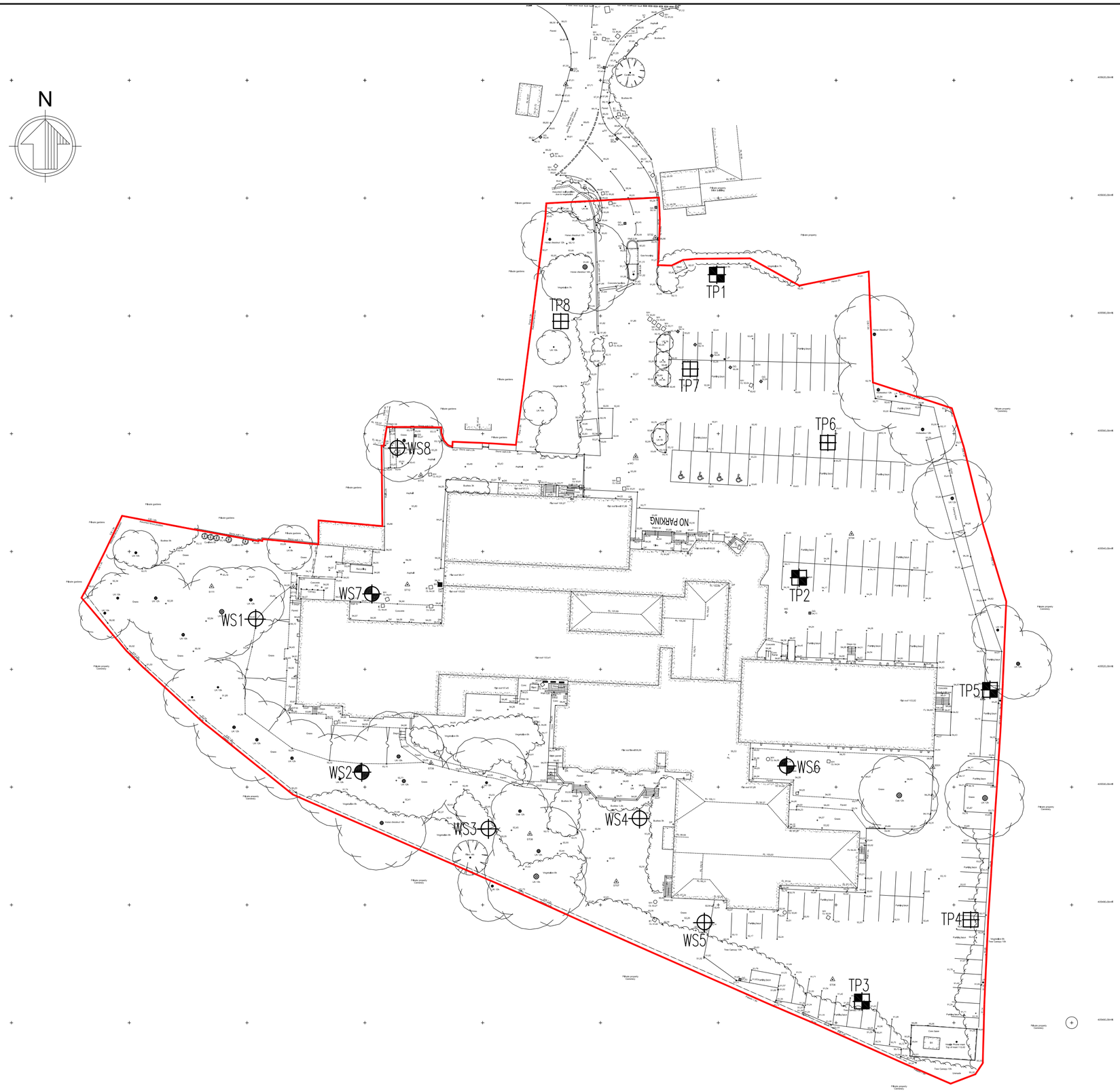
Scale	Drawn
NTS	FTH
Date	Chk.
JUNE'15	JW

Drg. No. ACF/20/SI.02

Rev.

A P P E N D I X B

BOREHOLE AND TRIAL PIT LOCATION PLAN AND LOGS



N O T E S

KEY:

- Trial Pit
- Trial Pit with Soakaway
- Window Sample Borehole
- Window Sample Borehole with Well installed

Rev	By	Date	Revision	Chk
/	FTH	04.06.15	Issued for approval	JW

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Northwest House • 5/6 Northwest Business Park • Servia Hill • Leeds LS6 2QH
Telephone: 0113 2458498 • Fax: 0113 2443864 • E-Mail: leeds@arpassociates.co.uk

TITLE

SITE INVESTIGATION PLAN

PROJECT

DONCASTER ROAD, BARNSLEY.

CLIENT

ARNCLIFFE HOMES LTD.

Scale	Date	Drawn	Chk.
1:500 @ A2	MAY 15	MW	JW

Drg. No.	Rev
ACF/20/SI.03	/

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.15-0.40	J1				(0.10) 0.10	MADE GROUND: Bitmac.		
					0.15	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone. [Sub-base]		
					(0.25) 0.40	MADE GROUND: Dark brown/black sandy angular gravel of red brick, ash, sandstone and occasional clinker.		
					(0.60) 1.00	MADE GROUND: Brown slightly sandy gravelly clay. Gravel is angular, of sandstone.		
					(1.20) 2.20	Orange brown sandy angular fine to coarse GRAVEL of sandstone. Occasional cobbles below 1.4m.		
					(0.15) 2.35	Weak orange brown SANDSTONE. Recovered as sandy angular gravel and cobbles. Terminated on hard strata.		
						Complete at 2.35m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Infiltration test undertaken in pit.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	MCB	ACF/20.TP01

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 01/05/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: Bitmac.		
					(0.15) 0.25	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone. [Sub-base]		
0.30-0.60	J1				(0.35) 0.60	MADE GROUND: Stiff brown grey slightly organic CLAY.		
					(0.40) 1.00	MADE GROUND: Stiff orange brown slightly gravelly sandy CLAY. Gravel is subangular, of sandstone.		
1.20	D2				(0.60) 1.60	Orange brown sandy angular fine to coarse GRAVEL of sandstone.		
					(0.40) 2.00	Weak orange brown fine to coarse grained SANDSTONE. Recovered as sandy, angular gravel.		
						Complete at 2.00m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Infiltration test undertaken in pit.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP02

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: Bitmac.		
					(0.15) 0.25	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone. [Sub-base]		
0.25-0.40	JB1				(0.15) 0.40	MADE GROUND: Dark grey angular fine to coarse GRAVEL of clinker.		
0.60	D2				(0.60) 1.00	Orange brown sandy angular fine to coarse GRAVEL of sandstone.		
					(0.80) 1.80	Orange brown sandy gravelly angular COBBLES of sandstone.		
					(0.70) 2.50	Light grey orange brown sandy angular fine to coarse GRAVEL and COBBLES of sandstone.		
					(0.10) 2.60	Weak orange brown fine to coarse grained SANDSTONE. Recovered as sandy, angular gravel.		
						Complete at 2.60m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Infiltration test undertaken in pit.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP03

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP04

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.08) 0.08	MADE GROUND: Bitmac.		
					(0.08) 0.16	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone. [Sub-base]		
0.25	JB1				(0.34)	MADE GROUND: Dark grey sandy angular fine to coarse GRAVEL of clinker, ash and occasional brick.		
					0.50	Orange brown sandy angular fine to coarse GRAVEL of sandstone.		
					(0.80)			
					1.30	Light grey orange brown sandy angular fine to coarse GRAVEL and COBBLES of sandstone.		
					(0.90)			
					2.20	Weak orange brown fine to coarse grained SANDSTONE. Recovered as sandy, angular gravel.		
					(0.10) 2.30	Complete at 2.30m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP04

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP05

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: Bitmac.		
					(0.20) 0.30	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone. [Sub-base]		
0.40	JB1				(0.60) 0.90	MADE GROUND: Grey brown clayey TOPSOIL, with rare coal and brick fragments.		
1.00	B2				(0.70) 1.60	Orange brown sandy angular fine to coarse GRAVEL of sandstone. Frequent sandstone cobbles.		
					(0.20) 1.80	Light grey orange brown sandy gravelly angular COBBLES of sandstone. At 1.80m: Trial pit terminated on sandstone bedrock.		
						Complete at 1.80m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Infiltration testing undertaken in pit.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP05

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	MADE GROUND: Bitmac.		
					(0.15)			
					0.20	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone, with limestone cobbles. [Sub-base]		
0.30	JB1				(0.30)	MADE GROUND: Stiff brown grey slightly organic slightly gravelly CLAY. Gravel is subangular, of sandstone and brick.		
					0.50	Orange brown sandy angular fine to coarse GRAVEL of sandstone. Occasional clay lenses.		
0.90	B2							
					(1.60)			
						Below 1.70m: Frequent sandstone cobbles.		
					2.10	Orange brown fine to coarse grained SANDSTONE.		
					(0.10)			
					2.20	Complete at 2.20m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP06

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP07

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.06	MADE GROUND: Bitmac.		
					(0.14)			
					0.20	MADE GROUND: Light brown angular fine to coarse GRAVEL of limestone, with limestone cobbles. [Sub-base]		
0.30-0.50	JB1				(0.30)	MADE GROUND: Stiff brown grey slightly organic slightly gravelly CLAY. Gravel is subangular, of sandstone and brick.		
					0.50	Orange brown sandy angular fine to coarse GRAVEL of sandstone. Frequent sandstone cobbles.		
					(1.30)			
					1.80	Orange brown fine to coarse grained SANDSTONE.		
					(0.10)			
					1.90	Complete at 1.90m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP07

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Doncaster Road, Barnsley	TP08

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX equipped with Two Foot Toothed Bucket			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Brown slightly gravelly clayey TOPSOIL. Gravel is subangular, of sandstone.		
0.30	JB1				0.50			
					(0.30)	Brown grey clayey sandy angular fine to coarse GRAVEL of sandstone, with frequent sandstone cobbles.		
					0.80			
					(0.90)	Orange brown clayey sandy angular fine to coarse GRAVEL of sandstone. Below 1.40m: Frequent sandstone cobbles.		
					1.70			
					1.75	Orange brown fine to coarse grained SANDSTONE. Complete at 1.75m		

Plan

Remarks

Excavation remained stable.
No groundwater encountered during excavation.
Trial pit backfilled with arisings on completion.

Scale (approx)	Logged By	Figure No.
1:25	JBW	ACF/20.TP08

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	JB1				(0.30) 0.30	Brown gravelly clayey TOPSOIL. Gravel is angular, of sandstone and brick.		
					(0.65)	Orange brown clayey sandy angular fine to coarse GRAVEL and COBBLES of sandstone.		
0.95-1.00 1.00-1.44	B2 SPT(C) 50/285		10,7/13,14,14,9		0.95 (0.49) 1.44	Extremely weak orange brown grey MUDSTONE.		
						Complete at 1.44m		

Remarks
SPT refusal at 1.44m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS01

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	JB1				(0.30) 0.30	MADE GROUND: Grey brown slightly gravelly clayey TOPSOIL. Gravel is angular, of coal and brick.		
					(0.20) 0.50	Orange brown clayey sandy angular fine to coarse GRAVEL of sandstone.		
0.90	B2				(0.67) 1.17	Very stiff orange brown gravelly CLAY with occasional cobbles. Gravel and cobbles are subangular, of sandstone.		
					(0.20) 1.37	Black angular fine and medium GRAVEL of coal.		
					(0.63) 2.00	Extremely weak laminated orange brown grey MUDSTONE.		
						Complete at 2.00m		

Remarks
Borehole refused at 2.00m.
No groundwater encountered during drilling.
Monitoring well installed to bottom of borehole, with upper 1m comprising plain pipe and bentonite surround and lower 1m slotted pipe with gravel surround, and fitted with flush cover.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS02

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site Doncaster Road, Barnsley			**Number** WS03
Excavation Method Tracked Window Sample Rig	**Dimensions**	**Ground Level (mOD)**	**Client** Arncliffe Homes Ltd	**Job Number** ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	JB1				(0.40)	Brown clayey TOPSOIL.		
					0.40			
					(0.20)	Orange brown slightly sandy clayey angular fine to coarse GRAVEL of sandstone.		
					0.60			
1.00-1.30	B2				(0.70)	Very weak light brown fine to coarse grained SANDSTONE.		
					1.30	Complete at 1.30m		

Remarks
Borehole refused at 1.30m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS03

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS04

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	JB1				(0.30)	Brown clayey TOPSOIL.		
					0.30	Orange brown slightly sandy clayey angular fine to coarse GRAVEL of sandstone.		
1.00-1.45	SPT(C) N=24		3,4/5,6,6,7		(1.10)	At 1.00m: Medium dense.		
					1.40			
1.50	B2				(0.40)	Very stiff grey orange brown slightly gravelly sandy CLAY. Gravel is angular, of sandstone.		
					1.80			
2.00-2.45	SPT(C) N=50		8,8/11,13,13,13		(0.65)	Extremely weak laminated grey brown sandy MUDSTONE.		
					2.45	Complete at 2.45m		

Remarks
SPT refusal at 2.45m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS04

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS05

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.20	JB1				(0.20) 0.20	Brown slightly gravelly clayey TOPSOIL.		
					(0.90)	Orange brown sandy angular fine to coarse GRAVEL of sandstone, with frequent sandstone cobbles.		
1.20	B2				1.10			
					(0.50)	Very stiff grey orange brown sandy CLAY.		
					1.60			
					(0.40)	Extremely weak laminated grey brown sandy MUDSTONE.		
					2.00	Complete at 2.00m		

Remarks
Borehole refused at 2.00m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS05

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly gravelly sandy TOPSOIL. Gravel is subangular, of sandstone.		
0.20-0.40	JB1				0.20	MADE GROUND: Grey brown clayey angular GRAVEL of brick, concrete and ceramic.		
					(0.60)	At 0.60m: Angular concrete cobble.		
					0.80	Firm grey brown silty CLAY.		
					(0.40)			
					1.20	Orange brown sandy angular fine to coarse GRAVEL of sandstone.		
					(0.70)			
					1.90			
					(0.10)	Very weak orange brown fine to coarse grained SANDSTONE.		
					2.00	Complete at 2.00m		

Remarks
Borehole refused at 2.00m.
No groundwater encountered during drilling.
Monitoring well installed to bottom of borehole, with upper 1m comprising plain pipe and bentonite surround and lower 1m slotted pipe with gravel surround, and fitted with flush cover.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS06

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site	Number
Doncaster Road, Barnsley	WS07

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Tracked Window Sample Rig			Arncliffe Homes Ltd	ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: Bitmac.		
					(0.30)	MADE GROUND: Light brown sandy angular GRAVEL of limestone.		
					0.40			
0.50-0.80	JB1				(0.80)	MADE GROUND: Medium dense orange brown and grey sandy ashy angular fine to coarse GRAVEL of limestone, sandstone and slate. Locally clayey.		
1.00-1.45	SPT(C) N=12		5,3/2,2,3,5		1.20			
1.50	D2				(0.70)	Firm (medium strength) orange brown mottled grey CLAY.		
					1.90			
2.00-2.44	SPT(C) 50/290		9,10/12,13,13,12		(0.54)	Extremely weak light brown grey fine to coarse grained SANDSTONE.		
					2.44	Complete at 2.44m		

Remarks
SPTrefused at 2.44m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS07

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Site Doncaster Road, Barnsley			**Number** WS08
Excavation Method Tracked Window Sample Rig	**Dimensions**	**Ground Level (mOD)**	**Client** Arncliffe Homes Ltd	**Job Number** ACF/20
	Location	**Dates** 30/04/2015	**Engineer** A R P	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50	JB1				(0.70)	MADE GROUND: Grey brown sandy TOPSOIL. Between 0.20m and 0.30m: Gravel of brick and limestone.		
					0.70 (0.15)	Orange brown sandy angular fine to coarse GRAVEL of sandstone.		
0.90	D2				0.85 (0.15)	Very stiff light brown sandy CLAY.		
					1.00 (1.00)	Orange brown sandy angular fine to coarse GRAVEL with frequent cobbles of sandstone.		
					2.00	Complete at 2.00m		

Remarks
Borehole refused at 2.00m.
No groundwater encountered during drilling.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:25	JBW

Figure No. ACF/20.WS08

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

A P P E N D I X C

PERCOLATION TEST RESULTS

ARP GEOTECHNICAL LTD

SITE:	**Former Ardsley House Hotel, Doncaster Road**
CLIENT:	**Arncliffe Homes Ltd**
JOB No:	**ACF/20**

TP1 TEST 1			**TP2 TEST 1**			**TP3 TEST 1**		
Depth of Pit	2.30	m	Depth of Pit	1.85	m	Depth of Pit	2.55	m
Depth to water at start	1.29	m	Depth to water at start	0.89	m	Depth to water at start	1.60	m
25% effective Depth	2.05	m	25% effective Depth	1.61	m	25% effective Depth	2.31	m
Depth used for calc*	1.77	m	Depth used for calc*	1.12	m	Depth used for calc*	2.55	m
Time (mins)	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**	**Time (mins)**	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**	**Time (mins)**	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**
0	1.29	0.48	0	0.89	0.23	0	1.60	0.95
1	1.30	0.47	1	0.91	0.21	2	1.89	0.66
2	1.31	0.46	2	0.92	0.20	3	2.00	0.55
3	1.32	0.45	3	0.93	0.19	4	2.11	0.44
4	1.33	0.44	4	0.93	0.19	6	2.27	0.28
5	1.34	0.43	7	0.95	0.18	7	2.32	0.23
6	1.35	0.43	9	0.95	0.17			
7	1.35	0.42	10	0.95	0.17			
8	1.35	0.42	15	0.97	0.15			
10	1.36	0.41	20	0.99	0.13			
15	1.39	0.38	30	1.00	0.12			
20	1.42	0.35	50	1.03	0.09			
31	1.47	0.30	81	1.09	0.03			
40	1.50	0.27	120	1.12	0.00			
50	1.53	0.24						
74	1.60	0.17						
108	1.67	0.10						
173	1.77	0.00						

* If water level passes 25% effective depth, actual depth of pit is used.

If water level does not pass 25% effective depth, final depth of water is used.

ARP GEOTECHNICAL LTD

SITE: Former Ardsley House Hotel, Doncaster Road
CLIENT: Arncliffe Homes Ltd
JOB No: ACF/20

TP3 TEST 2			TP3 TEST 3			TP5 TEST 1		
Depth of Pit	2.55	m	Depth of Pit	2.55	m	Depth of Pit	1.77	m
Depth to water at start	1.60	m	Depth to water at start	1.51	m	Depth to water at start	1.00	m
25% effective Depth	2.31	m	25% effective Depth	2.29	m	25% effective Depth	1.58	m
Depth used for calc*	2.55	m	Depth used for calc*	2.55	m	Depth used for calc*	1.77	m
Time (mins)	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**	**Time (mins)**	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**	**Time (mins)**	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**
0	1.59	0.96	0	1.51	1.04	0	1.00	0.77
2	1.81	0.74	1	1.70	0.85	1	1.03	0.74
3	1.90	0.65	2	1.80	0.75	3	1.08	0.69
4	1.99	0.56	3	1.88	0.67	4	1.12	0.65
5	2.07	0.48	4	1.96	0.59	6	1.15	0.62
6	2.14	0.41	5	2.04	0.51	8	1.21	0.56
7	2.20	0.35	6	2.12	0.43	9	1.23	0.54
8	2.26	0.29	8	2.19	0.36	15	1.33	0.44
9	2.31	0.24	9	2.24	0.31	21	1.42	0.35
10	2.35	0.20	10	2.30	0.25	25	1.49	0.28
						30	1.56	0.21
						38	1.62	0.15

* If water level passes 25% effective depth, actual depth of pit is used.

If water level does not pass 25% effective depth, final depth of water is used.

ARP GEOTECHNICAL LTD

SITE:	**Former Ardsley House Hotel, Doncaster Road**
CLIENT:	**Arncliffe Homes Ltd**
JOB No:	**ACF/20**

TP5 TEST 2			**TP5 TEST 3**		
Depth of Pit	1.77	m	Depth of Pit	1.77	m
Depth to water at start	0.96	m	Depth to water at start	1.07	m
25% effective Depth	1.57	m	25% effective Depth	1.60	m
Depth used for calc*	1.77	m	Depth used for calc*	1.58	m
Time (mins)	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**	**Time (mins)**	**Depth to Water Level (m.b.g.l)**	**Effective Depth of Water (m)**
0	0.96	0.81	0	1.07	0.51
1	0.99	0.78	1	1.10	0.48
2	1.01	0.76	4	1.14	0.44
4	1.06	0.71	7	1.17	0.41
6	1.09	0.68	9	1.19	0.39
9	1.14	0.63	15	1.28	0.30
20	1.29	0.48	20	1.34	0.24
30	1.42	0.35	25	1.38	0.20
40	1.53	0.24	30	1.44	0.14
50	1.60	0.17	45	1.58	0.00

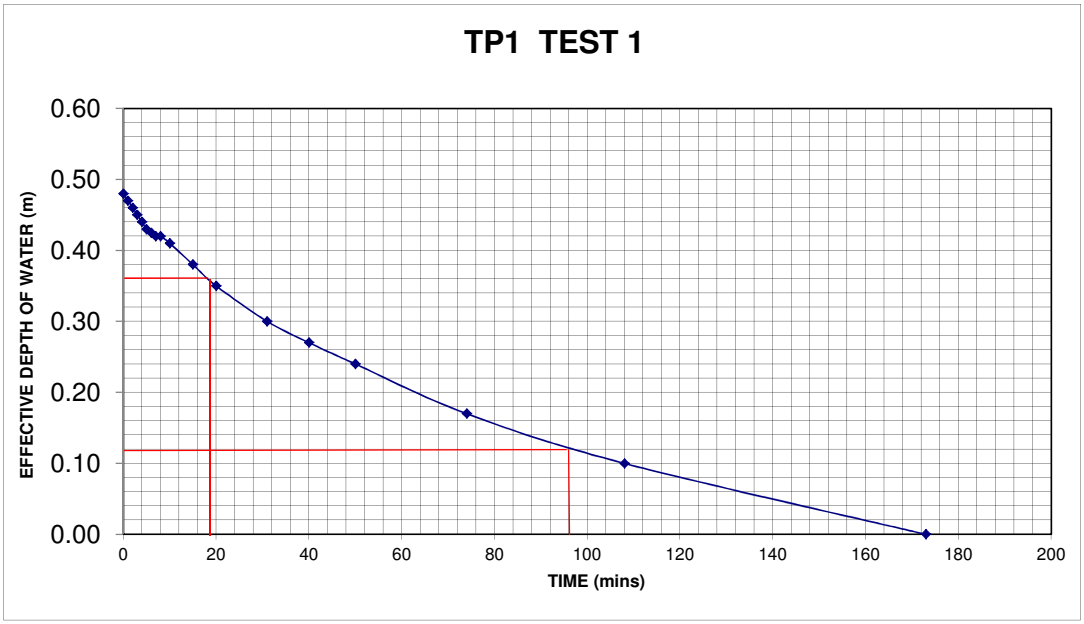
* If water level passes 25% effective depth, actual depth of pit is used.

If water level does not pass 25% effective depth, final depth of water is used.

ARP GEOTECHNICAL LTD

TP1 TEST 1

Depth of pit	2.300	
Depth water at start	1.290	
Depth used for calc*	1.77	
Length of hole at max. filled water level	1.600	Volume outflow (75% - 25% effective depth):
Length of hole at base	1.200	V_{p75} = 0.34 m^3
Average	1.400	
Width of hole at surface	1.000	Mean surface area (inc. base of pit)
Width of hole at base	1.000	a_{p50} = 2.552 m^2
Average	1.000	
Maximum effective depth	0.48	
75% effective depth	**0.360**	
50% effective depth	0.240	Time for discharge (75% and 25% effective depth):
25% effective depth	**0.120**	t_{p75-25} = 78 minutes
Depth of hole	2.300	
50% Effective depth	0.240	Soil infiltration rate:
		f = 2.81E-05 m/s
Time in mins at 75% effective depth (see curve)	18	
Time in mins at 25% effective depth (see curve)	96	



ARP GEOTECHNICAL LTD

TP2 TEST 1

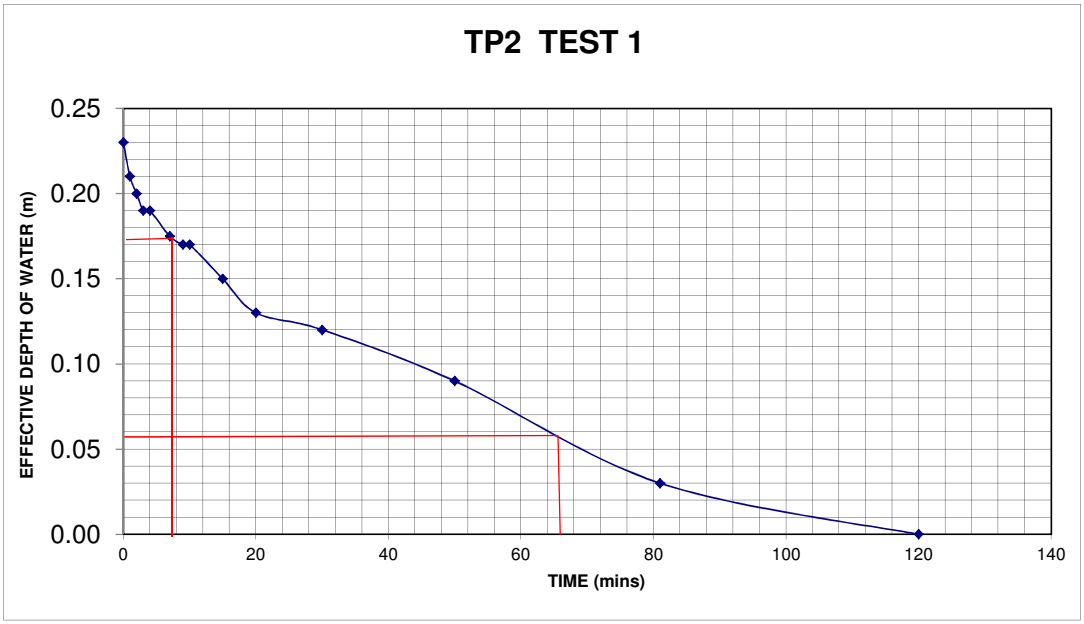
Depth of pit	1.850
Depth water at start	0.890
Depth used for calc*	1.12
Length of hole at max. filled water level	2.900
Length of hole at base	1.700
Average	2.300
Width of hole at surface	0.600
Width of hole at base	0.600
Average	0.600
Maximum effective depth	0.23
75% effective depth	**0.173**
50% effective depth	0.115
25% effective depth	**0.058**
Depth of hole	1.850
50% Effective depth	0.115
Time in mins at 75% effective depth (see curve)	7
Time in mins at 25% effective depth (see curve)	66

Volume outflow (75% - 25% effective depth):
$V_{p75} =$ 0.16 m^3

Mean surface area (inc. base of pit)
$a_{p50} =$ 2.047 m^2

Time for discharge (75% and 25% effective depth):
$t_{p75-25} =$ 59 minutes

Soil infiltration rate:
f = 2.19E-05 m/s



ARP GEOTECHNICAL LTD

TP3 TEST 1

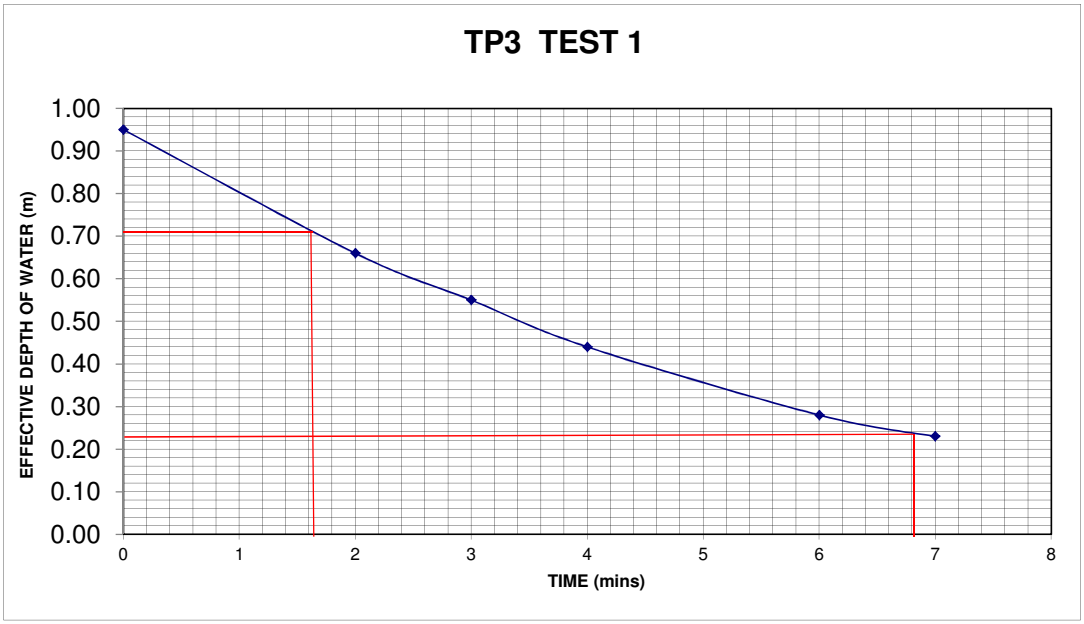
Depth of pit	2.550
Depth water at start	1.600
Depth used for calc*	2.55
Length of hole at max. filled water level	3.100
Length of hole at base	1.700
Average	2.400
Width of hole at surface	0.600
Width of hole at base	0.600
Average	0.600
Maximum effective depth	0.95
75% effective depth	**0.713**
50% effective depth	0.475
25% effective depth	**0.238**
Depth of hole	2.550
50% Effective depth	0.475
Time in mins at 75% effective depth (see curve)	1.6
Time in mins at 25% effective depth (see curve)	6.8

Volume outflow (75% - 25% effective depth):
$V_{p75} =$ 0.68 m^3

Mean surface area (inc. base of pit)
$a_{p50} =$ 4.29 m^2

Time for discharge (75% and 25% effective depth):
$t_{p75-25} =$ 5.2 minutes

Soil infiltration rate:
f = 5.11E-04 m/s



ARP GEOTECHNICAL LTD

TP3 TEST 2

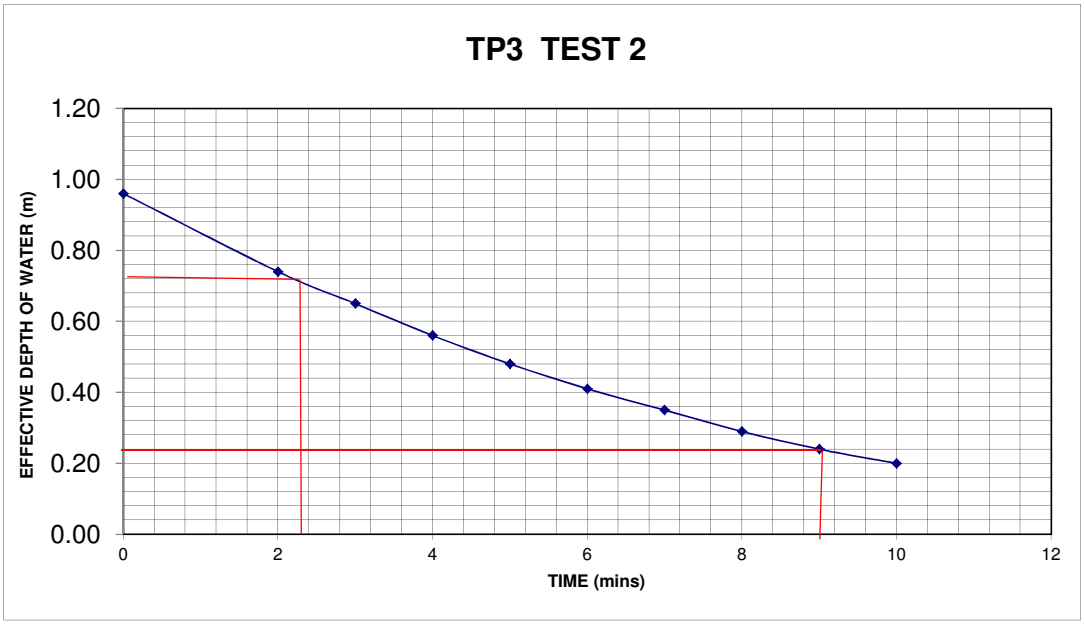
Depth of pit	2.550
Depth water at start	1.590
Depth used for calc*	2.55
Length of hole at max. filled water level	3.100
Length of hole at base	1.700
Average	2.400
Width of hole at surface	0.600
Width of hole at base	0.600
Average	0.600
Maximum effective depth	0.96
75% effective depth	**0.720**
50% effective depth	0.480
25% effective depth	**0.240**
Depth of hole	2.550
50% Effective depth	0.480
Time in mins at 75% effective depth (see curve)	2.3
Time in mins at 25% effective depth (see curve)	9

Volume outflow (75% - 25% effective depth):
$V_{p75} =$ 0.69 m^3

Mean surface area (inc. base of pit)
$a_{p50} =$ 4.32 m^2

Time for discharge (75% and 25% effective depth):
$t_{p75-25} =$ 6.7 minutes

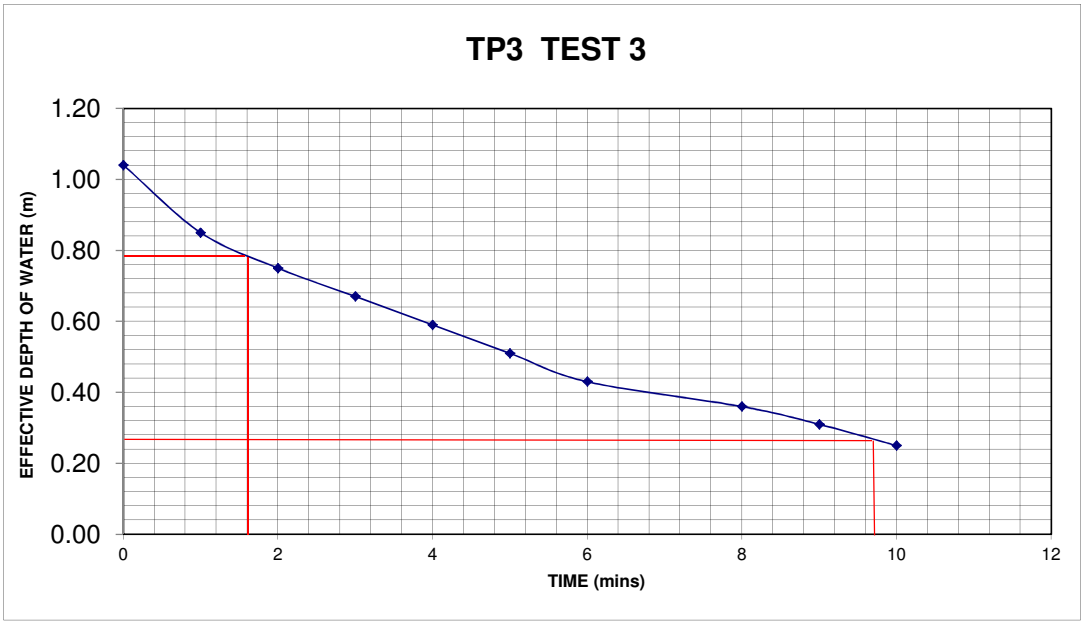
Soil infiltration rate:
f = 3.98E-04 m/s



ARP GEOTECHNICAL LTD

TP3 TEST 3

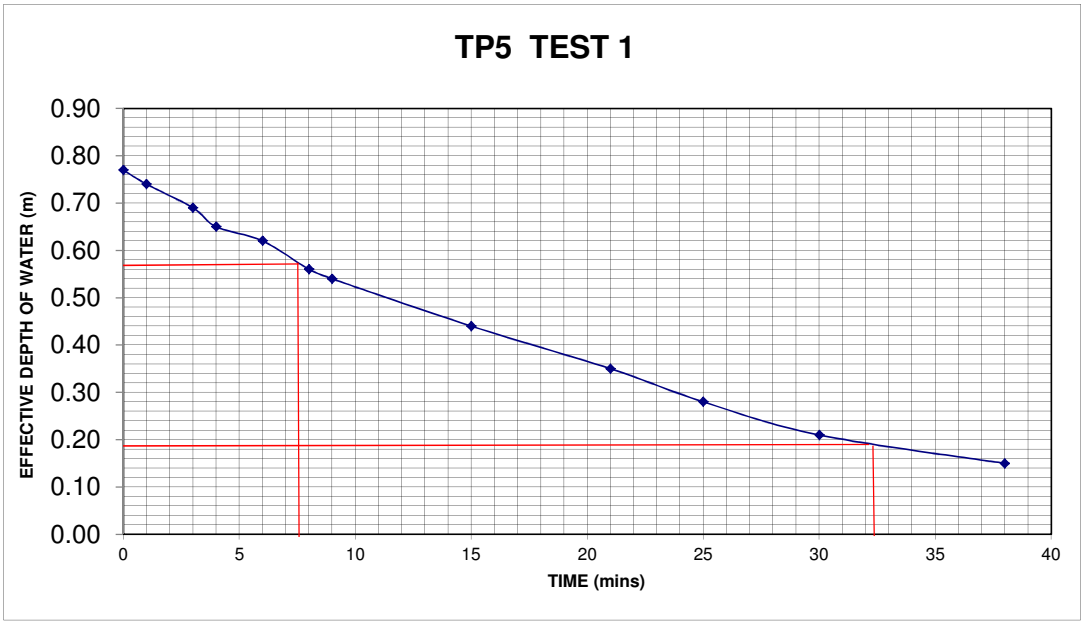
Depth of pit	2.550	
Depth water at start	1.510	
Depth used for calc*	2.55	
Length of hole at max. filled water level	3.100	Volume outflow (75% - 25% effective depth):
Length of hole at base	1.700	V_{p75} = 0.75 m^3
Average	2.400	
Width of hole at surface	0.600	Mean surface area (inc. base of pit)
Width of hole at base	0.600	a_{p50} = 4.56 m^2
Average	0.600	
Maximum effective depth	1.04	
75% effective depth	**0.780**	
50% effective depth	0.520	Time for discharge (75% and 25% effective depth):
25% effective depth	**0.260**	t_{p75-25} = 8.2 minutes
Depth of hole	2.550	
50% Effective depth	0.520	Soil infiltration rate:
		f = 3.34E-04 m/s
Time in mins at 75% effective depth (see curve)	1.6	
Time in mins at 25% effective depth (see curve)	9.8	



ARP GEOTECHNICAL LTD

TP5 TEST 1

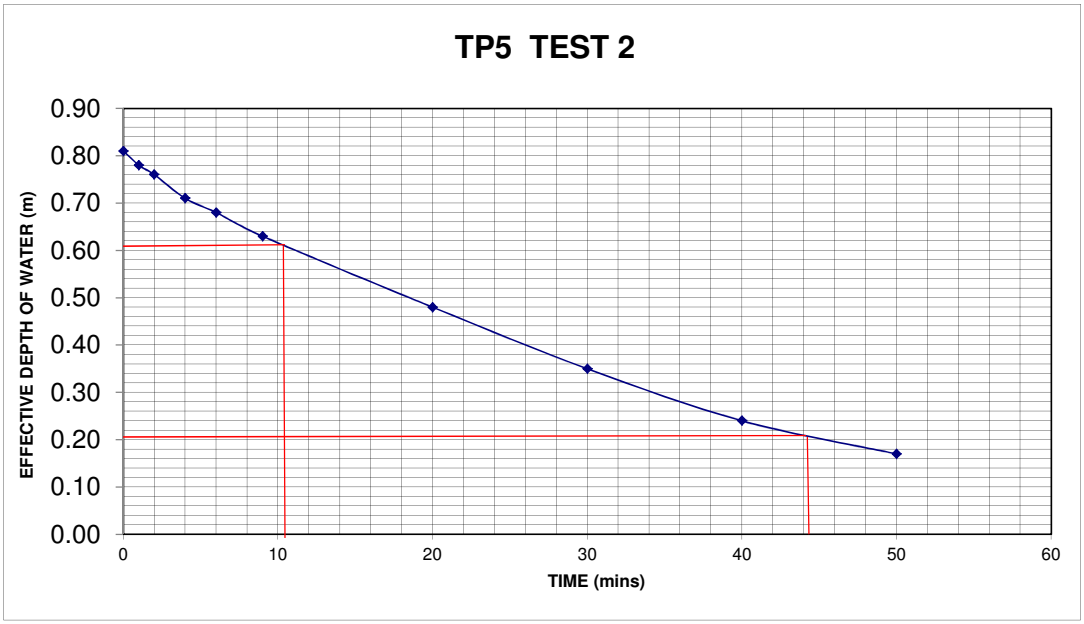
Depth of pit	1.770	
Depth water at start	1.000	
Depth used for calc*	1.77	
Length of hole at max. filled water level	2.600	Volume outflow (75% - 25% effective depth):
Length of hole at base	1.900	$V_{p75 =}$ 0.61 m^3
Average	2.250	
Width of hole at surface	0.700	Mean surface area (inc. base of pit)
Width of hole at base	0.700	$a_{p50 =}$ 3.8465 m^2
Average	0.700	
Maximum effective depth	0.77	
75% effective depth	**0.578**	
50% effective depth	0.385	Time for discharge (75% and 25% effective depth):
25% effective depth	**0.193**	$t_{p75-25 =}$ 25 minutes
Depth of hole	1.770	
50% Effective depth	0.385	Soil infiltration rate:
		f = 1.05E-04 m/s
Time in mins at 75% effective depth (see curve)	7.5	
Time in mins at 25% effective depth (see curve)	32.5	



ARP GEOTECHNICAL LTD

TP5 TEST 2

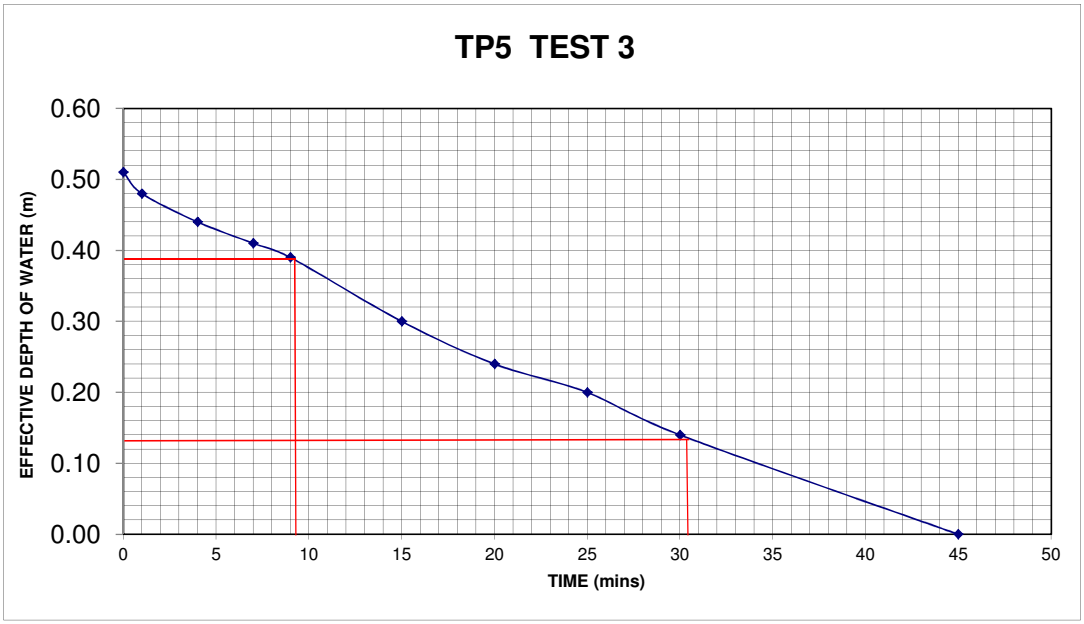
Depth of pit	1.770	
Depth water at start	0.960	
Depth used for calc*	1.77	
Length of hole at max. filled water level	2.600	Volume outflow (75% - 25% effective depth):
Length of hole at base	1.900	$V_{p75 =}$ 0.64 m^3
Average	2.250	
Width of hole at surface	0.700	Mean surface area (inc. base of pit)
Width of hole at base	0.700	$a_{p50 =}$ 3.9645 m^2
Average	0.700	
Maximum effective depth	0.81	
75% effective depth	**0.608**	
50% effective depth	0.405	Time for discharge (75% and 25% effective depth):
25% effective depth	**0.203**	$t_{p75-25 =}$ 33 minutes
Depth of hole	1.770	
50% Effective depth	0.405	Soil infiltration rate:
		f = 8.13E-05 m/s
Time in mins at 75% effective depth (see curve)	11	
Time in mins at 25% effective depth (see curve)	44	



ARP GEOTECHNICAL LTD

TP5 TEST 3

Depth of pit	1.770	
Depth water at start	1.070	
Depth used for calc*	1.58	
Length of hole at max. filled water level	2.600	Volume outflow (75% - 25% effective depth):
Length of hole at base	1.900	$V_{p75 =}$ 0.40 m^3
Average	2.250	
Width of hole at surface	0.700	Mean surface area (inc. base of pit)
Width of hole at base	0.700	$a_{p50 =}$ 3.0795 m^2
Average	0.700	
Maximum effective depth	0.51	
75% effective depth	**0.383**	
50% effective depth	0.255	Time for discharge (75% and 25% effective depth):
25% effective depth	**0.128**	$t_{p75-25 =}$ 21 minutes
Depth of hole	1.770	
50% Effective depth	0.255	Soil infiltration rate:
		f = 1.04E-04 m/s
Time in mins at 75% effective depth (see curve)	9.5	
Time in mins at 25% effective depth (see curve)	30.5	



A P P E N D I X D

LABORATORY TEST CERTIFICATES AND SCREENING VALUES

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 15-34131

13-May-15

Client ARP Geotechnical
5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH

Our Reference 15-34131

Client Reference ACF/20

Contract Title Former Ardsley House Hotel, Doncaster Road, Barnsley

Description 20 Soil samples.

Date Received 05-May-15

Date Started 06-May-15

Date Completed 13-May-15

Test Procedures Identified by prefix DETSn (details on request), Asbestos Analysis DETSC 1101.

Notes Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 15-34131
Client Ref ACF/20
Contract Title Former Ardsley House Hotel, Doncaster Road, Barnsley

			Lab No	806622	806623	806624	806625	806626	806627
			Sample ID	TP1	TP2	TP3	TP4	TP5	TP6
			Depth		0.30-0.60	0.25-0.40	0.25	0.40	0.30
			Other ID	D1					
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	13	7.6	6.8	21	26	12
Cadmium	DETSC 2301#	0.1	mg/kg	0.8	0.6	0.3	1.0	0.7	0.5
Chromium III	DETSC 2301*	0.15	mg/kg	19	15	77	27	19	20
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	120	13	33	130	29	22
Lead	DETSC 2301#	0.3	mg/kg	62	17	14	100	70	30
Mercury	DETSC 2325#	0.05	mg/kg	0.09	0.17	< 0.05	0.25	0.11	< 0.05
Nickel	DETSC 2301#	1	mg/kg	31	18	13	42	19	21
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	1.3	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	170	57	20	120	74	66
Inorganics									
pH	DETSC 2008#			8.6	6.7	11.3	8.3	7.8	7.3
Organic matter	DETSC 2002#	0.1	%	6.0	0.9	5.2	14	5.4	2.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	310	90	810	130	26	71
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.29	0.04	0.68	0.21	0.09	0.03
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	230	23	< 10	210	50	21
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	0.3	0.2	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	0.5
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	1.0
Phenanthrene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	< 0.1	3.0	1.7	2.4
Anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	< 0.1	0.9	0.5	0.7
Fluoranthene	DETSC 3301	0.1	mg/kg	2.0	< 0.1	< 0.1	6.8	2.5	1.9
Pyrene	DETSC 3301	0.1	mg/kg	2.1	< 0.1	< 0.1	6.3	2.3	1.7
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.1	< 0.1	< 0.1	3.1	1.2	0.7
Chrysene	DETSC 3301	0.1	mg/kg	1.2	< 0.1	< 0.1	3.2	1.1	0.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	1.2	< 0.1	< 0.1	2.5	0.8	0.5
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.7	< 0.1	< 0.1	1.7	0.5	0.3
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	< 0.1	3.0	1.1	0.5
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	1.5	< 0.1	< 0.1	2.4	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.7	< 0.1	< 0.1	0.7	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	1.0	< 0.1	< 0.1	1.9	< 0.1	< 0.1
PAH	DETSC 3301	1.6	mg/kg	14	< 1.6	< 1.6	37	12	11
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 15-34131
Client Ref ACF/20
Contract Title Former Ardsley House Hotel, Doncaster Road, Barns

			Lab No	806628	806629	806630	806631	806632	806633
			Sample ID	TP7	TP8	WS1	WS2	WS3	WS4
			Depth	0.30-0.50	0.30	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.30
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	13	14	11	12	14	23
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.6	0.7	0.9	0.6	1.2
Chromium III	DETSC 2301*	0.15	mg/kg	15	17	13	21	18	34
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	20	28	56	19	25	43
Lead	DETSC 2301#	0.3	mg/kg	49	83	84	210	65	83
Mercury	DETSC 2325#	0.05	mg/kg	0.07	0.24	0.14	0.07	0.38	0.15
Nickel	DETSC 2301#	1	mg/kg	15	17	12	21	16	32
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	68	81	80	82	60	120
Inorganics									
pH	DETSC 2008#			7.3	6.1	8.8	6.9	6.5	6.7
Organic matter	DETSC 2002#	0.1	%	2.9	4.6	5.2	4.9	4.0	4.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	62	30	110	31	76	37
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.04	0.11	0.08	0.03	0.06	0.08
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	19
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	0.3	< 0.1	< 0.1	0.4
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.6	< 0.1	< 0.1	1.0
Pyrene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	0.6	< 0.1	< 0.1	0.9
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	2.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	0.6	0.4	< 0.3	0.9

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 15-34131
Client Ref ACF/20
Contract Title Former Ardsley House Hotel, Doncaster Road, Barns

			Lab No	806634	806635	806636	806637	806638	806639
			Sample ID	WS5	WS6	WS7	WS8	TP6	TP2
			Depth	0.10-0.20	0.20-0.40	0.50-0.80	0.20-0.50	0.90	1.60
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15	30/04/15
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	16	12	5.2	19		
Cadmium	DETSC 2301#	0.1	mg/kg	0.9	0.9	0.7	1.2		
Chromium III	DETSC 2301*	0.15	mg/kg	29	34	8.3	25		
Hexavalent Chromium	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0		
Copper	DETSC 2301#	0.2	mg/kg	29	23	10	36		
Lead	DETSC 2301#	0.3	mg/kg	60	99	27	97		
Mercury	DETSC 2325#	0.05	mg/kg	0.12	0.07	< 0.05	0.19		
Nickel	DETSC 2301#	1	mg/kg	22	18	6.5	19		
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.6		
Zinc	DETSC 2301#	1	mg/kg	85	76	65	140		
Inorganics									
pH	DETSC 2008#			7.7	8.4	9.6	7.8	6.9	7.5
Organic matter	DETSC 2002#	0.1	%	4.0	2.0	0.9	4.5		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	30	48	140	56	38	230
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.05	0.07	0.13	0.07		
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	24	29	< 10	99		
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1		
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3		
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1		
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.4		
Phenanthrene	DETSC 3301	0.1	mg/kg	1.4	0.2	0.1	3.2		
Anthracene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	< 0.1	1.0		
Fluoranthene	DETSC 3301	0.1	mg/kg	1.5	0.3	0.3	5.3		
Pyrene	DETSC 3301	0.1	mg/kg	1.2	0.3	0.3	4.7		
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	2.7		
Chrysene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	2.2		
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	1.9		
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	< 0.1	1.2		
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	2.3		
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	1.4		
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.8		
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	1.0		
PAH	DETSC 3301	1.6	mg/kg	7.1	< 1.6	< 1.6	28		
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	1.1	< 0.3	< 0.3		

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 15-34131
Client Ref ACF/20
Contract Title Former Ardsley House Hotel, Doncaster Road, Barns

			Lab No	806640	806641
			Sample ID	WS1	WS3
			Depth	0.95-1.00	1.00-1.30
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/04/15	30/04/15
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg		
Cadmium	DETSC 2301#	0.1	mg/kg		
Chromium III	DETSC 2301*	0.15	mg/kg		
Hexavalent Chromium	DETSC 2204*	1	mg/kg		
Copper	DETSC 2301#	0.2	mg/kg		
Lead	DETSC 2301#	0.3	mg/kg		
Mercury	DETSC 2325#	0.05	mg/kg		
Nickel	DETSC 2301#	1	mg/kg		
Selenium	DETSC 2301#	0.5	mg/kg		
Zinc	DETSC 2301#	1	mg/kg		
Inorganics					
pH	DETSC 2008#			6.9	7.1
Organic matter	DETSC 2002#	0.1	%		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	34	13
Total Sulphate as SO4	DETSC 2321#	0.01	%		
Petroleum Hydrocarbons					
EPH (C10-C40)	DETSC 3311#	10	mg/kg		
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg		
Acenaphthylene	DETSC 3301	0.1	mg/kg		
Acenaphthene	DETSC 3301	0.1	mg/kg		
Fluorene	DETSC 3301	0.1	mg/kg		
Phenanthrene	DETSC 3301	0.1	mg/kg		
Anthracene	DETSC 3301	0.1	mg/kg		
Fluoranthene	DETSC 3301	0.1	mg/kg		
Pyrene	DETSC 3301	0.1	mg/kg		
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg		
Chrysene	DETSC 3301	0.1	mg/kg		
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg		
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg		
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg		
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg		
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg		
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg		
PAH	DETSC 3301	1.6	mg/kg		
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 15-34131
Client Ref ACF/20
Contract Title Former Ardsley House Hotel, Doncaster Road, Barnsley

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
806622	TP1 D1	SOIL	Chrysotile	Bundle of chrysotile	Michael Kay
806623	TP2 0.30-0.60	SOIL	NAD	none	Michael Kay
806624	TP3 0.25-0.40	SOIL	Chrysotile	Chrysotile present in gasket/insulation fragments	Michael Kay
806625	TP4 0.25	SOIL	Chrysotile	Bundles of chrysotile	Michael Kay
806626	TP5 0.40	SOIL	NAD	none	Michael Kay
806627	TP6 0.30	SOIL	NAD	none	Michael Kay
806628	TP7 0.30-0.50	SOIL	NAD	none	Michael Kay
806629	TP8 0.30	SOIL	NAD	none	Michael Kay
806630	WS1 0.10-0.30	SOIL	NAD	none	Michael Kay
806631	WS2 0.10-0.30	SOIL	NAD	none	Michael Kay
806632	WS3 0.10-0.30	SOIL	NAD	none	Michael Kay
806633	WS4 0.10-0.30	SOIL	NAD	none	Michael Kay
806634	WS5 0.10-0.20	SOIL	NAD	none	Michael Kay
806635	WS6 0.20-0.40	SOIL	NAD	none	Michael Kay
806636	WS7 0.50-0.80	SOIL	NAD	none	Michael Kay
806637	WS8 0.20-0.50	SOIL	NAD	none	Michael Kay

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 15-34131
Client Ref ACF/20
Contract Former Ardsley House Hotel, Doncaster Road, Barnsley

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
806622	TP1 SOIL	30/04/15	PG		Naphthalene, PAH FID, EPH/TPH
806623	TP2 0.30-0.60 SOIL	30/04/15	GJ 250ml, PG		
806624	TP3 0.25-0.40 SOIL	30/04/15	GJ 250ml, PG		
806625	TP4 0.25 SOIL	30/04/15	GJ 250ml, PG		
806626	TP5 0.40 SOIL	30/04/15	GJ 250ml, PG		
806627	TP6 0.30 SOIL	30/04/15	GJ 250ml, PG		
806628	TP7 0.30-0.50 SOIL	30/04/15	GJ 250ml, PG		
806629	TP8 0.30 SOIL	30/04/15	GJ 250ml, PG		
806630	WS1 0.10-0.30 SOIL	30/04/15	GJ 250ml, PG		
806631	WS2 0.10-0.30 SOIL	30/04/15	GJ 250ml, PG		
806632	WS3 0.10-0.30 SOIL	30/04/15	GJ 250ml, PG		
806633	WS4 0.10-0.30 SOIL	30/04/15	GJ 250ml, PG		
806634	WS5 0.10-0.20 SOIL	30/04/15	GJ 250ml, PG		
806635	WS6 0.20-0.40 SOIL	30/04/15	GJ 250ml, PG		
806636	WS7 0.50-0.80 SOIL	30/04/15	GJ 250ml, PG		
806637	WS8 0.20-0.50 SOIL	30/04/15	GJ 250ml, PG		
806638	TP6 0.90 SOIL	30/04/15	PG		
806639	TP2 1.60 SOIL	30/04/15	PG		
806640	WS1 0.95-1.00 SOIL	30/04/15	PG		
806641	WS3 1.00-1.30 SOIL	30/04/15	PG		

Key: P-Plastic G-Bag G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL15/2215

Client's Reference: ACF/20 Report Date: 11 May 2015

Client Name: ARP Associates
Northwest House
5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH

For the attention of: Jim Wilson

Contract Title: Former Ardsley Hose Hotel, Doncaster Road, Barnsley

Date Received: 05/05/2015
Date Commenced: 05/05/2015
Date Completed: 11/05/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
M Beastall (Laboratory Manager)



D Lambe (Senior Technician)
S Royle (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
WS2			0.90	Brown very sandy very silty CLAY.
WS5			1.20	Brown very sandy very silty CLAY.
WS8			0.90	Brown very sandy very silty CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
DL	11/05/15		11/05/15		11/05/15

FORMER ARDSLEY HOUSE HOTEL, DONCASTER ROAD, BARNSLEY.

Contract No: PSL15/2215

Client Ref: ACF/20

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
WS2			0.90	14				32	20	12	85	Low plasticity CL.
WS5			1.20	14				29	19	10	90	Low plasticity CL.
WS8			0.90	13				30	20	10	88	Low plasticity CL.

SYMBOLS : NP : Non Plastic *** : Liquid Limit and Plastic Limit Wet Sieved.**

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	11/05/15		11/05/15		11/05/15

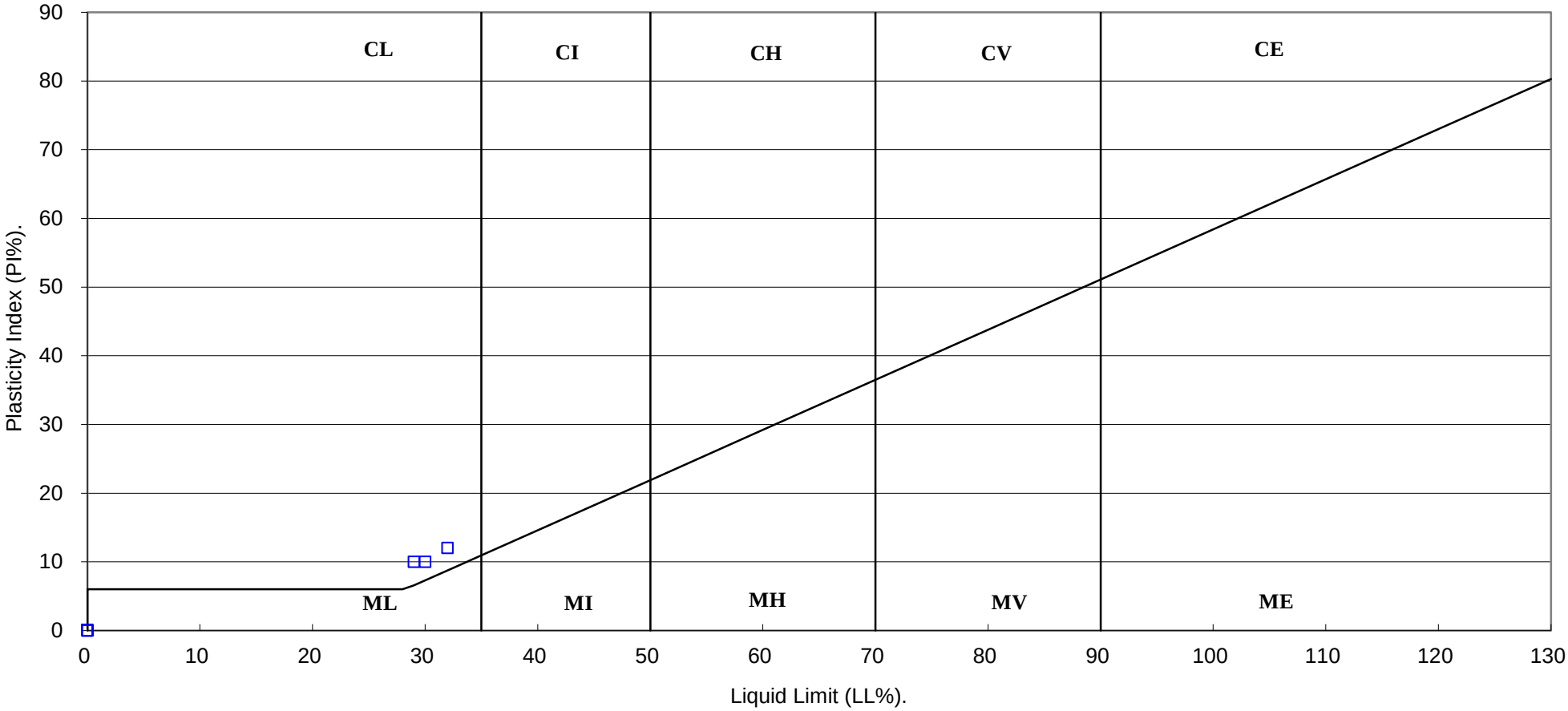
FORMER ARDSLEY HOUSE HOTEL, DONCASTER ROAD, BARNSLEY.

Contract No: **PSL15/2215**

Client Ref: **ACF/20**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		11/05/15		11/05/15		11/05/15
	FORMER ARDSLEY HOUSE HOTEL, DONCASTER ROAD, BARNSLEY.				Contract No:	PSL15/2215
					Client Ref:	ACF/20

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 15-34537

15-May-15

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	15-34537
Client Reference	PSL15/2215
Contract Title	FORMER ARDSLEY HOUSE HOTEL, DONCASTER RD, BARNSLEY
Description	2 Soil samples.
Date Received	11-May-15
Date Started	11-May-15
Date Completed	15-May-15
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 15-34537
Client Ref PSL15/2215
Contract Title FORMER ARDSLEY HOUSE HOTEL, DONCASTER RD, BARNSLEY

			Lab No	808782	808783
			Sample ID	WS4	WS7
			Depth	1.50	1.50
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Inorganics					
pH	DETSC 2008#			7.0	8.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	< 10	30

Key: # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 15-34537
Client Ref PSL15/2215
Contract FORMER ARDSLEY HOUSE HOTEL, DONCASTER RD, BARNSLEY

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
808782	WS4 1.50 SOIL		PG	Sample date not supplied	
808783	WS7 1.50 SOIL		PG	Sample date not supplied	

Key: P-Plastic G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

A R P G E O T E C H N I C A L L I M I T E D
SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITH HOME-GROWN PRODUCE

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				200		
Inorganic Mercury	40					
Selenium	250					
Copper	2400					
Nickel	180					
Zinc	3700					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Acenaphthene	210	510	1,100			
Acenaphthylene	170	420	920			
Anthracene	2,400	5,400	11,000			
Benzo(a)anthracene	7.2	11	13			
Benzo(a)pyrene	2.2	2.7	3			5
Benzo(b)fluoranthene	2.6	3.3	3.7			
Benzo(g,h,I)perylene	320	340	350			
Benzo(k)fluoranthene	77	93	100			
Chrysene	15	22	27			
Dibenzo(a,h)anthracene	0.24	0.28	0.3			
Fluoranthene	280	560	890			
Fluorene	170	400	860			
Indeno(1,2,3-cd)pyrene	27	36	41			
Naphthalene	2.3	5.6	13			
Phenanthrene	95	220	440			
Pyrene	620	1,200	2,000			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:			*Above 500, speciate and compare with values below (when published):		
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	48	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

S4ULs: Copyright Land Quality Management Ltd reproduced with permission; Publication No. S4UL3378. All rights reserved.

A R P G E O T E C H N I C A L L I M I T E D
SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	40			40		
Cadmium	85			150		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				310		
Elemental Mercury	1.2					
Inorganic Mercury	56					
Methyl Mercury	15					
Selenium	430					
Copper	7100					
Nickel	180					
Zinc	40000					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Acenaphthene	3000	4700	6000			
Acenaphthylene	2900	4600	6000			
Anthracene	31000	35000	37000			
Benzo(a)anthracene	11	14	15			
Benzo(a)pyrene	3.2	3.2	3.2			5.3
Benzo(b)fluoranthene	3.9	4	4			
Benzo(g,h,I)perylene	360	360	360			
Benzo(k)fluoranthene	110	110	110			
Chrysene	30	31	32			
Dibenzo(a,h)anthracene	0.31	0.32	0.32			
Fluoranthene	1500	1600	1600			
Fluorene	2800	3800	4500			
Indeno(1,2,3-cd)pyrene	45	46	46			
Naphthalene	2.3	5.6	13			
Phenanthrene	1300	1500	1500			
Pyrene	3700	3800	3800			
Phenols	440	690	1200			
Benzene	0.38	0.7	1.4			3.3
Toluene	880	1900	3900			
Ethylbenzene	83	190	440			
o-xylene	88	210	480			
m-xylene	82	190	450			
p-xylene	79	180	430			
Total TPH	*Above 500, speciate and compare with values below:			*Above 500, speciate and compare with values below (when published):		
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	770			
C12 to C16 Aliphatic	1100	2400	4400			
C16 to C35 Aliphatic	65000	92000	110000			
C35 TO C44 Aliphatic	65000	92000	110000			
C5 to C7 Aromatic (Benzene)	370	690	1400			
C7 to C8 Aromatic (Toluene)	860	1800	3900			
C8 to C10 Aromatic	47	110	270			
C10 to C12 Aromatic	250	590	1200			
C12 to C16 Aromatic	1800	2300	2500			
C16 to C21 Aromatic	1900	1900	1900			
C21 TO C35 Aromatic	1900	1900	1900			
C35 TO C44 Aromatic	1900	1900	1900			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

S4ULs: Copyright Land Quality Management Ltd reproduced with permission; Publication No. S4UL3378. All rights reserved.

A P P E N D I X E

GAS MONITORING RESULTS

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. ACF/20 **CLIENT:** ARNCLIFFE HOMES LTD

SITE: DONCASTER ROAD, BARNSLEY

BH: WS2

Date	BH Peak Flow (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
19/05/2015	0.1	0.0	0.000	0.7	0.001	20.2	DRY	2.02m to btm
03/06/2015	0.1	0.0	0.000	0.9	0.001	20.1	DRY	

* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. ACF/20 **CLIENT:** ARNCLIFFE HOMES LTD

SITE: DONCASTER ROAD, BARNSLEY

BH: WS6

Date	BH Peak Flow (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
19/05/2015	0.1	0.0	0.000	1.8	0.002	18.7	DRY	1.97m to btm
03/06/2015	0.1	0.0	0.000	1.7	0.002	19.2	DRY	

* Where no flow is detected, detection limit of 0.1l/hr should be inserted
Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. ACF/20 **CLIENT:** ARNCLIFFE HOMES LTD

SITE: DONCASTER ROAD, BARNSLEY

BH: WS7

Date	BH Peak Flow (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
19/05/2015	0.1	0.0	0.000	1.7	0.002	19.7	DRY	1.90m to btm
03/06/2015	0.1	0.0	0.000	1.4	0.001	18.2	DRY	

* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. ACF/20 **CLIENT:** ARNCLIFFE HOMES LTD

SITE: DONCASTER ROAD, BARNSLEY

BAROMETRIC PRESSURES

Monitor Date	Pressure on Site	Pressure on Day*	Day minus 1*	Day minus 2*	Trend*
19/05/2015	988	1000	1001	1020	Falling
03/06/2015	1006	1013	996	1004	Rising

*Pressures at midday, EGNM, corrected to sea level.

http://www.wunderground.com/history/

A P P E N D I X F

PROPOSED REMEDIATION METHOD STATEMENT

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

CONTAMINATION REMEDIATION METHOD STATEMENT

AT THE

FORMER ARDSLEY HOUSE HOTEL
DONCASTER ROAD
BARNSLEY

ON BEHALF OF

ARNCLIFFE HOMES LTD

JUNE 2015

Doc. No: ACF/20rem	Name	Signature	Date
Prepared By:	J B Wilson BEng FGS P.P.		8/6/15
Reviewed By:	A Radcliffe BEng CEng MIStructE	Mad	8/6/15

ARP GEOTECHNICAL LTD: Northwest House, 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH
☎ 0113 2458498 🖷 0113 2443864 ✉ leeds@arpgeotechnical.co.uk 🌐 www.arpgeotechnical.co.uk

A R N C L I F F E H O M E S L T D

F O R M E R A R D S L E Y H O U S E H O T E L
D O N C A S T E R R O A D
B A R N S L E Y

JUNE 2015

REMEDIATION METHOD STATEMENT

1.0 Introduction

1.1 This document has been prepared to provide information for the Client and other interested parties, such as the Regulatory Authorities, outlining how contamination encountered on the site will be managed to ensure that the site is environmentally suitable for the intended residential use. The document should be agreed, prior to implementation, with the relevant Regulatory Authorities, usually the local Planning Authority and NHBC or other building control provider.

2.0 The Site

2.1 The ARP Geotechnical Ltd Stage 2 Geo-Environmental Report, dated June 2015 under reference ACF/20r1, identifies the engineering proposals for the development, and makes an assessment of contamination.

2.2 The conceptual site model is for a residential development with private gardens.

2.3 The site is currently occupied by a disused hotel, with external areas of soft landscaping and car parking. It extends to an area of approximately 1.45 hectares and is irregular in shape. The main site area is generally level and flat, but slopes downwards gradually in the south and west, towards the boundaries. The site is generally surrounded by woodland except for some adjacent residential properties located to the northeast and northwest.

2.4 Ordnance Survey archive maps indicate that Ardsley House was present on the site from before the 1850s. The house was extended at various times during its history. It is understood that from the 1970s to 2014 it operated as a hotel.

2.5 The geological map shows the site to be underlain by Glass Houghton Rock, a sandstone unit, Undifferentiated Pennine Middle Coal Measures (MCM) - mudstone, siltstone and minor sandstones, are present approximately 55m to the southwest, beyond a coal seam outcrop. The outcrop and the undifferentiated strata are on lower ground, and will underlie the site. There are no faults shown to affect the site.

2.6 The site is not within a radon affected area.

2.7 The site investigation revealed up to 1.2m thickness of made ground or topsoil (generally much less), overlying residual granular and cohesive subsoils derived from weathering of

the underlying bedrock material: sandy gravel of sandstone on most of the site, and firm/stiff clay locally in the west and south. A 0.2m thick band of coal was encountered at around 1.2m depth in the southwest. Bedrock was proven at depths ranging from 0.6m to 2.5m. The bedrock typically comprised sandstone, with mudstone proven locally in the west and south. Groundwater was not encountered.

2.8 The contamination testing revealed the topsoil to contain locally a slightly elevated concentration of lead (210mg/kg), compared to the C4SL of 200mg/kg, and also dibenzo(a,h)anthracene (0.8mg/kg), compared to the S4UL of 0.28mg/kg. In both cases (WS2 and WS8), the topsoil had been reworked. In addition, the granular made ground containing ash and clinker was found to contain elevated dibenzo(a,h)anthracene at a concentration of 0.7mg/kg, and also chrysotile fibres.

3.0 Remediation Strategy

Topsoil at WS2

3.1 The slightly elevated concentration of lead in the topsoil at WS2 is below the C4SL for Residential without Home-grown Produce of 310mg/kg. Therefore, if the topsoil in the location of WS2 is used on areas of proposed front gardens or communal soft landscaping, then no remedial works would be required. However, if the material is to be used in private rear gardens, it is recommended that further sampling and testing of the topsoil material in this area is undertaken prior to development. Sampling of the topsoil at and around WS2 on a suitable grid should be implemented, along with laboratory testing of the samples for concentrations of lead. This will either confirm the original result at WS2 to be anomalous, and conclude that no further action needs to be taken, or define the contaminated area, so that the material can be either removed from site, or assessed further for other possible remedial options. This Remediation Statement would then be amended. The location of WS2 is indicated on the attached contamination summary plan.

Topsoil at WS8

3.2 The topsoil in the location of WS8, in which elevated dibenzo(a,h)anthracene was recorded, is currently isolated within a small existing landscaped area. The material is considered unsuitable to be used in future private gardens or be retained near the surface in future soft landscaping. Therefore, this isolated area of topsoil should be removed from site, or covered by at least 300mm of clean topsoil in a communal soft landscaping area, to a maximum combined topsoil thickness of 1m.

Made Ground Containing Ash & Clinker

3.3 The granular made ground containing ash and clinker, proven in TP1 (in the north) and TP3 and TP4 (in the south) will require the provision of a cover blanket of a minimum 0.6m thickness, with a hard break layer beneath, in part due to the presence of chrysotile fibres. Alternatively, the material could be retained below future hardstanding or disposed of off-site.

3.4 The cover blanket must be clean and uncontaminated, and at least 0.6m thick, as detailed below.

Thickness (mm)	Description
Minimum 150	Topsoil
Minimum 450	Subsoil
Minimum 100	Hard Break Layer

4.0 Materials Testing and Validation

4.1 To satisfy the Regulatory Authorities, verification that the above measures have been successfully implemented needs to be independently confirmed, in accordance with the guidance supplied in the document produced by the Yorkshire and Humberside Pollution Advisory Council (YAHPAC): "Guidance on the Verification Requirements for Cover Systems". The measures described below will be required to ensure compliance with the document.

Topsoil at WS2

4.2 The topsoil at WS2 could be used on front gardens or communal landscaped areas, with no further action. However, if it is proposed to use the topsoil in proposed private rear gardens, further testing will be required to confirm its suitability for use.

Topsoil at WS8

4.3 If this isolated area of topsoil is removed from site, the area shall be inspected and a photographic record made to confirm removal of all the affected material. In addition, samples shall be taken from the edges and base of the excavation and tested to confirm acceptability. Consignment notes shall be retained for inclusion in the Validation Report.

4.4 If the topsoil at WS8 is covered by at least 300mm of clean topsoil in a communal soft landscaping area, to a maximum combined topsoil thickness of 1m, then this will need to be confirmed by excavation of trial pits on completion of the area, on a 25m grid. The upper 0.3m thickness will be sampled and tested in a UKAS accredited laboratory for the suite of determinands appended to this Statement, and compared against the values given for "residential without home-grown produce".

Made Ground Containing Ash & Clinker

4.5 On completion of the works to place the made ground below hard areas and/or below a cover blanket in soft areas, trial pits shall be carried out on the basis of between one per two to three plots to confirm either the absence of contaminated material from soft areas, or the placement of the appropriate thickness of cover blanket materials. The trial pits will be photographed, to include a reference scale, and the photographs included within any report to enable the location on site to be identified.

Imported Soils

4.6 It is anticipated that topsoil and/or subsoil will be imported for future garden areas. For any imported material, the source will need to be confirmed, and the material tested for the attached suite of contaminants, to comply with the maximum screening values listed

appropriate to the proposed use (residential with home-grown produce for rear gardens, and residential without home-grown produce for communal landscaping and front gardens. The frequency of testing is given on the table below.

Material Type	**Number of Samples**
Topsoil or subsoil from greenfield site	Minimum 3No. or 1 per 250m^3 (whichever is greater)
Topsoil or subsoil from brownfield site	Minimum 6No. or 1 per 100m^3 (whichever is greater)

4.7 The material should be placed in quarantined stockpiles and once a stockpile has been approved by the Engineer, no further material should be added to the stockpile, and any further import should be stockpiled separately. Any cross contamination of materials should be avoided, and further testing carried out where any cross contamination is suspected to have occurred.

4.8 If space is insufficient on the site to store quarantined stockpiles, cover blanket materials can be placed directly into the appropriate gardens/landscape areas, but samples of each material would need to be tested from each of the validation trial pits discussed in Section 4.4.

4.9 The results of all the laboratory analysis, excavation logs, plans, photographs, and import/disposal documents will form part of the Remediation Validation Report.

4.10 In order to enable the scheme to progress and sales of properties to continue throughout the construction of the development, interim Validation Reports may be prepared for specific areas, showing how the contamination has been dealt with. This will enable enquiries during the sales of the properties to be satisfied and a final Validation Report will be prepared at the end of the development, incorporating all the interim reports to satisfy the planning conditions.

5.0 Unexpected Contamination

5.1 Any unexpected contamination uncovered during the works shall be inspected, sampled and analysed in laboratory for the suite of determinands appended to this Remediation Statement, and compared to the maximum concentration levels listed on the enclosure. Works on the affected materials shall cease until the appraisal is complete and, if necessary, a revised Remediation Statement is to be prepared and approved by the Planning Authority before work is recommenced.

6.0 Protection of Workers and the Public During Development Works

6.1 Damping down of the site should be implemented during dry periods, and timely placement of contaminated fill below barriers.

6.2 Washing facilities and a clean mess room from which work boots and overalls are excluded, should be provided.

6.3 Site fencing will be provided to exclude access to members of the public, and contaminated material will be contained within the site boundary, and placed below barriers as soon as possible.

6.4 Workers will be educated to use adequate hygiene and PPE.

6.5 Surface water run off should be prevented by minimising open exposure times of contaminated material and using bunds or cut off trenches as necessary.

6.6 Movement of contamination off site on vehicle wheels shall be minimised by cleaning of vehicle wheels and/or use of road sweeper, as required.

remA

A R P G E O T E C H N I C A L L I M I T E D
SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITH HOME-GROWN PRODUCE

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				200		
Inorganic Mercury	40					
Selenium	250					
Copper	2400					
Nickel	180					
Zinc	3700					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Acenaphthene	210	510	1,100			
Acenaphthylene	170	420	920			
Anthracene	2,400	5,400	11,000			
Benzo(a)anthracene	7.2	11	13			
Benzo(a)pyrene	2.2	2.7	3			5
Benzo(b)fluoranthene	2.6	3.3	3.7			
Benzo(g,h,I)perylene	320	340	350			
Benzo(k)fluoranthene	77	93	100			
Chrysene	15	22	27			
Dibenzo(a,h)anthracene	0.24	0.28	0.3			
Fluoranthene	280	560	890			
Fluorene	170	400	860			
Indeno(1,2,3-cd)pyrene	27	36	41			
Naphthalene	2.3	5.6	13			
Phenanthrene	95	220	440			
Pyrene	620	1,200	2,000			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:			*Above 500, speciate and compare with values below (when published):		
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	48	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

S4ULs: Copyright Land Quality Management Ltd reproduced with permission; Publication No. S4UL3378. All rights reserved.

A R P G E O T E C H N I C A L L I M I T E D
SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	40			40		
Cadmium	85			150		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				310		
Elemental Mercury	1.2					
Inorganic Mercury	56					
Methyl Mercury	15					
Selenium	430					
Copper	7100					
Nickel	180					
Zinc	40000					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Acenaphthene	3000	4700	6000			
Acenaphthylene	2900	4600	6000			
Anthracene	31000	35000	37000			
Benzo(a)anthracene	11	14	15			
Benzo(a)pyrene	3.2	3.2	3.2			5.3
Benzo(b)fluoranthene	3.9	4	4			
Benzo(g,h,I)perylene	360	360	360			
Benzo(k)fluoranthene	110	110	110			
Chrysene	30	31	32			
Dibenzo(a,h)anthracene	0.31	0.32	0.32			
Fluoranthene	1500	1600	1600			
Fluorene	2800	3800	4500			
Indeno(1,2,3-cd)pyrene	45	46	46			
Naphthalene	2.3	5.6	13			
Phenanthrene	1300	1500	1500			
Pyrene	3700	3800	3800			
Phenols	440	690	1200			
Benzene	0.38	0.7	1.4			3.3
Toluene	880	1900	3900			
Ethylbenzene	83	190	440			
o-xylene	88	210	480			
m-xylene	82	190	450			
p-xylene	79	180	430			
Total TPH	*Above 500, speciate and compare with values below:			*Above 500, speciate and compare with values below (when published):		
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	770			
C12 to C16 Aliphatic	1100	2400	4400			
C16 to C35 Aliphatic	65000	92000	110000			
C35 TO C44 Aliphatic	65000	92000	110000			
C5 to C7 Aromatic (Benzene)	370	690	1400			
C7 to C8 Aromatic (Toluene)	860	1800	3900			
C8 to C10 Aromatic	47	110	270			
C10 to C12 Aromatic	250	590	1200			
C12 to C16 Aromatic	1800	2300	2500			
C16 to C21 Aromatic	1900	1900	1900			
C21 TO C35 Aromatic	1900	1900	1900			
C35 TO C44 Aromatic	1900	1900	1900			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

S4ULs: Copyright Land Quality Management Ltd reproduced with permission; Publication No. S4UL3378. All rights reserved.

N

Ash & Clinker Made Ground
If this material is to remain below future soft landscaping, a 0.6m cover blanket with 0.1m 'no dig' layer will be required. Alternatively, it could be retained below future hard areas or disposed of off site

TP1
D(a, h)A 0.7 mg/kg
Chrysotile

TP8

Isolated area of topsoil to be removed, or blinded with >0.3m of clean topsoil.

D(a, h)A 0.8 mg/kg

WS8

TP7

TP6

NO PARKING

WS7

TP2

WS1

TP5

Pb 210 mg/kg

WS2

WS6

WS3

WS4

Further testing of topsoil required, if to be used in future gardens

Ash & Clinker Made Ground
If this material is to remain below future soft landscaping, a 0.6m cover blanket with 0.1m 'no dig' layer will be required. Alternatively, it could be retained below future hard areas or disposed of off site

TP4
D(a, h)A 0.7 mg/kg
Chrysotile

WS5

TP3
Chrysotile

Ash & Clinker Made Ground
If this material is to remain below future soft landscaping, a 0.6m cover blanket with 0.1m 'no dig' layer will be required. Alternatively, it could be retained below future hard areas or disposed of off site

N O T E S

KEY:

- Trial Pit
- Trial Pit with Soakaway
- Window Sample Borehole
- Window Sample Borehole with Well installed

Rev	By	Date	Revision	Chk
/		02.05.15	Issued for approval	

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Northwest House • 5/6 Northwest Business Park • Servia Hill • Leeds LS6 2QH
Telephone: 0113 2458498 • Fax: 0113 2443864 • E-Mail: leeds@arpassociates.co.uk

TITLE
CONTAMINATION SUMMARY PLAN

PROJECT
DONCASTER ROAD, BARNSLEY.

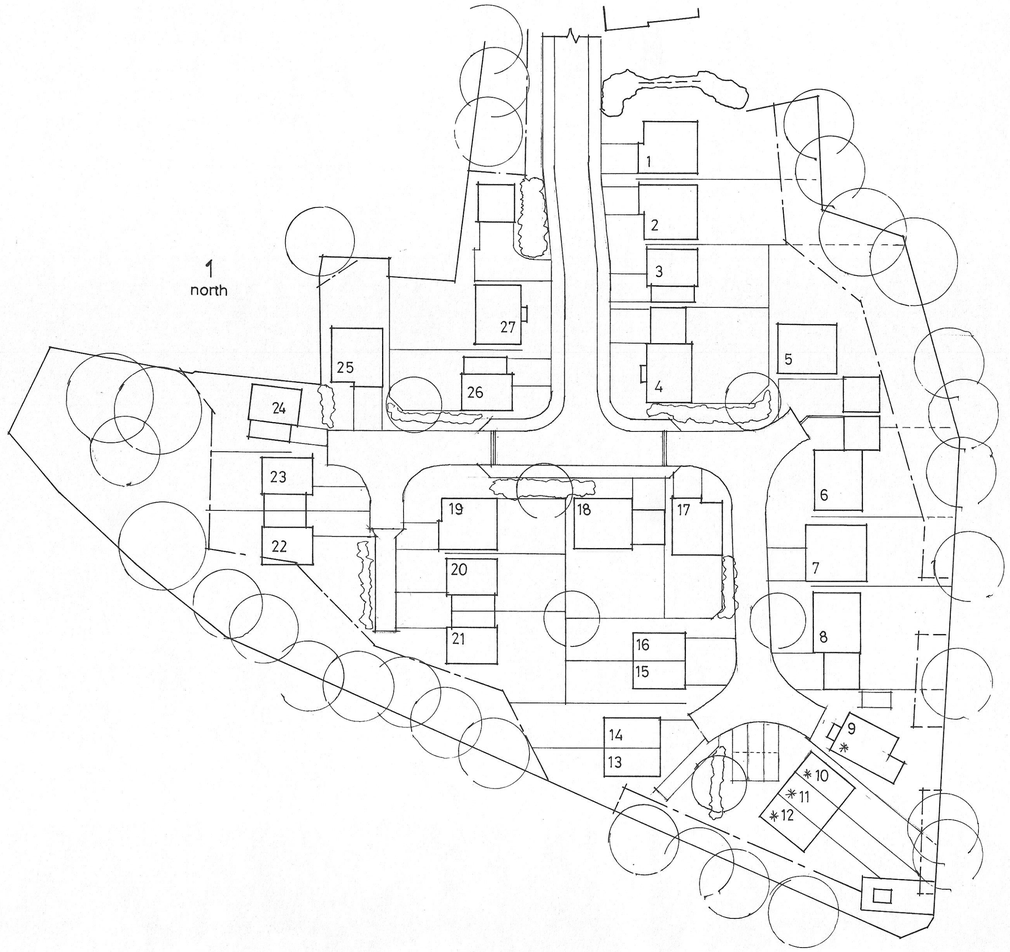
CLIENT
ARNCLIFFE HOMES LTD.

Scale	Date	Drawn	Chk.
1:500 @ A2	MAY 15	FTH	JW

Drg. No. ACF/20/SI.04 Rev /

A P P E N D I X G

INDICATIVE PROPOSED DEVELOPMENT



SCHEDULE OF ACCOMMODATION

NEWBURY 5 BEDROOM 3 STOREY DETACHED WITH DOUBLE GARAGE
X 4 No

EPWORTH 4 BEDROOM 2 STOREY DETACHED WITH DOUBLE GARAGE
X 2No

RICHMOND 4 BEDROOM 2 STOREY DETACHED WITH SINGLE GARAGE
X 6No

REGENT 4 BEDROOM 2 STOREY DETACHED/LINKED WITH SINGLE GARAGE
X 7No

MULBERRY 3 BEDROOM 2 STOREY SEMI DETACHED WITH PARKING
X 4No

AFFORDABLE MARKED * ON PLAN

BIRCH 2 BEDROOM 2 STOREY TERRACE WITH PARKING
X 3No

HAMPTON 2 BEDROOM BUNGALOW WITH PARKING
X 1No

TOTAL NUMBER OF DWELLINGS

27 No

Arncliffe
ARNCLIFFE HOMES LIMITED
Tel: 0113 235 0356 Fax: 0113 235 0894

Proposed Residential Development

ARDSLEY HOUSE HOTEL

BID PROPOSAL

SCALE 1:500

DATE FEB 15 DRAWN

DRG. No. SK 1 REV.

S Ltd L7984