

**Proposed Rockingham Development
Birdwell**

Phase II Geo-Environmental Assessment

For

Hartwood Estates Ltd.

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Rockingham Development, Birdwell Phase II Geo-Environmental Assessment

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Executive Summary

Site Investigation	The investigation has involved: • Review of an existing desk study report. • 20 trial pits to a maximum depth of 4.0m • 9 mini percussion boreholes to a maximum depth of 4.0m. • Installation of ground gas monitoring wells. • Geotechnical and contamination related testing. • Preliminary ground gas and groundwater monitoring.
Current Use	The site is open and unoccupied with overgrown scrub vegetation and long grass with numerous semi mature and mature trees along the boundaries. The site is uneven with lower lying parts of the site being saturated soils with bog grass present identifying that it is a regular condition on the site.
Site History	In house data identifies the site to have been on the fringes of an opencast mine, which was backfilled in the 1990s. Historical reports suggest that engineered made ground soils comprising colliery spoil were present to depths of between 0.8m and >4.0m. A former mineral railway in a potential shallow cutting is also present running northeast/southwest along the northern boundary.
Ground Conditions	The site is covered by made ground materials between 0.3m and >4.0m in thickness. The deeper areas of made ground were proven in the eastern part of the site however it does appear to be very variable in terms of depth rather than a consists increase in depth. The made ground generally comprised mudstone gravels in a clayey matrix (Colliery Spoil), reworked gravelly clay or clay bound gravel and sandstone and brick. The made ground is generally underlain by firm to stiff residual clay or directly by weathered bedrock.
Groundwater	Groundwater was encountered sporadically within the made ground at depths between 1.3m and 2.7m and prevented excavation progress in one location (TP09). During the preliminary monitoring visits, three wells were found to be dry or damp at base to a maximum depth of 2.50m bgl. However, a single well (BH07) was fully waterlogged during the first visit, with groundwater noted at 1.38m bgl during the second visit.
Gas Monitoring	Ground gas monitoring has been carried out on 2 occasions to date, with four further visits are planned. The results of the preliminary gas monitoring results indicate that no combustible ground gas (methane) is present and low concentrations of carbon dioxide (20.9% v/v). The results suggest a CIRIA C665 Characteristic Situation 2, where basic precautions are required.
Contamination	Information obtained during the desk study by Enzygo indicated a low to moderate risk of contamination. No physical evidence of contamination was encountered during the intrusive works and the results of the laboratory chemical analysis indicate low determinand concentrations which do not exceed the generic assessment criteria for human health for the proposed commercial end use.

Appraisal	Remediation – Based on the laboratory test results the proposed development with areas of building and hardstanding will be sufficient to break the latent pollutant pathway between the made ground and end users. Where soft landscaping areas are present, a capping of 300mm of imported capping materials will be required to provide a suitable growing media and protect against any latent contamination. Imported soil will need to be validated to ensure it does not pose a risk to the environment. Where more sensitive end uses such as a crèche are proposed the capping depth may need to be increased in areas of private soft landscaping. Disposal of Materials - Waste classification testing has not been carried out, however, an initial assessment suggests that generally, the made ground is considered to be suitable for disposal as inert waste. Mining – Based on the findings of the desk study the site is considered to be stable with respect to mining. Foundations and Floor Slabs – At this stage, the natural residual clays appear suitable for pad and strip foundations at a minimum depth of 900mm based on an allowable bearing capacity of 100kN/m² in the western and extreme southern parts of the site. Foundations will need to be deepened for heave where effected by trees which are present, particularly around the western and northern boundaries. Elsewhere where deep variable made ground is present an alternative foundation solution will be required. This could be ground improvement by vibro stone columns, although allowance for pre boring of the columns may be required, or the adoption of raft foundations on fully re-engineered fill materials where building size and sensitivity allows. Alternatively, large scale settlement testing could be carried out to determine the settlement characteristics, which may allow the use of fill as a bearing stratum without significant re-engineering. Based on the depth of fill present use of a suspended floor slab will be required. External Works – A CBR value of 2% should be adopted at this stage for design. Gas precautions – The results of the preliminary gas monitoring results indicate that no combustible ground gas (methane) is present, however, carbon dioxide was recorded to a maximum concentration of 20.9%. The results suggest a CIRIA C665 Characteristic Situation 2. This recommendation is subject to revision following completion of the gas monitoring and issue of the gas monitoring addendum report. Water Supply Pipes – UKWIR analysis has not been undertaken as part of this assessment. It is recommended that the results of the assessment are provided to the water supply company so that the correct pipe material can be selected. Subject to the receipt of the laboratory testing results, our preliminary assessment indicates that basic precautions are required with respect to water supply pipes. Drainage – Based on the presence of deep made ground and cohesive soils, the use of soakaways are not considered feasible. Excavations and Dewatering – If man entry is proposed into excavations, the use of support to excavation sides is recommended, in line with health and safety guidelines. Significant groundwater ingress into shallow excavations is anticipated sporadically across the site and dewatering of excavation should be allowed for and carefully monitored.
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	Sulphate attack on buried concrete – The laboratory testing results, buried concrete should be generally be designed to a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-3z for the made ground and a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-2z for natural soils.
Further Works	Further investigation to confirm the depth of made ground in areas of potential uncertainty. Settlement testing by the construction and accurate monitoring of a surcharge mound designed to simulate the loads imposed by the proposed development.

1 INTRODUCTION

1.1 3e Consulting Engineers Ltd (3e) were commissioned by Hartwood Estates Ltd. to carry out a Phase II geo-environmental assessment of land located off Dearne Valley Parkway, Birdwell, South Yorkshire. The proposed development for mixed use with associated car parking and landscaping, details of which are provided in **Appendix A**.

1.2 A review of an existing combined desk study was completed by Enzygo Ltd. and the pertinent information has been reviewed in this report. It is recommended that this information is read in conjunction with this assessment.

1.3 The objectives of this assessment were:

- To investigate near surface soil and groundwater conditions.
- To determine the potential risks posed by any ground or groundwater contamination and provide recommendations on remedial measures to manage such risks.
- To assess the risk posed by hazardous ground gas.
- To provide advice relating to geotechnical issues associated with the site.
- To provide foundation recommendations.

1.4 Fieldwork was undertaken on 19 and 20 August 2015 and comprised nine mini percussive boreholes and twenty machine excavated trial pits with associated sampling and testing.

1.5 This report presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the scope of works outlined above. It has been assumed in the production of this report that the site is to be redeveloped for commercial end use.

1.6 The comments and opinions presented in this report are based on the findings of the intrusive investigation carried out by 3e and the results of laboratory analysis. Responsibility cannot be accepted for any conditions not revealed by this investigation and which have not been taken into account by this report. Any diagram or opinion relating to site geology, contamination or other spatially variable features between or beyond investigation positions is conjectural and provided for guidance only. Confirmation of ground conditions between

exploratory holes should be undertaken if deemed necessary. Evaluation of ground gas and groundwater is based on observations made at the time of the investigation and any monitoring visits, but it should be noted that levels and quality may vary due to seasonal and other effects.

1.7 This report has been prepared for the sole use of Hartwood Estates Ltd. No other third party may rely upon or reproduce the contents of this report without the written approval of 3e. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and 3e do not owe them any Duty of Care or Skill.

2 THE SITE

Location and Description

2.1 The site, centred on National Grid Reference 434957, 400569, is located approximately 7km south of Barnsley town centre and to the south of the village of Birdwell. A site location plan is included as **Figure 1**.

2.2 The site is open and unoccupied with overgrown scrub vegetation, long grass with numerous semi mature and mature trees along the boundaries. The site is uneven with lower lying parts of the site being waterlogged with bog grass present identifying that it is a regular condition on the site. In addition an area of existing stock yard is present in the north west portion of the site. At the time of the investigation and initial monitoring it was under significant standing water and steel stock.

2.3 The adjacent land use is as follows:

- Northeast and East: Dearne Valley Parkway with open land beyond.
- Southwest: Highways Agency Depot with houses and Sheffield Road beyond.
- Northwest: Industrial Estate with housing beyond.

3 PHASE I GEO-ENVIRONMENTAL ASSESSMENT

3.1 The following Phase I geo-environmental assessment of the site is based on a review of the existing report by Enzygo Limited, Phase I Environmental Desk Study and Mining Report, referenced SHF.1122.002 GE R 0001, dated August 2014 and in house data. It is recommended that the Enzygo Limited report is read in conjunction with this assessment.

Site History

3.2 In house data identifies the site to have been on the fringes of an opencast mine, which was backfilled in the 1990s. Historical reports suggest that engineered made ground soils comprising colliery spoil were present to depths of between 0.8m and >4.0m. Based on the historic OS plans presented in the desk study report a former mineral railway in a potential shallow cutting is also present running northeast/southwest along the northern boundary.

Geology and Mining

3.3 The geological map of the area (Barnsley, Sheet 87, Bedrock and Superficial) indicates the site is underlain by Haigh Moor Rock (sandstone) on the west and Pennine Middle Coal Measures (interbedded sandstone, siltstone and mudstone) over the remainder of the site.

3.4 Historical reports suggest that engineered made ground soils comprising colliery spoil were present to depths of between 0.8m and >4.0m.

3.5 Based on the findings of the desk study the site is considered to be stable with respect to mining.

Watercourses and Groundwater

3.6 There are no water courses on the site. A tertiary river located 292m north west. A further secondary river/culvert/tertiary river is shown between 368m and 471m south west.

3.7 The immediate underlying solid strata (Pennine Middle Coal Measures) are classified as a Secondary A Aquifer and there are no groundwater abstractions located within 500m of the site.

Landfill Sites, Pollution Controls and Industrial Land Use

3.8 The northern part of the site is part of a former landfill associated with the infilled railway and a further landfill is recorded within 250m of the site associated with the backfilling of a quarry.

3.9 There is an active petrol filling station some 235m to the east of the site.

3.10 Industrial land uses within 250m of the site are limited to commercial uses associated with the Industrial Estate to the north of the site and the Depot to the west of the site

Conceptual Site Model

3.11 Based on the information available, it was concluded that the main sources of contamination on the site are associated with the potential for made ground soils from historic land use as a backfilled opencast mine.

3.12 The assessment indicates that the risk to human health from the contamination can be largely mitigated by use of appropriate PPE during construction and by the use of hardstanding or soil capping throughout the proposed development.

3.13 Overall the assessment indicates a low environmental risk until proved otherwise.

Ground Gas Risk Assessment

3.14 No Radon protection measures are required for the construction of new buildings.

3.15 The assessment indicates a low to moderate risk of ground gas associated with the recorded landfill and backfilling of the opencast on site with non-putrescible waste.

4 METHOD OF INVESTIGATION

Fieldwork

4.1 The intrusive works comprised nine mini percussive boreholes sunk to a maximum depth of 4.0m below existing ground level (bgl) and twenty trial pits excavated to a maximum depth of 4.0m bgl. The site works were carried out on 19 and 20 August 2015. The exploratory holes were located across the site to provide general coverage making allowance for utilities.

4.2 A copy of the exploratory hole records are included as **Appendix B** and the locations are shown on **Figure 2** (Exploratory Hole Location Plan). No works were able to be undertaken in the close proximity of overhead power lines and other underground services. In addition an area of existing stock yard was under significant standing water and steel stock.

4.3 The mini percussion boreholes were sunk in order to determine soil profile. Disturbed samples and, where possible, undisturbed open drive tube samples were recovered for soil descriptions and laboratory testing. Cone penetration tests (CPT) were carried out to provide an assessment of the in situ strength of the cohesive strata and the relative density of the granular and cohesive natural deposits.

4.4 Gas/groundwater monitoring wells, comprising slotted 19mm diameter HDPE pipe within a granular filter were installed in four of the mini percussion boreholes (BH01, BH04, BH05 and BH07) to a maximum depth of approximately 2.90m below ground level (bgl). The wells were sealed using bentonite and a lockable cover was fitted at the surface. To date, the wells have been monitored on two occasions for methane, carbon dioxide and oxygen using a portable infra-red gas monitor. The rate of gas flow from the boreholes was also recorded using a portable flow meter and the groundwater levels were recorded using a portable dip meter. The results of the ground gas monitoring are presented in **Appendix C**.

4.5 Fieldwork and soil descriptions were carried out in general accordance with BS5930:2015, "Code of Practice for Site Investigations".

Laboratory Chemical Testing

4.6 The results of the chemical analysis scheduled by 3e Consulting Engineers Ltd. are included as **Appendix D**. The analyses were carried out at an MCERTS registered and UKAS accredited laboratory.

4.7 In order to provide a preliminary assessment of contamination, nineteen samples of made ground and one sample of natural soils were screened for the following determinands:

- Arsenic
- Boron
- Cadmium
- Chromium
- Lead
- Mercury
- Nickel
- Selenium
- Copper
- Zinc
- Speciated polyaromatic hydrocarbons (PAH)
- Water soluble sulphate
- pH
- Total organic carbon (TOC)
- Organic Matter Content
- Asbestos (*ten samples of made ground only*)

4.8 In addition, a further five samples of the underlying natural soil and one sample of made ground were scheduled for water soluble sulphate and pH determinations to assess the potential for sulphate attack on buried concrete.

Laboratory Geotechnical Testing

4.9 Geotechnical related testing was carried out to determine the physical characteristics of the soils and comprised the following:

- 8 Atterberg limits determinations to confirm field descriptions and classify cohesive soils.

4.10 The results of the geotechnical test results are included as **Appendix E**.

5 RESULTS OF THE INVESTIGATION

Soil Profile

5.1 Detailed descriptions of the materials encountered together with observations of groundwater behaviour, visible contamination, the results of in situ testing and sampling information are given on the exploratory hole records included as **Appendix B**. A summary of the ground conditions encountered is presented below.

Made Ground

5.2 The site is covered by made ground materials between 0.3m and greater than 4.0m in thickness. The deeper areas of made ground were proven in the eastern part of the site, however, it does appear to be very variable in terms of depth rather than a consistent increase in depth in any particular direction. The made ground generally comprised mudstone gravels in a clayey matrix (Colliery Spoil), reworked gravelly clay or clay bound gravel and sandstone and brick. The made ground is generally underlain by firm to stiff residual clay or directly by weathered bedrock.

5.3 Across the site within the made ground soils, SPT 'N' values ranged between N11 and N29 which generally increase with depth, however, the average was around N19.

Natural Deposits

5.4 The made ground is generally underlain by clay or slightly gravelly clays which are generally of firm or stiff consistency overlying Coal Measures bedrock (sandstone, mudstone or siltstone).

5.5 Limited tests in the slightly gravelly clays recorded, SPT 'N' values of N18 and N22. Within the underlying Coal Measures bedrock SPT 'N' values were recorded between 46 and 51, with the majority of tests refusing at N50.

5.6 Exploratory holes were generally terminated within natural soil, however, a number of locations were terminated in deep made ground.

Groundwater

5.7 Groundwater was encountered sporadically within the made ground at depths between 1.3m and 2.7m and prevented excavation progress in one location (TP09).

5.8 During the preliminary monitoring visits, three wells were found to be dry or damp at base to a maximum depth of 2.50m bgl. However, a single well (BH07) was fully waterlogged during the first visit and during the second visit the water level was recorded to be at 1.38m bgl. The results of the groundwater monitoring are presented in **Appendix C**.

5.9 It should be noted that groundwater levels may vary seasonally and that a higher water table than recorded could occur.

Physical Evidence of Contamination

5.10 No visual and olfactory evidence of significant contamination was encountered within the made ground or the natural deposits.

Gas Monitoring

5.11 The results of the preliminary ground gas monitoring carried out on 26 August and 10 September 2015 are summarised in the following table:

Location	CH ₄ (% v/v)	CO ₂ (% v/v)	O ₂ (% v/v)	Maximum Flow (l/hr)	Barometric Pressure (mb)	Maximum GSV*	
						CO ₂	CH ₄
BH01	0.0	0.7-2.8	15.2-19.6	0.0	985-1013	<0.07	<0.07
BH04	0.0	11.6	3.2-4.7	0.0			
BH05	0.0	18.8-20.9	0.7-2.6	0.0			
BH07	0.0	4.8	9.1	0.0			

* CIRIA 665 Gas Screening Value

5.12 Methane was not recorded, however, carbon dioxide was recorded to be present up to 20.9%. Zero flow was recorded during the monitoring giving CIRIA Gas Screening Value (GSV) were less than <0.07l/hr. The results to date indicate a CIRIA 665 site Characteristic

Situation 2, where precautions are necessary. Further gas monitoring is planned and the final set of results will be issued as an addendum to this report with the final classification.

Contamination Related Testing

5.13 The results of the contamination related testing undertaken on nineteen samples of made ground and one of natural soils obtained by 3e, are included as **Appendix D**.

5.14 Generally, the results have been assessed using the LQM/CIEH Suitable for Use Levels (S4ULs) for Human Health Risk Assessment (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3170; All rights reserved).

5.15 Where no S4UL is available, reference is made to published CLEA Soil Guidelines Values (SGVs) for standard land uses, or generic levels derived using the CLEA model (v1.06). For the purpose of this report, all S4ULs or SGVs will be referred to as Generic Assessment Criteria (GAC).

5.16 With respect to the assessment of the site, as the site is proposed to be a mixed use commercial development, therefore, the most appropriate values are considered to be the GACs for a commercial end use. Based on the laboratory results, an SOM of 1% has been used in the assessment.

5.17 A summary of the contamination related testing is presented below.

Metals and Inorganics

Determinand	Minimum conc. mg/kg	Maximum conc. mg/kg	No of Samples Tested	Generic Assessment Criteria (GAC) ⁽¹⁾ mg/kg	No of Samples Exceeding GAC
Arsenic	5.7	39	20	640	0
Boron	<0.5	2.1	20	240000	0
Cadmium	<0.2	0..2	20	190	0
Chromium (III)	9.1	64	20	8600	0
Lead	12	29	20	2330 ⁽²⁾	0
Mercury	<0.5	-	20	1100	0
Selenium	<0.5	1.5	20	12000	0
Copper	16	40	20	68000	0
Nickel	7.8	48	20	980	0
Zinc	17	116	20	730000	0

Notes

(1) LQM/CIEH S4UL for commercial/industrial end use unless otherwise stated

(2) DEFRA, SP1010: Category 4 Screening Levels

Hydrocarbons

Determinand	Minimum conc. mg/kg	Maximum conc. mg/kg	No of Samples Tested	Generic Assessment Criteria (GAC) ⁽¹⁾ mg/kg	No of Samples Exceeding GAC
<u>Speciated PAH</u>					
Naphthalene	<0.01	1.82	20	190	0
Acenaphthylene	<0.01	-	20	83000	0
Acenaphthene	<0.01	0.04	20	84000	0
Fluorene	<0.01	0.26	20	63000	0
Phenanthrene	<0.02	1.16	20	22000	0
Anthracene	<0.01	0.24	20	520000	0
Fluoranthene	<0.02	2.8	20	23000	0
Pyrene	<0.02	2.7	20	54000	0
Benzo(a)anthracene	<0.01	1.38	20	170	0
Chrysene	<0.01	1.49	20	350	0
Benzo(b)fluoranthene	<0.01	1.74	20	44	0
Benzo(k)fluoranthene	<0.01	0.7	20	1200	0
Benzo(a)pyrene	<0.01	1.47	20	35	0
Indeno(1,2,3-cd)pyrene	<0.01	1.01	20	500	0
Dibenz(a,h)anthracene	<0.01	0.17	20	3.5	0
Benzo(ghi)perylene	<0.02	0.92	20	3900	0

Notes

(1) LQM/CIEH S4UL for commercial/industrial end use unless otherwise stated

5.18 None of the determinands tested were elevated above the generic assessment criteria for a commercial/industrial end use.

Asbestos

5.19 None of the ten samples of made ground screened for asbestos fibres detected any fibres.

Leachate

5.20 In order to assess the risk to the wider environment, four samples of made ground were scheduled for leachate analysis. Where appropriate, the results have been compared against environmental quality standards (EQS) for freshwater. In the absence of freshwater EQS, UK drinking water standards have been adopted.

5.21 None of the metals were recorded to be above the relevant GACs and in turn none of the speciated PAH compounds were recorded to be above the laboratory detection limits.

Phytotoxic Contaminants

5.22 To assess the potential risks to plants in areas of soft landscaping the results of the soil screening have also been assessed with respect to plant phytotoxicity, as summarised in the table below.

Plant Phytotoxicity						
Determinand	Soil pH range	Minimum conc. (mg/kg)	Maximum conc. (mg/kg)	Assessment Value as outlined within BS3882:2007 (dependent upon soil pH range) (mg/kg)		
				pH<6.0	pH 6.0-7.0	pH>7.0
Zinc	4.74 - 8.53	17	116	<200	<200	<300
Nickel		7.8	48	<100	<135	<200
Copper		16	40	<60	<75	<110

5.23 From the above results, there is not considered to be a potential impact on future plant growth.

Sulphate and pH Determinations

5.24 Twenty samples of made ground and six samples of natural soil were scheduled for water soluble sulphate and pH determinations to assess the potential for sulphate attack on buried concrete.

5.25 Within the made ground across the site, water soluble sulphate concentrations varied between 331mg/l and 11mg/l with pH values between 4.74 and 8.5, indicating a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-3z is adopted on the site.

5.26 Within the natural soils, water soluble sulphate concentrations varied between 231mg/l and 17mg/l with pH values between 5.1 and 7.5. These results indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-2z is adopted on the site.

Modified Site Conceptual Model

Sources of Contamination

5.27 From the information gathered during the desk study, it was concluded that potential contamination sources include made ground on the site associated with the historic land use as an opencast mine.

5.28 The site is covered by made ground materials between 0.3m and greater than 4.0m in thickness. The deeper areas of made ground were proven in the eastern part of the site, however, it does appear to be very variable in terms of depth rather than a consistent increase in depth. The made ground generally comprised mudstone gravels in a clayey matrix (Colliery Spoil), reworked gravelly clay or clay bound gravel and sandstone and brick. The made ground is generally underlain by firm to stiff residual clay or directly by weathered bedrock. Physical evidence of contamination was not encountered.

5.29 The results of the preliminary gas monitoring results indicate that no combustible ground gas (methane) is present, however, carbon dioxide was recorded to a maximum concentration of 20.9%. The results suggest a CIRIA C665 Characteristic Situation 2. This recommendation is subject to revision following completion of the gas monitoring and issue of the gas monitoring addendum report.

Pathways and Receptors

5.30 Based on the results of the laboratory chemical analysis, the risk to human health from contamination on the site is considered to be low to negligible.

5.31 With respect to potential environmental receptors, the following pathways are considered:

- Vertical migration to Secondary A Aquifer – Given the results of the chemical analysis and low permeability soils present across the majority of the site, the risk to the underlying aquifer is considered to be negligible.
- Adjacent property – Given the results of the chemical analysis the risk to adjacent property is considered to be negligible.

Pollutant Linkage Assessment

5.32 In view of the low determinand concentrations, increases in hard cover associated with the mixed use commercial development and associated car parking/hardstanding, the pollutant linkage assessment indicates that the site poses a negligible risk to humans and a negligible risk to the wider environment.

Geotechnical Related Testing

5.33 The results of the geotechnical testing are presented in **Appendix E**.

Classification Tests

5.34 Four samples of made ground and four samples of natural cohesive soils were scheduled for Atterberg limits determinations. The samples were obtained from between 0.60m and 3.7m bgl.

5.35 The samples recorded modified plasticity indices between 9.6% and 18.6% for the made ground soils which generally indicates a low volume change potential. The natural cohesive soils recorded modified plasticity indices between 18.4% and 34.6% which indicates low to medium volume change potential.

6 DISCUSSION

6.1 Development proposals for a mixed use commercial development with associated car parking with areas of landscaping. This investigation was carried out to provide geotechnical information with respect to foundations for the proposed development and contamination related testing to outline potential constraints.

Contamination Assessment

6.2 Information obtained during the desk study indicated a low risk of contamination. No physical evidence of contamination was encountered during the intrusive works and the results of the laboratory chemical analysis indicate low determinand concentrations which do not exceed the generic assessment criteria for human health.

6.3 Given the results of the laboratory analysis, the risk to the wider environment is considered to be low to negligible.

Remediation

6.4 The proposed areas of buildings and hardstanding will be sufficient to break the latent pollutant pathway between the made ground and end users. Where landscaping areas are present, a capping of 300mm of imported capping materials will be required, however, this is primarily to provide suitable growing media. Where more sensitive end uses such as a crèche are proposed the capping depth may need to be increased in areas of private soft landscaping.

6.5 Imported soil will need to be validated to ensure it does not pose a risk to the environment (i.e. contaminated). The acceptance criteria for validation will need to be agreed with the local authority as part of a remediation strategy for the site.

Disposal of Materials

6.6 Waste classification testing has not been carried out, however, the results of the chemical analyses allow an initial assessment and suggest that generally, the made ground present on the site are considered to be suitable for disposal as inert waste.

6.7 It is recommended that the results of the investigation are made available to the waste carrier/receiver in order to determine the waste classification and costs for offsite disposal.

Water Supply Pipes

6.8 UKWIR analysis has not been undertaken as part of this assessment. It is recommended that the results of the assessment are provided to the water supply company so that the correct pipe material can be selected. Our preliminary assessment indicates that no precautions are required with respect to water supply pipes.

Mining Assessment

6.9 The site is currently considered to be stable with respect to mining.

Foundations and Floor Slabs

6.10 The proposed mixed use development includes a public house, hotel, petrol filling station, crèche and other small commercial units with associated car parking.

6.11 At this stage, the natural residual clays appear suitable for pad and strip foundations at a minimum depth of 900mm based on an allowable bearing capacity of 100kN/m² in the western and extreme southern parts of the site. Foundations will need to be deepened for heave where effected by trees which are present, particularly around the western and northern boundaries.

6.12 Elsewhere where deep variable made ground is present an alternative foundation solution will be required. This could be ground improvement by vibro stone columns, although allowance for pre boring of the columns may be required, or the adoption of raft foundations on fully re-engineered fill materials where building size and sensitivity allows. Alternatively, large scale settlement testing using could be carried out to determine the settlement characteristics, which may allow the use of fill as a bearing stratum without significant re-engineering.

6.13 Based on the depth of fill present use of a suspended floor slab is likely to be required.

Gas Protection Measures

6.14 No Radon protection measures are required for the proposed development.

6.15 The results of the preliminary gas monitoring results indicate that no combustible ground gas (methane) is present, however, carbon dioxide was recorded at 18.8%. The results suggest a CIRIA C665 Characteristic Situation 2. This recommendation is subject to revision following completion of the gas monitoring and issue of the gas monitoring addendum report.

Excavations and Dewatering

6.16 If man entry is proposed into excavations, the use of support to excavation sides is recommended, in line with health and safety guidelines.

6.17 Significant groundwater ingress into shallow excavations is anticipated sporadically across the site and dewatering of excavation should be allowed for and carefully monitoring.

External Works

6.18 A CBR value of 2% should be adopted at this stage for design on the made ground, subject to confirmation. It is recommended that in-situ plate load tests are carried out to verify the CBR at formation level, particularly in the low lying, waterlogged areas.

Surface Water Disposal

6.19 Based on the presence of deep made ground and cohesive soils, the use of soakaways are not considered feasible.

Sulphate Attack on Buried Concrete

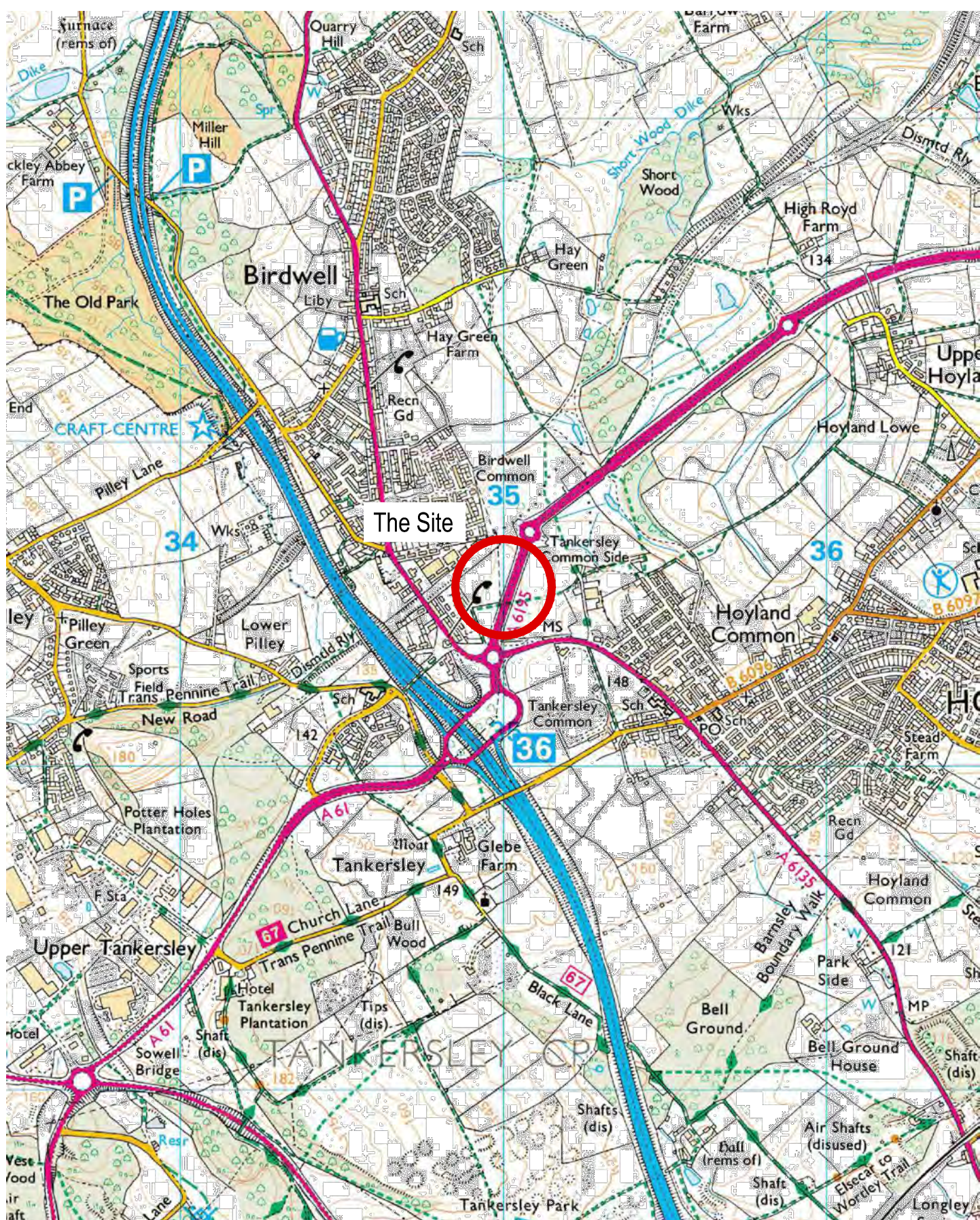
6.20 The laboratory testing results, buried concrete should be generally be designed to a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-3z for the made ground and a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-2z for natural soils.

7 FURTHER WORK

7.1 Further investigation to confirm the depth of made ground in areas of potential uncertainty.

7.2 Settlement testing by the construction and accurate monitoring of a surcharge mound designed to simulate the loads imposed by the proposed development.

Figures



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Project Rockingham Development, Birdwell
For Hartwood Estates Ltd

Title Site Location Plan

Scale
1:25,000

Drawn
AHC

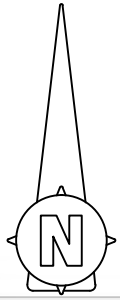
Checked
AB

Date
Aug '15

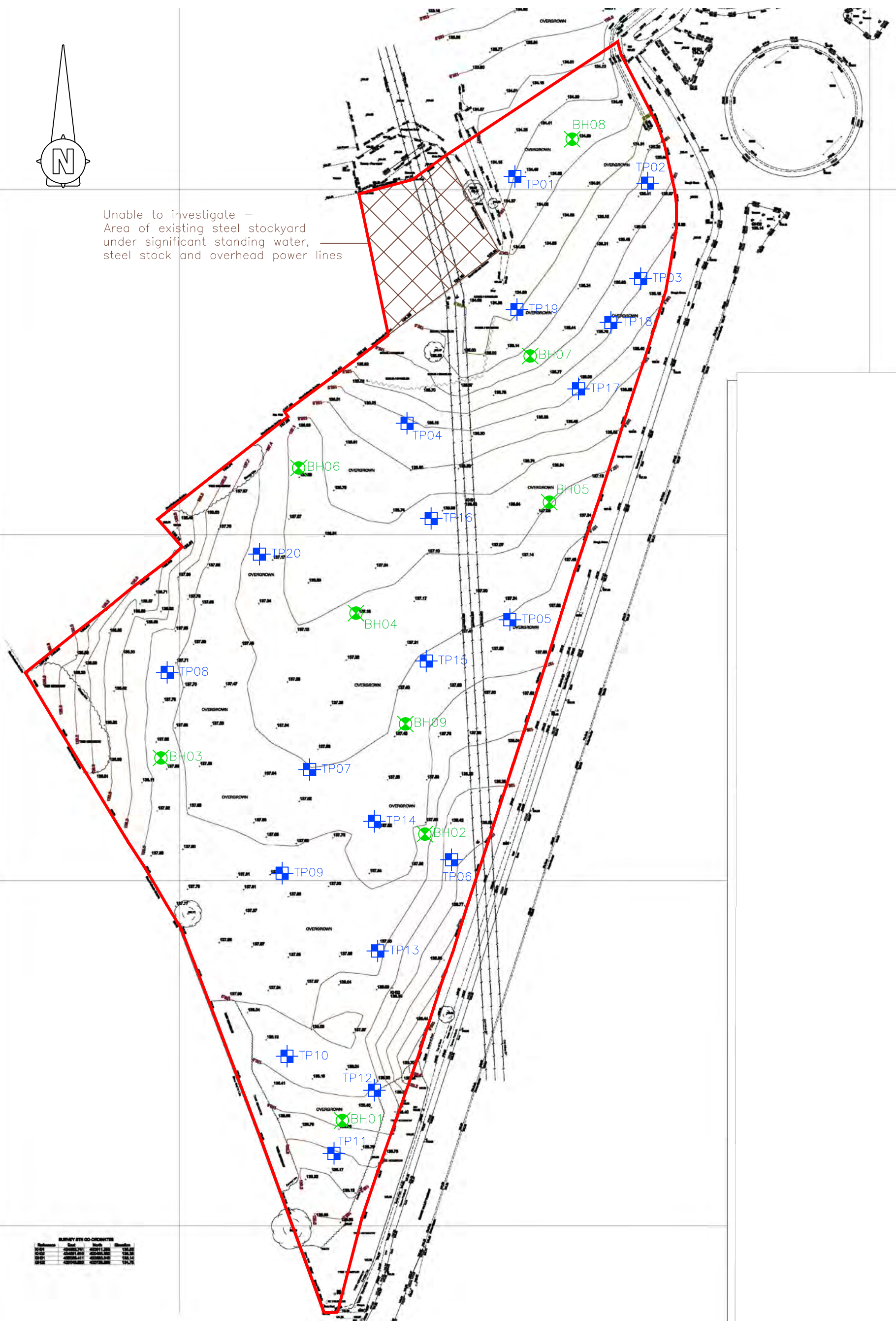
Job No. 15677

Drawing No. Figure 1

Rev 0



Unable to investigate –
Area of existing steel stockyard
under significant standing water,
steel stock and overhead power lines



SURVEY 2TH CO-ORDINATES			
Reference	East	North	Direction
TP01	42082.241	42071.282	135.02
TP02	42071.282	42082.241	135.02
TP03	42082.241	42071.282	135.02
TP04	42071.282	42082.241	135.02

Legend:



Trial Pit Position



Mini Percussive
Borehole Location



1st Floor, Block C
Holland Park
Holland Drive
Newcastle upon Tyne
NE2 4LD

tel: 0191 230 2993
fax: 0191 230 3677
www.3econsult.com

Project		Rockingham Development, Birdwell, Barnsley for Hartwood Estates Ltd.		
Title		Exploratory Hole Location Plan		
Scale	NTS	Drawn	NW	Checked AHC
Job No.	15677	Drawing No.	Figure 2	Date Aug '15
				Rev 0

Appendix A

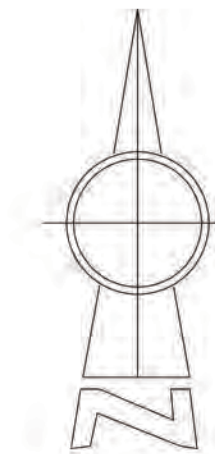
Proposed Development Plan



LOCATION PLAN SCALE 1:5000

KEY

- CLASS A1 - RETAIL
- CLASS A2/D1 - RETAIL/DAY NURSERIES
- CLASS A2/D1 - CAFE/DAY NURSERIES
- CLASS A2 - OFFICE
- CLASS A3 - CAFE
- CLASS A4 - DRINKING ESTABLISHMENT
- CLASS A5 - TAKEAWAY
- CLASS B2 - GENERAL INDUSTRY
- CLASS D1 - DAY NURSERIES
- OTHER



FOR ILLUSTRATIVE PURPOSES

REV B - REVISIONS TO THE LAYOUT AS PER LOCAL AUTHORITY COMMENTS 07.08.14
REV A - REVISIONS TO THE LAYOUT AS PER CLIENT COMMENTS 07.08.14

■ architectural design
■ town planning
■ landscape architecture
J R P
John R Paley Associates

CLIENT
HARTWOOD ESTATES

PROJECT
**DEARNE VALLEY PARKWAY
SHEFFIELD ROAD**

DRAWING OF
**PROPOSED LAYOUT
OPTION THREE**
MARKETING NAME

drawing no
P 13 4806 03
scale @ A1
AS INDICATED

rev
B
drawn
EW

date
06AUG14
check
date

1 Red Hall Crescent
Paragon Business Village
Wakefield
WF1 2DF
t-01924 383322
f-01924 384382
e-info@jrpassoc.co.uk

Schedule					
Name	Total SqM	Total SqFt	Comments	Car Parking	Car Parking Ratio
CLASS A1 - RETAIL					
UNIT ONE A	104 m ²	1119 ft ²	Single Storey Unit	6 spaces	5.2 spaces
UNIT ONE B	104 m ²	1119 ft ²	Single Storey Unit	6 spaces	5.2 spaces
UNIT TWO	289 m ²	3110 ft ²	Single Storey Unit	13 spaces	14.2 spaces
CLASS A2					
OFFICE ONE	448 m ²	4840 ft ²	Two Storey Unit	14 spaces	14 spaces
CLASS A3					
CAFE	318 m ²	3413 ft ²	Single Storey Unit	15 spaces	16.6 spaces
CLASS A4					
PUBLIC HOUSE	449 m ²	4840 ft ²	Two Storey Unit	75 spaces	38.3 spaces
CLASS A5					
DELIVER TAKEAWAY	336 m ²	3616 ft ²	Single Storey Unit	33 spaces	19.6 spaces
CLASS B2					
INDUSTRIAL ONE	381 m ²	4107 ft ²	Single Storey Unit	NA	NA
INDUSTRIAL TWO	371 m ²	4014 ft ²	Single Storey Unit	6 spaces	7.58 spaces
INDUSTRIAL THREE	371 m ²	4014 ft ²	Single Storey Unit	12 spaces	7.58 spaces
INDUSTRIAL FOUR	371 m ²	4014 ft ²	Single Storey Unit	12 spaces	7.58 spaces
INDUSTRIAL FIVE	371 m ²	4014 ft ²	Single Storey Unit	8 spaces	7.58 spaces
INDUSTRIAL SIX	232 m ²	2497 ft ²	Single Storey Unit	6 spaces	4.64 spaces
INDUSTRIAL SEVEN	232 m ²	2497 ft ²	Single Storey Unit	6 spaces	4.64 spaces
INDUSTRIAL EIGHT	232 m ²	2497 ft ²	Single Storey Unit	7 spaces	4.64 spaces
CLASS D1					
CELEBRATE	636 m ²	6845 ft ²	Two Storey Unit	5 spaces	3.4 spaces
OTHER					
BO BED HOTEL	2226 m ²	23940 ft ²	Three Storey Unit	84 spaces	Unknown, Max 800 Spaces
FILLING STATION TOTAL	446 m ²	5015 ft ²	Single Storey Unit	14 spaces	9.5 spaces
FILLING STATION - Retail Area	150 m ²				
TOTAL RETAIL AREA					
	2448 m ²				
				Additional Parking	28 spaces
				Total Parking	390 spaces
				4.5m Doubled Parking	2515 spaces
				12 Cycle Storage spaces	4% of Total
					Approx 12 spaces

**PROPOSED LAYOUT
SCALE 1:1250**

Appendix B

Exploratory Hole Records

Mini-Percussive Log

BH01

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:

↓ = Water Strike Depth & No.
↓ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.20	ES	N22 (3/3/4/4/6/8)	(0.30) 0.30	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone. (Colliery Spoil)					
0.90 1.00	D C		(1.20)	Stiff brown mottled yellow CLAY.	1.0				
1.90 2.00	D C		(0.50) 2.00	Brown/grey completely weathered MUDSTONE.	2.0				
		N46/225mm (7/9/12/15/19/-)		End of Exploratory Hole at 2m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	
		No Groundwater Encountered					1. Borehole terminated on refusal

Mini-Percussive Log

BH02

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:
 = Water Strike Depth & No.
 = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.30	ES	N19 (3/3/4/5/5/5)	0.10	MADE GROUND: Clayey TOPSOIL.					
			(0.30)	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone. (Colliery Spoil)					
			0.40	MADE GROUND: Brown friable gravelly CLAY. Gravel is fine to coarse angular mudstone and sandstone.					
0.80	D	N12 (2/2/3/2/3/4)	(1.50)	POSSIBLE MADE GROUND: Firm to stiff friable brown mottled grey slightly gravelly CLAY.	1.0				
1.00	C								
1.80	D								
2.00	C	N20 (4/3/4/4/6/6)	(1.80)	Stiff grey mottled brown CLAY.	2.0				
2.80	D								
3.00	C								
4.00	C	N51 (5/6/6/8/13/24)	3.70	End of Exploratory Hole at 4m	4.0				
			(0.30)						
			4.00						

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	
1	3.0	Groundwater strike.					1. Borehole terminated on refusal

Mini-Percussive Log

BH03

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

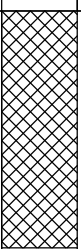
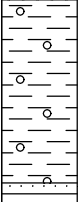
Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:
 = Water Strike Depth & No.
 = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.50	ES	N18 (2/2/3/4/5/6)	(1.10)	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone. (Colliery Spoil)					
1.00	C		1.10		1.0				
1.50	D		(0.85)	Firm to stiff brown mottled grey slightly gravelly CLAY.					
2.00	D	N50/50mm (8/12/50/-/-)	1.95		2.0				
2.00	C		2.00	Completely weathered SANDSTONE/SILTSTONE recovered as tabular angular gravel. End of Exploratory Hole at 2m	2.0				

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	
		No Groundwater Encountered					1. Borehole terminated on refusal

Mini-Percussive Log

BH04

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:

↓ = Water Strike Depth & No.
↓ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.50	ES	N18 (2/2/3/4/5/6)	(1.50)	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone and occasional ironstone. (Colliery Spoil)					
1.00	C				1.0				
1.60	D		(0.40)	Brown gravelly CLAY. Gravel is fine to coarse angular sandstone and mudstone.					
2.00	D	N50/15mm (25/-/50/-/-)	(0.15)	Firm brown mottled grey gravelly CLAY.	2.0				
2.00	C		2.05	End of Exploratory Hole at 2.05m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	
		No Groundwater Encountered					1. Borehole terminated on refusal

Mini-Percussive Log

BH05

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

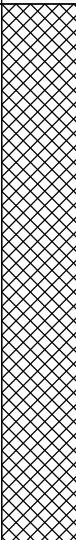
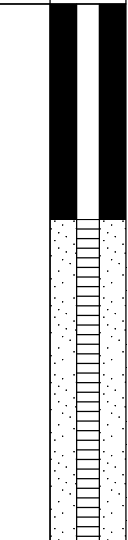
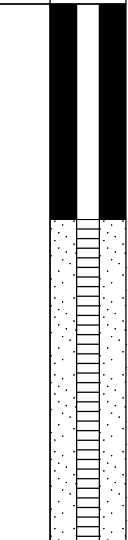
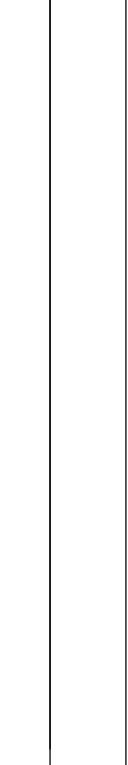
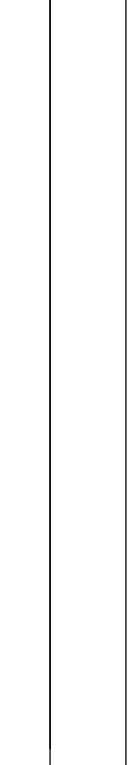
Contractor: White Rose

Key:

↓ = Water Strike Depth & No.
↓ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.50	ES			MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone. (Colliery Spoil)					
1.00	C	N23 (4/7/6/6/5/6)	(2.50)		1.0				
1.50	D								
2.00	C	N15 (3/3/2/2/5/6)			2.0				
2.50	C	N50/0mm (25/-/50/-/-/-)	2.50	End of Exploratory Hole at 2.5m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	1. Borehole terminated on refusal
		No Groundwater Encountered					

Mini-Percussive Log

BH06

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

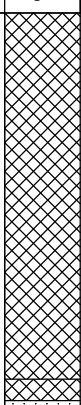
Contractor: White Rose

Key:

↓ = Water Strike Depth & No.
↓ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.40	ES	N17 (2/3/4/4/5/4)	(1.70)	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone and occasional sandstone. (Colliery Spoil)	1.0				
1.00	C								
1.40	D								
1.75	D	N50/0mm (18/12/50/-/-)	1.70	MADE GROUND: Grey/brown gravelly CLAY. Gravel is fine to coarse angular mudstone and occasional brick					
1.85	D		1.80						
1.85	C		1.85						
				SUSPECTED BEDROCK: Recovered as gravel of SANDSTONE. <i>End of Exploratory Hole at 1.85m</i>					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	1. Borehole terminated on refusal
		No Groundwater Encountered					



consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA
Tel. 01924 240420

Mini-Percussive Log

BH07

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:

↓ = Water Strike Depth & No.
↓ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.40	ES			MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone. (Colliery Spoil)					
1.00	C	N19 (2/2/4/5/5/5)			1.0				
1.40	D		(2.90)						
2.00	C	N19 (3/4/4/5/5/5)			2.0				
2.40	D			2.50 - 2.90 occasional sandstone gravel					
2.90	C	N50/10mm (25/-/50/-/-)	2.90	End of Exploratory Hole at 2.9m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	1. Borehole terminated on refusal
		No Groundwater Encountered					



Mini-Percussive Log

BH08

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:

- = Water Strike Depth & No.
- = Resting Water Depth & No.
- D = Small Disturbed Sample
- B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.50	ES		(1.30)	MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone with pockets of brown gravelly clay. (Colliery Spoil)					
1.00	C	N29 (2/3/3/5/7/14)			1.0				
1.30	C	N50/10mm (25/-/50/-/-/-)	1.30						
				End of Exploratory Hole at 1.3m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	
		No Groundwater Encountered					1. Borehole terminated on refusal

Mini-Percussive Log

BH09

Site Name: Rockingham, Birdwell
Client: Hartwood Estates Ltd
Project No: 15677

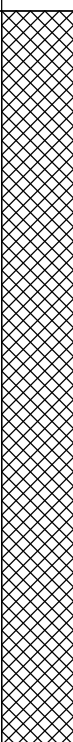
Ground Level:
Easting:
Northing:

Contractor: White Rose

Key:
 = Water Strike Depth & No.
 = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample

ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 19/08/2015
Logged By: AHC

Samples/Tests			Strata Details					Well	
Depth (m)	Type	Results	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend	Strike	Log
0.50	ES			MADE GROUND: Grey clayey, sandy angular GRAVEL of mudstone with pockets of brown gravelly clay. (Colliery Spoil)					
1.00	C	N11 (1/2/2/2/3/4)			1.0				
1.50	D								
2.00	C	N21 (1/2/3/6/7/5)			2.0				
2.50	D								
3.00	C	N26 (2/3/3/4/5/14)			3.0				
3.45	C	N50/10mm (25/-/50/-/-/-)	3.40	End of Exploratory Hole at 3.45m					

Groundwater Observations			Window Sample Run				General Remarks
No.	Struck (m)	Remarks	From (m)	To (m)	Dia. (mm)	Recovery (%)	1. Borehole terminated on refusal
		No Groundwater Encountered					



consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA
Tel. 01924 240420

Trial Pit Log

TP01

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecone
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	ES				0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil)			
					(1.00)	MADE GROUND: Grey clayey sandy fine to coarse angular GRAVEL of mudstone. occasional cobbles of subrounded sandstone. (Colliery spoil).			
1.00	D				1.10		1.0		
1.30	D				(0.30) 1.40	MADE GROUND: Firm brown very silty slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mixed aggregates.			
					(1.10)	MADE GROUND: Grey claybound fine to coarse angular GRAVEL of mudstone. (Colliery spoil).			
2.00	D				2.50		2.0		
					2.60	SUSPECTED BEDROCK: Recovered as fine to coarse gravel of SANDSTONE.			
						End of Exploratory Hole at 2.6m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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4 Calder Close
Calder Park
Wakefield
WF4 3BA
Tel. 01924 240420

Trial Pit Log

TP02

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecone
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.40	ES				0.10	MADE GROUND: Grass over soft grey silty very gravelly CLAY. Gravel is fine to coarse angular mudstone and sandstone. Many rootlets. (Colliery spoil)	1.0		
					(1.20)				
					1.30	Grey clayey fine to coarse gravel of highly weathered MUDSTONE.			
					(0.50)				
2.50	D				1.80	BEDROCK: Recovered as fine to coarse angular gravel of MUDSTONE.	2.0		
					(0.90)				
					2.70	End of Exploratory Hole at 2.7m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP03

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.60	ES				(0.20) 0.20	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil)			
					(0.40) 0.60	MADE GROUND: Grey sandy fine to coarse angular GRAVEL and COBBLES of mudstone. (Colliery spoil).			
					(1.80) 2.40	MADE GROUND: Grey claybound fine to coarse angular GRAVEL of mudstone. occasional pockets of clay.	1.0 2.0		
2.70	D				(0.40) 2.80	SUSPECTED BEDROCK: Grey/brown clayey fine to coarse angular gravel of MUDSTONE becoming less clayey with depth.			
						End of Exploratory Hole at 2.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP04

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	ES				0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
						MADE GROUND: Grey clayey fine to coarse angular GRAVEL and COBBLES of mudstone with occasional clay pockets. (Colliery spoil).			
1.10	ES				(2.80)		1.0		
1.90	D						2.0		
					2.90				
3.00	ES				(0.20)	MADE GROUND: Grey/brown clayey sandy fine to coarse angular GRAVEL of mudstone, sandstone, brick fragments and ironstone.	3.0		
					3.10				
					3.20				
					(0.35)	MADE GROUND: Yellow sandy fine to coarse angular to rounded GRAVEL of dolomite.			
					3.55				
					3.60	MADE GROUND: Grey clayey sandy fine to coarse GRAVEL mudstone, coal, sandstone.			
						SUSPECTED BEDROCK: Brown fine to coarse gravel of SANDSTONE.			
						End of Exploratory Hole at 3.6m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP05

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	D				(0.20) 0.20	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone and coal. Many rootlets. (Colliery spoil).			
					(0.40) 0.60	MADE GROUND: Brown sandy fine to coarse angular GRAVEL and COBBLES of sandstone and mudstone.			
					(0.50) 1.10	MADE GROUND: grey clayey sandy fine to coarse angular GRAVEL of mudstone.			
1.20	ES				1.20	BEDROCK: Recovered as grey fine to coarse angular gravel of SANDSTONE.			
						End of Exploratory Hole at 1.2m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP06

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.70	ES				0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
					(1.60)	MADE GROUND: Grey clayey sandy fine to coarse angular GRAVEL and COBBLES of mudstone. occasional boulders of subrounded sandstone. (Colliery spoil).			
1.30	D				1.70				
3.20	D				(1.40)	MADE GROUND: Brown/grey fine to coarse angular GRAVEL of mudstone and sandstone. (Colliery spoil).			
					3.10				
					(0.30)	Firm brown silty CLAY.			
					3.40				
						End of Exploratory Hole at 3.4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP07

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecon

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.50	ES				0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
					(0.30)				
					0.40	MADE GROUND: Grey clayey sandy fine to coarse angular GRAVEL of mudstone.			
0.90	D				(0.40)	MADE GROUND: Brown sandy fine to coarse angular GRAVEL of sandstone.			
					0.80	MADE GROUND: Firm to stiff brown silty slightly gravelly CLAY. Gravel is fine to coarse angular mudstone and occasional brick fragments.			
1.30	ES				(0.80)		1.0		
2.00	D				1.60	POSSIBLE MADE GROUND: Brown and grey firm silty slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mixed lithology.			
					(0.90)				
					2.50	SUSPECTED BEDROCK: Recovered as a brown gravel of SANDSTONE.			
					2.55	End of Exploratory Hole at 1.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP08

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecone
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	ES				(0.25) 0.25	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
0.60	D				(1.25) 1.50	Stiff brown and grey silty CLAY	1.0		
					(0.30) 1.80	BEDROCK: Recovered as brown angular gravel of MUDSTONE.			
						End of Exploratory Hole at 1.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP09

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.90	ES				0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
					(2.10)	MADE GROUND: Grey sandy fine to coarse angular GRAVEL and COBBLES sandstone and mudstone. Becomes clayey below 1.3m.			
2.30	D				2.20	Stiff silty slightly gravelly CLAY. Gravel is fine to coarse of mudstone.			
					(0.20) 2.40				
						End of Exploratory Hole at 2.4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:		1. Excavation terminated in bedrock
1	1.3	Moderate groundwater seepage.	Length:	Poor below water strike	
			Width:		
			Orientation:		



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Trial Pit Log

TP10

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecon

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 19/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
					0.10	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
					(1.40)	MADE GROUND: Brown sandy fine to coarse angular GRAVEL and COBBLES of sandstone with occasional brick.	1.0		
1.60	D				1.50				
1.70	D				(0.15) 1.65	MADE GROUND: Very soft brown and grey silty CLAY with occasional fibrous organic matter.			
					(1.25)	Firm brown and grey silty CLAY.	2.0		
2.70	D				2.90				
					3.00	SUSPECTED BEDROCK: Recovered as brown fine to coarse angular gravel of MUDSTONE.			
						End of Exploratory Hole at 2.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP11

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecon

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.20	ES				(1.00)	MADE GROUND: Grass over grey clayey sandy fine to coarse angular GRAVEL mudstone and sandstone. occasional rootlets and brick fragments. (Colliery spoil).			
1.10	D				1.00		1.0		
1.80	D				(1.30)	Firm to stiff brown and grey silty slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mixed lithology.			
					2.30		2.0		
					(0.50)	SUSPECTED BEDROCK: Recovered as brown and grey fine to coarse angular gravel of MUDSTONE.			
					2.80				
						End of Exploratory Hole at 2.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP12

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	ES				(0.15)	MADE GROUND: Grass over soft grey silty gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).			
0.30	ES				(0.45)	MADE GROUND: Brown very friable sandy gravelly CLAY. Gravel is fine to coarse angular mudstone, sandstone and old pipe fragment.			
					0.60				
					0.70				
					(0.40)	MADE GROUND: Dark brown friable silty sandy slightly gravelly CLAY. Gravel is fine to coarse angular sandstone. (Possible relict topsoil).			
					1.10		1.0		
						POSSIBLE MADE GROUND: Firm to stiff brown silty sandy slightly gravelly CLAY. occasional concrete.			
1.50	D				(1.10)	Firm to stiff brown silty sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mixed lithology.			
					2.20		2.0		
						SUSPECTED BEDROCK: Brown fine to coarse angular gravel of MUDSTONE.			
					(0.60)				
					2.80				
						End of Exploratory Hole at 2.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP13

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecone
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.10	ES				(0.20) 0.20	MADE GROUND: Grass over brown and grey clayey sandy fine to coarse angular GRAVEL of sandstone and mudstone. Many rootlets. (Colliery spoil).			
0.40	ES				(0.65) 0.85	MADE GROUND: Brown clayey sandy fine to coarse angular GRAVEL of mudstone and sandstone.			
					(0.55) 1.40	MADE GROUND: Firm to stiff friable sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mixed lithology.	1.0		
2.20	D				(1.30) 2.70	MADE GROUND: Firm friable brown and grey silty sandy gravelly CLAY.	2.0		
2.80	D				(0.30) 3.00	Stiff brown and grey silty CLAY.	3.0		
						End of Exploratory Hole at 3m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP14

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.10	ES				(0.25) 0.25	MADE GROUND: Grass over very soft grey sandy very gravelly CLAY. Gravel is fine to coarse angular mudstone. Many rootlets. (Colliery spoil).	1.0		
					(0.75) 1.00	MADE GROUND: Grey sandy fine to coarse angular GRAVEL mudstone and sandstone with occasional clay pockets. (colliery spoil).			
					(0.40) 1.40	MADE GROUND: Brown clayey sandy fine to coarse angular GRAVEL sandstone with occasional clay pockets.			
1.80	D				(1.50) 2.90	MADE GROUND: Firm brown and grey friable sandy gravelly reworked CLAY. Gravel is fine to coarse angular mudstone and sandstone.	2.0		
3.00	D				(0.50) 3.40	Stiff brown and grey silty CLAY.	3.0		
						End of Exploratory Hole at 3.4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP15

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.30	ES				(2.70)	MADE GROUND: Grass over grey sandy fine to coarse angular GRAVEL of sandstone and mudstone.. Many rootlets. (Colliery spoil).	1.0		
					2.70		2.0		
					(0.80)	MADE GROUND: Brown slightly clayey very sandy fine to coarse angular GRAVEL of sandstone with occasional clay pockets.	3.0		
3.70	D				3.50				
					(0.40)	MADE GROUND: Very soft grey and brown sandy gravelly CLAY. Gravel is fine to coarse angular sandstone, mudstone, ironstone, bricks and occasional fibrous organic matter.			
3.95	D				3.90				
					4.00	Firm to stiff brown and grey very sandy silty CLAY.	4.0		
						End of Exploratory Hole at 4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP16

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
0.15	ES				(0.20) 0.20	MADE GROUND: Grass over slightly clayey silty gravelly fine to medium SAND. Gravel is fine to coarse angular mudstone. Many rootlets.			
0.50	D				(0.60) 0.80	MADE GROUND: Grey sandy fine to coarse angular GRAVEL and COBBLE of sandstone and siltstone.			
					(0.80) 1.60 1.65	MADE GROUND: Grey clayey sandy fine to coarse angular GRAVEL of sandstone and mudstone.	1.0		
						BEDROCK: Recovered as grey fine to coarse angular gravel of SANDSTONE. End of Exploratory Hole at 1.65m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP17

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample

HSV = Hand Shear Vane

D = Small Disturbed Sample

CBR = Mexecone

W = Water Sample

ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
2.80	ES				0.10	MADE GROUND: Grass over dark brown clayey sandy fine to coarse angular GRAVEL of mudstone. occasional rootlets.			
						MADE GROUND: Grey sandy fine to coarse GRAVEL and COBBLES of mudstone and sandstone. Many boulders.			
							1.0		
					(3.60)		2.0		
							3.0		
					3.70				
					3.80	Grey and brown silty CLAY.			
						End of Exploratory Hole at 3.8m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
1	2.7	Slight water ingress.	Length:		
			Width:		
			Orientation:		



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Trial Pit Log

TP18

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.40	ES				(3.20)	MADE GROUND: Grass over grey slightly clayey sandy fine to coarse angular GRAVEL and COBBLES of mudstone and sandstone. Colliery spoil). Many boulders of mudstone and sandstone and becomes clayey below 1.8m.	1.0		
2.10	D						2.0		
3.50	D				3.20		3.0		
					(0.40)	Very stiff brown and grey CLAY			
					3.60	End of Exploratory Hole at 3.6m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in natural soils
1	1.8	Slight water ingress.	Length:		
			Width:		
			Orientation:		



consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA
Tel. 01924 240420

Trial Pit Log

TP19

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.80	ES				(1.20)	MADE GROUND: Grass over sandy fine to coarse angular GRAVEL and COBBLES sandstone and mudstone. occasional boulders of angular sandstone.	1.0		
					1.20				
					(0.50)	MADE GROUND: Brown slightly clayey sandy angular fine to coarse GRAVEL, with sandstone and occasional brick (colliery spoil).			
2.20	D				(0.40)	MADE GROUND: Friable brown and grey slightly gravelly silty CLAY. Gravel is angular fine to coarse sandstone, with occasional brick and dolomite.	2.0		
					2.10				
					(1.90)	MADE GROUND: Firm grey sandy gravelly CLAY, with occasional soft clay pockets. Gravel is angular to subangular fine to coarse dolomite, mudstone and occasional brick (reworked clay).			
					4.00		3.0		
							4.0		
						End of Exploratory Hole at 4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	
		No Groundwater Encountered	Length:		1. Excavation terminated on maximum depth of excavator
			Width:		
			Orientation:		



consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA
Tel. 01924 240420

Trial Pit Log

TP20

Site Name: Rockingham, Birdwell

Client: Hartwood Estates Ltd

Project No: 15677

Ground Level:

Easting:

Northing:

Key:

B = Large Disturbed Sample HSV = Hand Shear Vane
D = Small Disturbed Sample CBR = Mexecon
W = Water Sample ES = Environmental Sample

Plant: Backhoe Excavator

Date: 20/08/2015

Logged By: CB

Samples		Tests			Strata Details				
Depth (m)	Type	Depth (m)	HSV (kPa)	CBR (%)	Depth (m) (Thickness)	Strata Description	Depth (m)	Level (AOD)	Legend
1.10	ES				(0.70) 0.70	MADE GROUND: Grass over clayey sandy fine to coarse angular GRAVEL and COBBLES, with occasional boulders. Gravel and cobbles consist of sandstone. Boulders are subangular sandstone (colliery spoil).			
					(0.90) 1.60	MADE GROUND: Brown slightly clayey sandy angular GRAVEL and COBBLES, with occasional boulders. Gravel and cobbles consist of sandstone and mudstone. Boulders are subrounded sandstone (colliery spoil).	1.0		
					(0.80) 2.40	BEDROCK: Recovered as very weak fine to coarse sandstone GRAVEL.	2.0		
						End of Exploratory Hole at 2.4m			

Groundwater Observations			Stability / Dimensions		General Remarks
No.	Struck (m)	Remarks	Stability:	Good	1. Excavation terminated in bedrock
		No Groundwater Encountered	Length:		
			Width:		
			Orientation:		

Appendix C

Gas and Groundwater Monitoring Results

Gas monitoring record

3e Consulting Engineers Ltd

4 Calder Close

Calder Park

Wakefield

WF4 3BA

Job no: 15677
Site: Rockingham, Birdwell
Date: 26/08/2015
Weather: Sunny with clouds
Pressure Trend: Rising

BH No	Methane (%v/v)	Carbon dioxide (%v/v)	Oxygen (%v/v)	Barometric Pressure (mb)	Flow (l/hr)	Water level (m bgl)	Remarks
BH1	0.0	2.8	15.2	985	0.0	Dry	
BH4	0.0	11.6	3.2		0.0	DAB	
BH5	0.0	18.8	2.6		0.0	Dry	
BH7	*	*	*	*	*	*	Waterlogged to surface

DAB = Damp at Base

Date: 10/06/2015
Weather: Heavily overcast
Pressure Trend: Falling

BH No	Methane (%v/v)	Carbon dioxide (%v/v)	Oxygen (%v/v)	Barometric Pressure (mb)	Flow (l/hr)	Water level (m bgl)	Remarks
BH1	0.0	0.7	19.6	1013	0.0	Dry	
BH4	0.0	11.6	4.7		0.0	DAB	
BH5	0.0	20.9	0.7		0.0	Dry	
BH7	0.0	4.8	9.1		0.0	1.38	

Appendix D

Laboratory Chemical Test Results



2531



ANALYTICAL TEST REPORT

Contract no: 56593(1)

Contract name: Rockingham, Birdwell

Client reference: 15677

Clients name: 3E Consulting Engineers

Clients address: 1st Floor, Block C
Holland Park, Holland Drive
Newcastle Upon Tyne
NE2 4LD

Samples received: 21 August 2015

Analysis started: 21 August 2015

Analysis completed: 08 September 2015

Report issued: 08 September 2015

This is a supplementary report to report number 56593 issued 31 August 2015.

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope. Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling. Methods, procedures and performance data are available on request. Results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

D. Bowerbank

Karan Campbell
Director

John Campbell
Director

Dave Bowerbank
Customer Services Co-ordinator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
56593-1	BH01	0.20	Clay with Gravel, Brick & Roots	-	-	10.1
56593-2	BH02	0.30	Clay	-	-	14.5
56593-3	BH04	0.50	Clay with Mudstone	-	-	5.0
56593-4	BH05	0.50	Clay with Mudstone	-	-	5.4
56593-5	BH06	0.40	Clay	-	-	11.3
56593-6	BH07	0.40	Clay	-	-	10.6
56593-7	BH08	0.50	Clay	-	-	12.1
56593-8	BH09	0.50	Clay	-	-	5.2
56593-9	TP01	0.10	Clay with Roots	-	-	13.3
56593-10	TP02	1.40	Clay	-	-	10.6
56593-11	TP02	2.50	Clay	-	-	10.8
56593-12	TP04	3.00	Clay	-	-	12.0
56593-13	TP05	0.10	Clay with Roots	-	-	14.9
56593-14	TP07	0.50	Sand with Gravel	-	-	7.4
56593-15	TP07	2.00	Clay	-	-	20.3
56593-16	TP08	0.10	Clay with Gravel	-	-	10.6
56593-17	TP08	0.60	Clay	-	-	13.9
56593-18	TP09	0.90	Clay with Mudstone	-	-	7.2
56593-19	TP09	2.30	Clay	-	-	18.1
56593-20	TP11	0.20	Clay with Roots	-	-	15.6
56593-21	TP11	1.10	Clay	-	-	23.0
56593-22	TP12	0.30	Sand with Gravel	-	-	11.0
56593-23	TP14	1.10	Clay	-	-	12.8
56593-24	TP15	3.95	Silty Clay	-	-	19.4
56593-25	TP17	2.80	Silt with Gravel	-	-	9.9
56593-26	TP20	1.10	Sand with Gravel	-	-	9.2

Chemtech Environmental Limited

SOILS

Lab number			56593-1	56593-2	56593-3	56593-4	56593-5	56593-6
Sample id			BH01	BH02	BH04	BH05	BH06	BH07
Depth (m)			0.20	0.30	0.50	0.50	0.40	0.40
Date sampled			19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	6.8	5.8	18	7.7	5.7	4.9
Boron (water soluble)	CE063 ^M	mg/kg B	1.2	1.7	1.4	0.7	2.1	1.2
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	28	30	27	27	24	27
Copper (total)	CE127 ^M	mg/kg Cu	29	32	30	23	32	34
Lead (total)	CE127 ^M	mg/kg Pb	22	23	23	21	22	23
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	35	39	39	48	45	46
Selenium (total)	CE127 ^M	mg/kg Se	0.8	1.0	0.8	0.9	1.0	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	84	89	99	104	116	95
pH	CE004 ^M	units	7.8	8.5	7.8	7.7	8.0	7.9
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	47	61	312	146	221	298
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.50	1.46	0.58	1.97	1.56	1.49
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	4.31	2.52	1.00	3.40	2.69	2.57
PAH								
Naphthalene	CE087 ^M	mg/kg	0.43	0.13	0.08	0.03	0.27	0.15
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	CE087 ^U	mg/kg	0.04	0.03	<0.01	0.01	0.02	0.01
Phenanthrene	CE087 ^M	mg/kg	0.39	0.15	0.04	0.09	0.18	0.14
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.18	0.05	<0.02	0.05	0.05	0.03
Pyrene	CE087 ^M	mg/kg	0.21	0.06	<0.02	0.06	0.04	0.04
Benzo(a)anthracene	CE087 ^U	mg/kg	0.09	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	CE087 ^M	mg/kg	0.11	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.06	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.08	<0.02	<0.02	<0.02	<0.02	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	1.59	0.42	<0.27	<0.27	0.55	0.38
Subcontracted analysis								
Asbestos (qualitative)	\$	-	-	NAD	-	NAD	-	NAD

Chemtech Environmental Limited

SOILS

Lab number			56593-7	56593-8	56593-9	56593-10	56593-11	56593-12
Sample id			BH08	BH09	TP01	TP02	TP02	TP04
Depth (m)			0.50	0.50	0.10	1.40	2.50	3.00
Date sampled			19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	8.1	8.0	5.9	4.8	-	6.4
Boron (water soluble)	CE063 ^M	mg/kg B	0.9	1.3	1.1	0.6	-	1.7
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	0.2	<0.2	<0.2	-	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	26	34	26	9.1	-	44
Copper (total)	CE127 ^M	mg/kg Cu	25	34	37	23	-	25
Lead (total)	CE127 ^M	mg/kg Pb	19	18	23	22	-	22
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	-	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	32	41	36	7.8	-	19
Selenium (total)	CE127 ^M	mg/kg Se	0.8	1.0	0.8	0.5	-	1.5
Zinc (total)	CE127 ^M	mg/kg Zn	89	87	99	17	-	48
pH	CE004 ^M	units	8.0	8.2	8.0	5.1	7.0	7.7
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	111	103	47	64	17	222
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	1.00	1.53	2.22	0.40	-	1.77
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	1.72	2.64	3.83	0.69	-	3.05
PAH								
Naphthalene	CE087 ^M	mg/kg	0.03	0.39	0.19	<0.01	-	0.17
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	-	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	-	<0.01
Fluorene	CE087 ^U	mg/kg	<0.01	0.05	0.03	<0.01	-	0.26
Phenanthrene	CE087 ^M	mg/kg	0.08	0.42	0.73	<0.02	-	0.39
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	0.24	<0.02	-	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.03	0.05	2.80	<0.02	-	0.12
Pyrene	CE087 ^M	mg/kg	0.05	0.08	2.70	<0.02	-	0.27
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	<0.02	1.38	<0.02	-	0.05
Chrysene	CE087 ^M	mg/kg	<0.01	<0.01	1.49	<0.01	-	<0.01
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	1.74	<0.02	-	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	0.70	<0.02	-	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	<0.02	1.47	<0.02	-	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	<0.02	1.01	<0.02	-	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	0.17	<0.02	-	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	0.04	0.92	<0.02	-	0.04
PAH (total of USEPA 16)	CE087	mg/kg	<0.27	1.03	15.6	<0.27	-	1.31
Subcontracted analysis								
Asbestos (qualitative)	\$	-	-	NAD	NAD	-	-	-

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			56593-13 TP05 0.10 19/08/2015	56593-14 TP07 0.50 19/08/2015	56593-15 TP07 2.00 19/08/2015	56593-16 TP08 0.10 19/08/2015	56593-17 TP08 0.60 19/08/2015	56593-18 TP09 0.90 19/08/2015
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	39	4.4	-	4.5	-	5.6
Boron (water soluble)	CE063 ^M	mg/kg B	1.3	0.8	-	0.5	-	0.9
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	-	<0.2	-	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	19	39	-	29	-	32
Copper (total)	CE127 ^M	mg/kg Cu	40	20	-	27	-	27
Lead (total)	CE127 ^M	mg/kg Pb	29	12	-	18	-	17
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	-	<0.5	-	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	28	28	-	40	-	36
Selenium (total)	CE127 ^M	mg/kg Se	0.8	0.8	-	0.8	-	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	54	54	-	104	-	92
pH	CE004 ^M	units	4.7	7.3	5.8	7.9	5.3	7.9
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	300	112	62	24	103	68
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	14.26	0.54	-	0.61	-	0.90
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	24.58	0.93	-	1.05	-	1.55
PAH								
Naphthalene	CE087 ^M	mg/kg	1.82	<0.01	-	0.08	-	0.13
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01	-	<0.01	-	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	<0.01	-	<0.01	-	0.03
Fluorene	CE087 ^U	mg/kg	0.09	<0.01	-	<0.01	-	0.04
Phenanthrene	CE087 ^M	mg/kg	1.16	<0.02	-	0.08	-	0.19
Anthracene	CE087 ^U	mg/kg	0.08	<0.02	-	<0.02	-	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.28	<0.02	-	<0.02	-	0.09
Pyrene	CE087 ^M	mg/kg	0.24	<0.02	-	0.03	-	0.10
Benzo(a)anthracene	CE087 ^U	mg/kg	0.11	<0.02	-	<0.02	-	<0.02
Chrysene	CE087 ^M	mg/kg	0.24	<0.01	-	<0.01	-	<0.01
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.16	<0.02	-	<0.02	-	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	-	<0.02	-	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	<0.02	-	<0.02	-	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	<0.02	-	<0.02	-	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	-	<0.02	-	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.08	<0.02	-	<0.02	-	0.03
PAH (total of USEPA 16)	CE087	mg/kg	4.25	<0.27	-	<0.27	-	0.61
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	-	-	NAD	-	NAD

Chemtech Environmental Limited

SOILS

Lab number			56593-19	56593-20	56593-21	56593-22	56593-23	56593-24
Sample id			TP09	TP11	TP11	TP12	TP14	TP15
Depth (m)			2.30	0.20	1.10	0.30	1.10	3.95
Date sampled			19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	-	7.9	-	3.0	8.0	-
Boron (water soluble)	CE063 ^M	mg/kg B	-	0.8	-	<0.5	0.7	-
Cadmium (total)	CE127 ^M	mg/kg Cd	-	<0.2	-	<0.2	<0.2	-
Chromium (total)	CE127 ^M	mg/kg Cr	-	53	-	64	39	-
Copper (total)	CE127 ^M	mg/kg Cu	-	24	-	21	23	-
Lead (total)	CE127 ^M	mg/kg Pb	-	18	-	17	17	-
Mercury (total)	CE127 ^M	mg/kg Hg	-	<0.5	-	<0.5	<0.5	-
Nickel (total)	CE127 ^M	mg/kg Ni	-	35	-	31	30	-
Selenium (total)	CE127 ^M	mg/kg Se	-	0.8	-	0.9	0.9	-
Zinc (total)	CE127 ^M	mg/kg Zn	-	85	-	67	68	-
pH	CE004 ^M	units	6.5	8.0	7.4	7.8	8.0	7.5
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	108	35	231	11	126	191
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	-	1.26	-	0.43	0.43	-
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	-	2.17	-	0.74	0.74	-
PAH								
Naphthalene	CE087 ^M	mg/kg	-	0.11	-	<0.01	<0.01	-
Acenaphthylene	CE087 ^M	mg/kg	-	<0.01	-	<0.01	<0.01	-
Acenaphthene	CE087 ^M	mg/kg	-	<0.01	-	<0.01	<0.01	-
Fluorene	CE087 ^U	mg/kg	-	0.03	-	<0.01	<0.01	-
Phenanthrene	CE087 ^M	mg/kg	-	0.19	-	<0.02	<0.02	-
Anthracene	CE087 ^U	mg/kg	-	<0.02	-	<0.02	<0.02	-
Fluoranthene	CE087 ^M	mg/kg	-	0.07	-	<0.02	<0.02	-
Pyrene	CE087 ^M	mg/kg	-	0.06	-	<0.02	<0.02	-
Benzo(a)anthracene	CE087 ^U	mg/kg	-	<0.02	-	<0.02	<0.02	-
Chrysene	CE087 ^M	mg/kg	-	<0.01	-	<0.01	<0.01	-
Benzo(b)fluoranthene	CE087 ^M	mg/kg	-	<0.02	-	<0.02	<0.02	-
Benzo(k)fluoranthene	CE087 ^M	mg/kg	-	<0.02	-	<0.02	<0.02	-
Benzo(a)pyrene	CE087 ^U	mg/kg	-	<0.02	-	<0.02	<0.02	-
Indeno(123cd)pyrene	CE087 ^M	mg/kg	-	<0.02	-	<0.02	<0.02	-
Dibenz(ah)anthracene	CE087 ^M	mg/kg	-	<0.02	-	<0.02	<0.02	-
Benzo(ghi)perylene	CE087 ^M	mg/kg	-	0.03	-	<0.02	<0.02	-
PAH (total of USEPA 16)	CE087	mg/kg	-	0.50	-	<0.27	<0.27	-
Subcontracted analysis								
Asbestos (qualitative)	\$	-	-	NAD	-	-	NAD	-

Chemtech Environmental Limited

SOILS

Lab number			56593-25	56593-26
Sample id			TP17	TP20
Depth (m)			2.80	1.10
Date sampled			19/08/2015	19/08/2015
Test	Method	Units		
Arsenic (total)	CE127 ^M	mg/kg As	8.5	5.7
Boron (water soluble)	CE063 ^M	mg/kg B	1.1	0.8
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	45	51
Copper (total)	CE127 ^M	mg/kg Cu	20	16
Lead (total)	CE127 ^M	mg/kg Pb	15	13
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	18	25
Selenium (total)	CE127 ^M	mg/kg Se	0.9	0.8
Zinc (total)	CE127 ^M	mg/kg Zn	43	44
pH	CE004 ^M	units	7.9	7.8
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	65	331
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	0.64	0.54
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	1.10	0.93
PAH				
Naphthalene	CE087 ^M	mg/kg	0.08	0.17
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	0.04
Fluorene	CE087 ^U	mg/kg	0.02	<0.01
Phenanthrene	CE087 ^M	mg/kg	0.08	0.26
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02
Fluoranthene	CE087 ^M	mg/kg	<0.02	0.10
Pyrene	CE087 ^M	mg/kg	0.04	0.11
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	<0.02
Chrysene	CE087 ^M	mg/kg	<0.01	0.02
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.02	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	<0.27	0.70
Subcontracted analysis				
Asbestos (qualitative)	\$	-	-	-

Chemtech Environmental Limited

PREPARED LEACHATES

Lab number Sample id Depth (m)			56593-1L BH01 0.20	56593-8L BH09 0.50	56593-9L TP01 0.10	56593-12L TP04 3.00
Test	Method	Units				
Arsenic (dissolved)	CE128 ^U	µg/l As	0.06	<0.06	<0.06	0.83
Boron (dissolved)	CE128 ^U	µg/l B	20	22	13	33
Cadmium (dissolved)	CE128 ^U	µg/l Cd	<0.07	<0.07	<0.07	<0.07
Chromium (dissolved)	CE128 ^U	µg/l Cr	<0.2	<0.2	<0.2	<0.2
Copper (dissolved)	CE128 ^U	µg/l Cu	0.5	<0.4	0.7	0.6
Lead (dissolved)	CE128 ^U	µg/l Pb	<0.2	<0.2	<0.2	<0.2
Mercury (dissolved)	CE128 ^U	µg/l Hg	<0.008	<0.008	<0.008	<0.008
Nickel (dissolved)	CE128 ^U	µg/l Ni	<0.5	<0.5	<0.5	1.8
Selenium (dissolved)	CE128 ^U	µg/l Se	0.25	0.63	<0.07	0.67
Zinc (dissolved)	CE128 ^U	µg/l Zn	<1	<1	<1	<1
pH	CE004 ^U	units	7.1	7.4	7.5	7.4
Sulphate	CE049 ^U	mg/l SO ₄	<10	36	<10	33
PAH						
Naphthalene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Acenaphthene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Fluorene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Phenanthrene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Anthracene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Fluoranthene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Pyrene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Chrysene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Indeno(123cd)pyrene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Dibenz(ah)anthracene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	CE087	µg/l	<0.1	<0.1	<0.1	<0.1
PAH (total of USEPA 16)	CE087	µg/l	<1.6	<1.6	<1.6	<1.6

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE072	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry	M	0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	Wet	U	0.01	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	Wet		0.27	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	PREPARED LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE001	Leachate preparation (EA)	L:S 10:1		-	-
CE128	Arsenic (dissolved)	ICP-MS	U	0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS	U	6	µg/l B
CE128	Cadmium (dissolved)	ICP-MS	U	0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS	U	0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS	U	0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS	U	0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS	U	0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS	U	0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS	U	1	µg/l Zn
CE004	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	10	mg/l SO ₄
CE087	PAH (speciated)	Solvent extraction, GC-MS		0.1	µg/l

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
A	Sampling date not provided
B	Sampling time not provided (waters only)
C	Sample exceeded holding time(s)
D	Sample not received in appropriate containers
E	Headspace present in sample container
F	Sample not chemically fixed (where appropriate)
G	Sample not cooled
H	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
56593-1	BH01	0.20	N	
56593-2	BH02	0.30	N	
56593-3	BH04	0.50	N	
56593-4	BH05	0.50	N	
56593-5	BH06	0.40	N	
56593-6	BH07	0.40	N	
56593-7	BH08	0.50	N	
56593-8	BH09	0.50	N	
56593-9	TP01	0.10	N	
56593-10	TP02	1.40	N	
56593-11	TP02	2.50	N	
56593-12	TP04	3.00	N	
56593-13	TP05	0.10	N	
56593-14	TP07	0.50	N	
56593-15	TP07	2.00	N	
56593-16	TP08	0.10	N	
56593-17	TP08	0.60	N	
56593-18	TP09	0.90	N	
56593-19	TP09	2.30	N	
56593-20	TP11	0.20	N	
56593-21	TP11	1.10	N	
56593-22	TP12	0.30	N	
56593-23	TP14	1.10	N	
56593-24	TP15	3.95	N	
56593-25	TP17	2.80	N	
56593-26	TP20	1.10	N	

Appendix E

Laboratory Geotechnical Test Results

Northumberland

Northumberland County Council

Highways Laboratory

Bassington Drive • Cramlington • Northumberland • NE23 8AJ

Tel (01670) 737575 • Fax (01670) 732044 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 01 at 2.00m**Material Type: **Grey, silty CLAY, clayey SILT with occasional mudstone**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **14.1** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **44** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **22** Part 2 Clause 5.3Plasticity Index (%): **22** Part 2 Clause 5.4Passing 425mic (%): **61**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐Signed: 

[] M. Newton, Senior Technician

[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

Northumberland

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Tel (01670) 737575 • Fax (01670) 732044 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 04 at 1.90m**Material Type: **Grey, silty CLAY, clayey SILT with mudstone gravel**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **13.2** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **45** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **23** Part 2 Clause 5.3Plasticity Index (%): **22** Part 2 Clause 5.4Passing 425mic (%): **46**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐Signed: 

[] M. Newton, Senior Technician

[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

NORTHUMBERLAND

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Highways Laboratory

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Tel (01670) 737575 • Fax (01670) 732044 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 07 at 0.90m**Material Type: **Yellow, orange, grey mottled sandy, silty CLAY with very occasional gravel**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **21.3** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **43** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **23** Part 2 Clause 5.3Plasticity Index (%): **20** Part 2 Clause 5.4Passing 425mic (%): **93**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐Signed: 

[] M. Newton, Senior Technician

[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 08 at 0.60m**Material Type: **Orange, grey, sandy, silty CLAY**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **17.5** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **41** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **21** Part 2 Clause 5.3Plasticity Index (%): **20** Part 2 Clause 5.4Passing 425mic (%): **92**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐

Signed:



[] M. Newton, Senior Technician

[✓] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

Northumberland

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Highways Laboratory

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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 10 at 1.70m**Material Type: **Orange, yellow, grey, mottled silty, sandy CLAY with very occasional gravel**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **22.2** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **47** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **23** Part 2 Clause 5.3Plasticity Index (%): **24** Part 2 Clause 5.4Passing 425mic (%): **87**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐

Signed:



[] M. Newton, Senior Technician

[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

NORTHUMBERLAND

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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 12 at 1.50m**Material Type: **Orange, grey, silty, sandy CLAY with occasional gravel**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **24.7** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **49** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **24** Part 2 Clause 5.3Plasticity Index (%): **25** Part 2 Clause 5.4Passing 425mic (%): **90**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐Signed: 

[] M. Newton, Senior Technician

[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 13 at 2.80m**Material Type: **Yellow, grey, orange, silty CLAY**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **26.9** Part 2 Clause 3.2

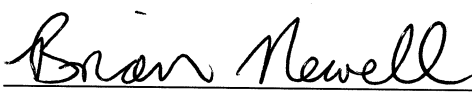
The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **61** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **26** Part 2 Clause 5.3Plasticity Index (%): **35** Part 2 Clause 5.4Passing 425mic (%): **99**Soil Classification: **CH**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐Signed:  [] M. Newton, Senior Technician
[x] B. Newell, Laboratory ManagerStart of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**

Northumberland

Northumberland County Council

Highways Laboratory

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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Client: **3E Consulting Engineers Ltd**Engineer: **Christopher Brewster**Project: **Rockingham, Birdwell**Location: **TP 15 at 3.70m**Material Type: **Grey, silty CLAY with mudstone gravel**Source: **Site**Date Sampled: **20/08/2015**Date Received: **24/08/2015**Sampled By: **Clients Staff**

Test Results

Specification

Natural Moisture Content (%): **15.3** Part 2 Clause 3.2

The liquid and Plastic Limits are prepared in accordance with BS1377: Part 2: Clause 4.2.4 due to the nature of most materials in the surrounding area (Sandy CLAY with gravel cobbles and boulders)

Liquid Limit (%): **42** Part 2 Clause 4.4 (One Point Method)Plastic Limit (%): **22** Part 2 Clause 5.3Plasticity Index (%): **20** Part 2 Clause 5.4Passing 425mic (%): **48**Soil Classification: **CI**Mean Particle Density **N/A** Part 2 Clause 8.2 (Gas Jar Method)

The following tests are NOT accredited.

Moisture Condition Value* **N/A** Part 4 Clause 5.4MCV Test Moisture Content (%): **N/A**Permeability (m/s) * **N/A**

(Method as given in Head's "Manual Of Soil Laboratory Testing" Volume 3 Section 20.4.2)

Remarks: **None**Certificate of sampling received: ☐

Signed:  [] M. Newton, Senior Technician
[x] B. Newell, Laboratory Manager

Start of Test Date: **26/08/2015**End of Test Date: **28/08/2015**Report Date: **28/08/2015**