Report type:	Phase II Site Appraisal
Site:	Land to the north east of Glebelands, Pulborough
Client:	Catesby Estates Ltd
Ref:	GRM/P7298/F.1
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LAND TO THE NORTH EAST OF GLEBELANDS, PULBOROUGH
PHASE II SITE APPRAISAL REPORT
FOR
CATESBY ESTATES LTD

Report Ref:
P7298

Date:
April 2016

Prepared for:
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

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When required in-house geological, geotechnical, environmental, structural and civil staff helped to produce this document.		

Issue	Description of Revision	Signature

Site Appraisal for Land to the north east of Glebelands, Pulborough

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column.		
Proposed Development	Residential properties with associated gardens, soft landscaping and infrastructure.	
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	No remediation required.	
Site Workers	No remediation required (depleted oxygen needs to be considered).	
Construction Materials	Appropriate concrete specification. PE water supply pipes should be suitable (to be confirmed).	Y
Groundwater	No remediation required.	
Surface Water	No remediation required.	
Waste Disposal	Preliminary Waste Classification: Non-Hazardous for topsoil and made ground. Inert for natural strata. Will need to be confirmed by receiving landfill.	Y
GEOTECHNICAL ASSESSMENT – FOUNDATIONS		
Ground Treatment Required	Stabilisation of shallow soils prior to plant movement. Temporary haulage roads may be required.	Y
Main Bearing Strata	Sand and clay.	
Nett Allowable Bearing Pressure	110kN/m^2 Clay; 110kN/m^2 Sand; 300kN/m^2 Rock, for trench fill foundations.	
Rockhead	Across site from 0.5m in the south eastern corner to 3m towards the centre of the southern boundary.	
Tree Influence	Some. Extent to be confirmed by a tree survey.	Y
Volume Change Potential	Low.	
Likely Foundation Types	100% Strip/Trench Fill.	
Likely Foundation Depth Range	0.6m begl minimum (sand), 2.5m begl maximum depths; average depth 1.0m begl.	
Excavation Hazards	Localised shallow rock.	
Floor Slab Types	100% beam and block.	
Gas Protection Requirements Radon and/or Landfill	Gas protection measures required for carbon dioxide at this stage. Need for and scope of, to be confirmed when gas monitoring is complete. No radon protection required.	Y
GEOTECHNICAL ASSESSMENT - GENERAL		
Slope Stability Risk	Low.	
Soakaways Potential	Potentially suitable – further testing will be required to confirm.	Y
New Access Roads	Laboratory CBRs 0.4% to 0.7% in granular soils. The DCP testing recorded values of 4% to 8% for granular soils and 3% to 4% for cohesive soils.	
Buried Concrete Class	DS - 1; AC- 1. GEN-1, RC35.	
Retaining Walls and Boundary Features	Maybe (proposed).	Y
Further Assessment Targets	Further investigation and potentially testing under current beds and polytunnels.	Y
Other Comments	Further site investigation under polytunnels.	

This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by Catesby Estates Ltd (Client) to undertake a Phase II Site Appraisal. A previous desk study by GRM (GRM Phase I Site Appraisal (Desk Study), GRM/P7298/DS.1, January 2016) formed Phase I of the assessment and allowed the geotechnical and geo-environmental setting of the site to be determined and the identification of areas of particular concern that required targeted investigation. The Phase II works reported within this document comprise the intrusive ground investigation, geotechnical testing and chemical analysis. The information gained from the Phase II works will be used to refine the conceptual model for the site and determine the most cost-effective development solutions.

This document is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

The Client's outline development proposal includes a residential development with gardens, public open space and associated infrastructure.

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of the Phase II Site Appraisal are as follows:

a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.

b) Determine the possible ground-related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.

c) Provide preliminary development recommendations.

d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY SUMMARY

Project Name.	Land to the north east of Glebelands, Pulborough.
Project Reference.	P7298.
Client.	Catesby Estates Ltd.
Site Location (address).	Drover's Lane, Pulborough.
National Grid Reference.	TQ 057 191.
Site Area (Ha).	4.7 hectares.
Summary of Proposed Development.	Residential properties with gardens, public open space, infrastructure and attenuation basins.
Client Supplied Information.	Site location and boundary plans.
Site Setting.	The site is presently used both as agricultural land for producing container grown shrubs and trees, and open fields.
Site History.	Open fields until 2002 until it was developed with a nursery.
Geology.	Superficial Head Deposits in southern most corner (sand, silt and clay). The solid geology comprises the Hythe Formation (sandstone).
Groundwater and Surface Water.	The superficial deposits (Head) are a Secondary (undifferentiated) Aquifer and the solid geology (Hythe Formation) is a Principal Aquifer. The BGS suggests the site is within an area of limited potential groundwater flooding related to Clearwater Flooding (unconfined aquifers). The only significant surface water features within 250m of the site are the field drains along the site boundaries. The site is not within an indicative fluvial floodplain and the Environment Agency's Internet based flood risk maps suggest there is a very low risk from river flooding. However, due to the site's size (>1ha) a Flood Risk Assessment will be required.
Mining.	None identified.
Potential Soil Contamination Sources.	Pesticides associated with former and current land use.
Potential Ground Gas Sources (including Radon).	No significant sources identified.

The Phase I Ground Hazard Diagram is presented in Appendix B.

2.1 PHASE I CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Solution**
Pesticides associated with current land use.	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users and construction workers.	Soil capping and/or localised removal of contaminated soils.
A significant source of ground gas has not been identified.	Inhalation.	End users.	None anticipated.

CONTROLLED WATERS			
Pesticides associated with current land use.	Surface run-off. Leaching and vertical migration.	Drains along site boundaries.	Assessment of groundwater quality and, if required, subsequent risk assessment and remediation.
		Secondary and Principal Aquifers.	

CONSTRUCTION MATERIALS			
Pesticides associated with current land use.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Standard water pipes/clean backfill material likely to be suitable.
Elevated levels of sulphate and/or acidic ground conditions.	Direct contact.	Buried concrete.	Appropriate concrete specification.

3 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The ground investigation has been designed in accordance with the general comments outlined in Appendix A (iv).

The ground investigation fieldwork was conducted on 3rd to 6th March 2016 with groundwater/gas monitoring visits continuing after that period. A total of seventeen exploratory holes, ten trial pits (of which three were soakaway test locations) and seven windowless sample boreholes were progressed, to a maximum depth of 3m below existing ground level (begl). The exploratory hole location plan and exploratory hole logs are presented in Appendix C and Appendix D respectively.

The rationale for the positioning of the individual exploratory holes is illustrated in the table below:

LIST OF TARGETED EXPLORATORY HOLES	
Exploratory Hole	**Reason for Location and Type**
TP1-TP3	Proposed position of attenuation basins (Soakaway pits).
TP4-TP7, TP9 and TP10	General grid across fields (Trial Pits).
TP8	In growing bed, potential for higher levels of pesticides (Trial Pit).
WS1-WS7	General grid incorporating areas inaccessible to an excavator (Window Sample Boreholes).
TP = Trial Pit, WS = Window Sample Hole.	

Areas not accessible at the time of the ground investigation included in the planted beds and under the polytunnels. The areas where further investigations are recommended is illustrated on the Constraints Plan presented in Appendix E.

Seven gas and water monitoring standpipes were installed, the rationale for these works are discussed fully in Section 6. A Gas Monitoring Plan, illustrating the locations of the standpipes, is presented in Appendix F. The standpipes will need to remain in place until the middle of June.

3.2 PROVEN GROUND

The following ground conditions were encountered during the investigation fieldwork:

- Topsoil.
- Made Ground.
- Head Deposits.
- Hythe Beds.

3.2.1 Topsoil

Topsoil was encountered as a dark grey and dark brown gravelly slightly clayey sand in most holes (TP1-TP10, WS1, WS2 and WS4), ranging in thickness from 0.2m to 0.4m, with a general thickness of 0.3m.

3.2.2 Made Ground

Made ground was encountered as a red brown, grey and brown clayey gravelly sand in WS3 and WS5-WS7 on the footpaths between the growing beds, ranging in thickness from 0.3m to 0.4m with a general thickness of 0.3m.

3.2.3 Head Deposits

These deposits generally comprised:

- Loose to medium dense orange brown locally grey, silty, locally clayey, gravelly sand. The sand was encountered across the majority of site, although it was absent in TP9 and TP10 in the south eastern corner, WS2 close to the southern boundary and only a thin band found in WS5.

- Firm to stiff, medium to high strength, brown and orange brown sandy gravelly CLAY. The clay was mainly found in the north eastern corner of the site to depths of up to 1.1m to 1.8m begl.

The head was observed to depths of between 0.9m and 2.7m begl, and was on average 1.4m thick.

Standard Penetration Test N-values generally ranged from 10 to 15 at 1m depth; indicating a medium strength. The sands encountered were typically loose to medium dense.

3.2.4 Hythe Formation

Weathered Hythe Formation

These strata generally comprised medium dense orange brown, grey brown and red brown, silty, sand with gravel of sandstone and localised clay bands.

This material was found, in all holes except for TP1-TP3, which terminated at shallow depth. Where encountered it was observed to depths of up to 3.0m and was generally 0.6m thick.

Standard Penetration Test N-values generally ranged from 13 to 50 (refusal) at 2m depth, the refusals are due to the presence of rock immediately below the encountered sand. The sands encountered were typically medium dense to very dense. A single very low SPT of 3 was encountered in WS2 at 2m begl. The sands recorded in the Trial Pits were at least medium dense.

Hythe Formation

These strata generally comprised extremely weak to weak grey brown and reddish brown sandstone.

This material was generally only encountered in the trial pits through the centre of site (TP4, TP5, TP8, TP9 and TP10), however the refusals in the window sample holes are likely to be due to rock being present (WS1-WS7), although not seen in the

sampling tubes. Sandstone was encountered at depths below 0.5m begl in the south eastern corner and 2.7m begl in the centre of the southern boundary.

3.3 CONTAMINATION OBSERVATIONS

No visual or olfactory evidence of potential contamination was encountered during the fieldwork and monitoring.

3.4 GROUNDWATER OBSERVATIONS

The soils in TP1 and TP2 were damp from 0.3m to 1.2m (base of hole). However, the exploratory techniques used were rapid and may have masked other small water seepages.

One groundwater monitoring visit has been conducted and the results of the monitoring are reported in Appendix G. In summary, standing water was recorded at a depth of 1.67m begl in WS5. This is likely to be water that was perched in the head deposits.

Long term monitoring of groundwater levels has not been conducted as part of this investigation and interpreted levels are approximate and may be dependent on seasonal variations.

Due to the lack of groundwater data for the site it has not been possible to accurately determine the groundwater flow direction beneath the site. However, the groundwater flow is considered to be to the south east following the local topography.

3.5 GROUND GAS AND VAPOURS

Ground gases are discussed in full in Section 6. In summary, the concentrations of ground gases recorded to date are presented in Appendix G and summarised below:

- Methane has not been detected.
- Carbon dioxide between 0.0%v/v and 4.5%v/v.
- Oxygen between 7.7%v/v and 19.5%v/v.

No flow has been noted during the monitoring completed to date.

3.6 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed/confirmed the following:

Significant Features identified during fieldwork
The presence of Head Deposits and locally shallow rock.
The absence of significant made ground.
Cohesive strata (in association with trees).
Variable strata.
Locally perched groundwater.

4 LABORATORY ANALYSES RATIONALE

4.1 CHEMICAL LABORATORY ANALYSIS

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the Phase I assessment, identified past uses of the site, site observations and comprised:

- Twelve samples (three of made ground and nine of topsoil) were analysed for a general suite of contaminants (metals, inorganics and speciated PAH).
- Three samples of made ground and one sample of topsoil underwent leachate analysis and were analysed for a general suite of contaminants.
- Twelve samples (three of made ground and nine of topsoil) have been screened for the presence of asbestos.
- Twelve samples (three of made ground and nine of topsoil) have been submitted for a pesticide screen.

The chemical analysis results are presented in Appendix H.

4.2 GEOTECHNICAL LABORATORY TESTING

Geotechnical soils testing has been undertaken as part of the ground investigation including the following:

- Three samples (two of Head Deposits and one of the weathered Hythe Beds) underwent Atterberg Limits (PI) classification.
- Fifteen samples (three of made ground, six of topsoil, three of the weathered Hythe Beds and three of the Head Deposits) underwent pH and water soluble sulphate testing.
- Three samples (three samples of Head deposits) underwent Remoulded CBR testing.

Geotechnical tests were selected to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure. The geotechnical test results are presented in Appendix I, and summarised in Section 10.2.

5 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (SOIL)

5.1 INTRODUCTION

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping and infrastructure.

Various sources of contamination have been put forward in earlier text and summarised in the Phase I conceptual model. The material on site identified as being the most likely to be contaminated is the made ground and the topsoil (which might have been impacted by the use of pesticides).

Representative samples of all strata and those considered to be potentially contaminated by virtue of the desk study and/or based on site observations were collected for further examination and/or potential testing.

The rationale for the end use specific Tier 1 Acceptance Criteria (TAC) used by GRM is outlined in Appendix A (vi) and for this site the chemical analysis results are being compared against the TAC for residential end use with plant uptake. In order to adopt a conservative approach a Soil Organic Matter (SOM) content of 1% has been used to assess the topsoil and made ground as this reflects the lowest SOM recorded in each material.

A copy of the thresholds used in this assessment is presented in Appendix J.

5.2 RISK TO END USERS

The chemical analysis results are presented in Appendix H.

Statistical analysis in accordance with the principles outlined in the CIEH document *Guidance on Soil Contamination Data with a Critical Concentration* (May 2008) has been used to assess the chemical analysis test results for the general suite analysis (metals, inorganics and speciated PAHs) for the topsoil; the accompanying reports are presented in Appendix K.

Whilst the number of samples tested is considered sufficient to characterise the made ground, it is not considered appropriate to carry out statistical analysis on this data set. Therefore, the results have been compared directly against the TAC.

The results of the pesticides have also been assessed separately.

5.2.1 Analysis of Soil Contamination Data

GRM General Suite –Made Ground and Topsoil

Topsoil

The 'Upper Confidence Limit (UCL) of the True Mean' values for all of the contaminants are below the relevant 'Critical Concentrations' (i.e. TAC) for residential end use with plant uptake.

The statistical analysis revealed a statistical outlier of 34.2mg/kg of Chromium III in TP08 which was below the relevant 'Critical Concentration', and is considered not to be indicative of another population that requires further consideration.

Made Ground

The recorded concentrations of contaminants of concern are below the relevant threshold for residential end use with plant uptake.

Pesticides

The pesticides screen revealed the presence of the pesticides for the samples analysed. The pesticides were speciated, and DDE and DDD recorded above detection limits. However, the levels recorded do not exceed the threshold for human health.

Asbestos

No asbestos was detected in the samples analysed.

5.2.2 Summary of Risk to End Users

The risk to end users from soil contamination based on current information is considered to be negligible and the topsoil is considered suitable for reuse.

5.3 RISK TO SITE WORKERS

The investigation has not revealed any specific risk to site workers; however, the general comments outlined in Appendix A (vii) should be considered when site specific risk assessments are completed.

6 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (GROUND GAS)

The gas risk assessment methodology used by GRM is outlined in Appendix A (v).

As the proposed land use is classed as high (residential with gardens); seven 35mm gas/water monitoring standpipes have been installed across the site (WS1-WS7). The response zones have been targeted at the natural strata as the encountered made ground was less than 0.4m.

Based on BS8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds*, the gas hazard is considered very low (natural soil with low organic content (up to 5%)), and so the monitoring programme will comprise six visits over three months. To date one visit has been conducted; therefore, only an initial assessment of the local gas regime has been undertaken at this stage and further visits will be required to complete the monitoring program. A separate gas addendum letter report will be issued following the completion of the full monitoring program.

The gas monitoring results to date, are presented in Appendix G, and summarised in Section 3.5.

The gas monitoring has been undertaken using a LMSxi Multifunction Gas Analyser.

The primary guidance document to determine if protection measures are required is *BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Flow Rate (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

As both flow rate and methane concentrations were below the monitor's lower limit of detection a default flow rate of 0.1l/hr and a default methane concentration of 0.1%v/v have been used in the following assessment.

Using the default flow rate of 0.1l/hr and the default methane concentration of 0.1%v/v a Q_{hg} of 0.0001l/hr has been calculated for methane. Using the default flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 4.5%v/v, a Q_{hg} of 0.0045l/hr has been calculated for carbon dioxide. On this basis the Q_{hg} GSV for the site is determined as 0.0045l/hr.

Although the GSV is <0.07l/hr, and the maximum recorded concentration of methane is <1%v/v; as the maximum recorded concentration of carbon dioxide is 4.5%v/v (which is close to 5%v/v), consideration has to be given the increasing the 'Characteristic Situation' from 1 to 2 as outlined in table 2 of BS8485:2015, for which gas protection measures are required.

Further monitoring will be required to confirm the above assessment and may negate the need for protection measures; however, at this stage it is recommended that allowance is made for the incorporation of gas precautions to 'Characteristic Situation 2'.

Depleted oxygen was recorded in WS3 where the elevated carbon dioxide was recorded, this could pose a risk to site workers.

The desk study risk assessment determined that no radon protection measures are required.

6.1 SUMMARY OF RISK FROM GAS

The investigation has revealed a potential risk to end users from ground gas and gas protection measures may be required, subject to completion of the gas monitoring program.

The depleted oxygen may pose a risk to site workers particularly if they have to enter excavations, a full risk assessment should be conducted prior to starting works on site.

7 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

The methodology, rationale and guidance GRM have used to assess the risk to controlled waters is set out in Appendix A (viii).

The primary receptors for this site have been identified as underlying Secondary (undifferentiated) Aquifer (Head), the Principal Aquifer (Hythe Formation) and the drains running along the site boundaries. The primary pathways are leaching of contaminants and vertical migration to the groundwater, and surface run-off.

The made ground has been identified as a potential source for controlled waters and, accordingly, soil leachate testing has been conducted to determine whether it poses risk.

7.1 INTERPRETATION OF GROUNDWATER OBSERVATIONS AND MONITORING

Groundwater has only been encountered in the weathered Hythe Formation in WS5.

7.2 ASSESSMENT OF THE CHEMICAL ANALYSIS RESULTS

The results of the soil leachate testing are presented in Appendix H; these have been compared against the UKDWS and EQS values presented in Appendix J.

The recorded concentrations of all contaminants are below the relevant threshold.

7.3 SUMMARY OF RISK TO CONTROLLED WATERS

The risk to the aquifers below the site is negligible.

The risk to nearby surface waters is negligible.

7.4 PHASE II CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Remedial Solution**
A source of contamination has not been identified.	Indoor and outdoor inhalation of soil/soil dust and asbestos fibres, ingestion of, and dermal contact with contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	No remediation required.
		Construction workers.	
Natural strata.	Inhalation of carbon dioxide.	End users.	Gas protection measures are potentially required (Scope to be confirmed following completion of the gas monitoring).
A source of contamination has not been identified.	Migration of contamination through leaks and joints, degradation of water pipe materials.	End Users.	PE water supply pipes and clean backfill should be suitable (to be confirmed by water supply company).

CONTROLLED WATERS			
A source of contamination has not been identified.	Leaching of contaminants and vertical migration to the groundwater.	Principal and Secondary Aquifer.	No remediation required.
	Surface run-off.	Drains along site boundaries.	

8 REMEDIATION

8.1 RECOMMENDED REMEDIAL MEASURES AND VALIDATION REQUIREMENTS

8.1.1 Protection of End Users

Soil Contamination

In addition to the testing already undertaken, testing of the shallow soils should be undertaken following the removal of the polytunnels and the planted beds, to confirm that no contamination exists and the final scope of the remediation works can be determined. A Constraints Plan is presented in Appendix E.

Based on the current testing a source of soil contamination has not been identified and so remedial measures are not required to protect end users.

The existing topsoil has been shown be uncontaminated and can be used as a growing medium in private gardens and soft landscaping. If there is insufficient topsoil to complete the proposed development, then some will need to be imported.

Any topsoil imported for use to construct the growing medium will require chemical validation to confirm that it is suitable for use. Samples of this material will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs and other contaminants such as, speciated hydrocarbons and asbestos depending on the source. The number of samples that require analysis will depend in the volume imported and the source of the materials. Typically an analysis rate of one sample per $50m^3$ and one sample per $250m^3$ (minimum of three samples per source and material type) applies for generated and virgin soils respectively.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

Ground Gas

Gas protection measures are potentially required for the proposed development.

If required the gas protection measures should comprise the provision of a gas resistant membrane (such as Monarflex Reflex Super), fully sealed at joints and service penetrations, and a vented sub-floor void. These would provide a score of 3.5 points under BS8545 and so will be suitable for the type of building proposed (Type A). More details would need to be provided in a Gas Protection Measures Verification Plan.

8.1.2 Protection of Site Workers

The risk to site workers from the identified soil contamination is negligible. Elevated carbon dioxide and depleted oxygen has been identified. The risk of depleted oxygen will need to be considered with regards to man entry into excavations. However the use of suitable PPE should be enforced during the ground works stage of construction.

8.1.3 Protection of Controlled Waters

The risk to controlled waters is negligible and no remedial measures are required.

8.2 REMEDIATION METHOD STATEMENT

A Gas Verification Plan will be required if gas protection measures are needed.

If the recommended further investigation in the growing beds and under the polytunnels reveals contamination then a remediation method statement may be required.

Following your review of this document, we would recommend that a copy of it be forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency).

Consultation should be undertaken at the earliest possible opportunity to avoid abortive or delayed works.

8.3 DISPOSAL AND CLASSIFICATION

The topsoil will be classified as Non-Hazardous Waste.

Based on the Waste Classification Report (Appendix L) it is considered that the made ground and topsoil will be classed as Not-Hazardous Waste, depending on the individual landfill site's criteria. Reference should be made to the relevant notes presented in Appendix A (x).

The natural strata underlying the site is likely to be classified as Inert for disposal purposes, however, further testing will be required to confirm this. Natural soils may be suitable for re-use on-site as part of any capping layer and consideration should be given to retaining this material on-site. Alternatively, it may be sold as a commodity to off-set construction costs.

Care should be taken to keep natural arisings separate from the made ground and free from construction materials, as natural soils mixed with made ground and construction materials may attract additional disposal costs.

Although not identified during the site works, visible asbestos containing materials (ACMs) within soils will result in the soils being classified as Hazardous Waste. Visible ACMs should be removed, employing appropriate health and safety protocols and where possible, prior to disposal.

It is recommended that any materials to be exported are stockpiled and tested to confirm disposal rates, as this may be more cost effective than using the results contained within this report.

9 GEOTECHNICAL ASSESSMENT

9.1 INTRODUCTION

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping and infrastructure. Finished floor levels and the levels of any underground engineering works have not been provided.

Detailed development plans were not available at the time of report preparation so it has been assumed in the following assessment that the development will be in line with current planning guidance and comprise two to three storey residential housing and three to four storey apartment blocks.

In addition to the site specific comments below reference should be made to the general comments relating to the Geotechnical Assessment listed in Appendix A (xi to xvi).

9.2 GEOTECHNICAL TESTING

Geotechnical testing has been carried out both on site and in the laboratory; the results of this testing are provided on the logs in Appendix D, and in Appendix I. These results are summarised in the tables below:

Insitu Testing:
Cohesive Natural

Test Parameter	Range of Results
SPT 'N' values	10 to 15

Granular Natural

Test Parameter	Range of Results
SPT 'N' values	13 to 50 (refusal)

Laboratory Testing:
Cohesive Natural

Test Parameter	Range of Results
Natural Moisture Content	25% to 27%
Plasticity Index	18% to 19%

Granular Natural

Test Parameter	Range of Results
Natural Moisture Content	25% to 27%
Remoulded CBR	0.4% to 0.7%

9.3 ENGINEERING GROUND TREATMENT

The near surface soils were generally soft under foot during the intrusive investigation. It is therefore considered likely that pre-treatment of the surface soils and temporary haul roads will be required for plant/personnel movements.

9.4 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques. A breaker will be required for deeper excavations in the less weathered sandstone, as the machine used for trial pitting was struggling to excavate past 3m begl.

From the ground investigation undertaken, it is likely that excavations will be generally stable in the short term. However, some materials such as granular soils and made ground are liable to collapse without warning. This situation is likely to be exacerbated by water ingress.

It is considered unlikely that dewatering will be required for shallow short-term excavations. However for deeper excavations into the rock simple dewatering techniques (e.g. sump pumping) may be needed to control water ingress.

9.5 EXISTING STRUCTURES / SUBSTRUCTURES

There are existing structures on the site including polytunnels; however, these are unlikely to have significant substructures.

9.6 FOUNDATIONS

The made ground and topsoil, are considered unsuitable as a bearing stratum and all new foundations should be carried down through them to found on the more competent natural cohesive, granular or rock quality strata. This will not result in excessive deepening.

The site is mainly underlain by granular strata and so a minimum foundation depth of 0.6m will apply for new foundations for the majority of the site area.

The north eastern area of the site is underlain by low volume change potential cohesive strata and so a minimum foundation depth of 0.75m begl will apply for new foundations in this area.

There are trees along and within the site boundaries and any new foundations within the zone of influence of them in areas where cohesive strata have been encountered will need to be deepened in line with guidance in NHBC Chapter 4.2. Based on the trees tentatively identified on site it is estimated that approximately 10% of the site will be affected by trees. The resultant foundation depths can only be determined by a tree survey and tree influence drawing, but at this stage it is estimated that foundation depths of no deeper than 2.5m begl might be expected.

At this stage, and based on the above, it is considered likely that trench fill foundations, founded on the natural cohesive, granular and rock quality strata will be suitable for the proposed development. Foundation depths of between 0.6m begl and 2.5m begl may be expected, with an average foundation depth of 1.0m begl.

The natural cohesive and granular soils encountered, at anticipated foundation depths, were generally at least loose to medium dense (granular) and medium to high strength (clay). It is anticipated that a nett allowable bearing pressure of at least 110kN/m^2 should be available for conventional strip or trench fill footings. This will allow line loads up to 49kN/m to be taken on footings 450mm wide and 66kN/m on

footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

The sandstone encountered at anticipated foundation depths, was generally at least very weak. It is anticipated that a nett allowable bearing pressure of at least 300kN/m^2 should be available for conventional strip or trench fill footings. This will allow line loads up to 135kN/m to be taken on footings 450mm wide and 180kN/m on footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

Heave precautions will be required where the foundations lie within the heave zone of trees as defined in NHBC Standards Chapter 4.2. Foundations should be remote from the direct action of tree roots, and should not be constructed so close to trees as to significantly damage their root systems.

Wider footings may be required for higher point/line loads such as at party walls etc. Should wider footings be required for higher point/line loads, GRM should be contacted for further advice.

The strata at the site are variable and so an allowance should be made for deepening of foundations to consistent strata.

9.7 FLOOR SLABS

Due to the potential requirement for gas protection measures and the localised influence of trees, it is recommended that an allowance be made for the use of beam and block floors throughout the development.

Cast in-situ suspended floors could be used, but they would require the use of a void former (such as Cordeck Cellcore HX) in the heave zone and would need to be monolithic in nature to achieve the required points for gas protection.

9.8 BURIED CONCRETE

Based on the recorded water soluble sulphate and pH levels in the soils below the site and assuming mobile groundwater conditions, in accordance with requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the Design Sulphate Class for buried concrete at the site should be assumed as DS-1 and the ACEC Class as AC-1.

For unreinforced trench-fill foundations with a width of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500 and RC35 for reinforced foundations.

The results of the water soluble sulphate and pH testing of are presented in Appendix H.

9.9 SLOPE STABILITY AND RETAINING STRUCTURES

The site is generally gently sloping down to the south, and the area surrounding the site is at a similar level. Therefore, there is no risk of slope instability occurring on the site at present gradients.

Grading of the site, and cut and fill operations may cause instability and failure to occur.

The present gradients on site are likely to be adjusted by minor earthworks. Future ground profiles may require earth retaining structures, for which further advice may be required when more information is available.

9.10 SOAKAWAY DRAINAGE

For full details of the soakaway investigation refer to GRM Letter Report GRM/P7298-SA1 dated: March 2016 (see Appendix M).

The soakaway tests were carried out in the head deposits at three locations (TP1-TP3).

The exploratory hole location plan and logs are presented in Appendices C and D respectively.

Infiltration rates have been calculated for each test pit from the data obtained from site. The calculated infiltration rates are presented below in the order in which they were tested:

	Infiltration Rates		
Location	Test A	Test B	Test C
TP01	Insufficient infiltration (22% over 24 hours)	Not conducted	Not conducted
TP02	1.55×10^{-5} m/s	8.25×10^{-6} m/s	Not conducted
TP03	7.37×10^{-6} m/s	4.16×10^{-6} m/s	Not conducted

The strata at the base of TP01 was recorded as slightly damp, the soils throughout TP02 were recorded as damp and TP03 was recorded as dry, prior to the soakaway testing.

Detailed groundwater monitoring has not yet been conducted and the results may affect the site's surface water drainage design.

The results of the testing should be provided to the project's drainage engineers for inclusion within the site's surface water drainage design after taking into account suitable factors of safety.

It is recommended that the Environment Agency be consulted with regards to the use of attenuation basins.

9.11 NEW ACCESS ROADS

Dynamic Cone Penetrometer (DCP) testing was carried out across the site at six locations. A plan showing the test locations are shown in Appendix C, together with the probe logs is provided in Appendix D.

The results of the DCP are converted into equivalent CBR results. The minimum measured CBR value from each location is illustrated in the below table

DCP Probe Hole Number	Strata	Minimum CBR for Location (%)	Depth of CBR (m)
DCP1	Sand	5.7	0.75 - 0.92
DCP2	Sand	5.2	0.73 - 0.96
DCP3	Clay	4.3	0.48 - 0.87
DCP4	Sand	4.4	0.44 - 0.88
DCP5	Sand	8.1	0.54 - 0.97
DCP6	Clay	3.4	0.32 – 0.96

The results of the DCP testing that values ranging from 4.4% to 8.1% should be expected from the sand soils, and 3.4% to 4.3% in the clay soils.

The natural granular soils have been tested for remoulded CBRs in the laboratory in three locations; the results suggest values of only 0.4% to 0.7% are achievable.

Proof rolling and the improvement of soft spots will be required to increase the CBR values and the incorporation of a geotextile grid into sub-base layers may allow for reduced capping thickness.

Site observations should be confirmed by in situ or laboratory testing in accordance with the adopting Local Authority's preference.

10 FURTHER INVESTIGATION

Further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes the following:

- Completion of the gas monitoring program.
- Additional investigation under the plant beds and polytunnels.

A copy of this report should be submitted to the Planning Department of the Local Authority/Local Authority EHO for review, if planning conditions exist for this site. A copy should also be sent to the NHBC for their records.

11 CONCLUSIONS

Assuming compliance with all the recommendations contained within this report (for abridged version see 'Summary of Recommendations' table at the beginning of the report) the site is suitable for the proposed development.

Based on the evidence currently available the site is assessed as being of low risk for geotechnical hazards and low risk for contamination hazards. These are summarised in the Post Ground Investigation Hazard Plan (Ground Model) in Appendix N.

APPENDIX A

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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GENERAL APPRAISAL COMMENTS

i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records
- Environment Agency Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: http://www.environment-agency.gov.uk/
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2007), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- NRPB Publication W26 (2002), 'Radon Atlas of England and Wales'
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings.
- BS8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds.
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- Arsenic
- Cadmium
- Chromium (III and IV)
- Lead
- Mercury
- Selenium
- Copper
- Nickel
- Zinc
- Phenols
- cyanide (total)
- pH
- Water soluble sulphate
- PAH (polycyclic aromatic hydrocarbons)

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

iii CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in BS8576:2013.

To assess the risks posed by ground gases such as carbon dioxide and methane, the relevant current guidance has been used (i.e. BS8485:2015). For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2007)'.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Report has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables.

For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by C4SLs published by DEFRA, values calculated by GRM using the CLEA v1.07 risk assessment and values and chemical data developed by LQM/CIEH.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.07 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the an aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values. Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

x WASTE DISPOSAL AND SITE WASTE MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste.

Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs are a legal requirement for all projects with an overall development cost of over £300k. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

xv GEOTECHNICAL ASSESSMENT – SOAKAWAYS

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE 365 (1991). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.

- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi GEOTECHNICAL ASSESSMENT – FOUNDATIONS

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects.

The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

APPENDIX B

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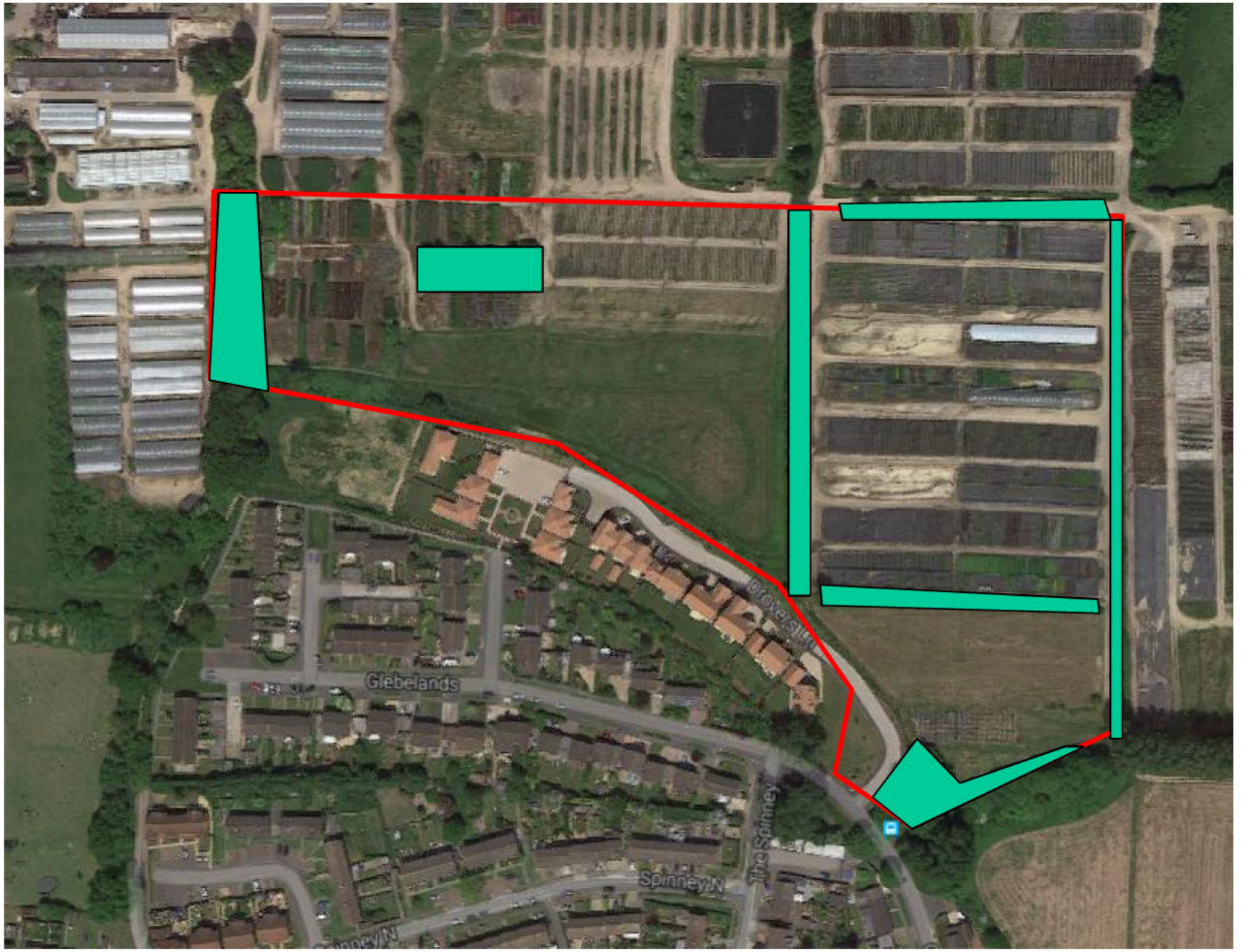

DO NOT SCALE

NOTES:

N

Areas of mature trees and hedgerows

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CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: Ground Hazard Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : KH	DATE: 01/2016
PROJECT No: P7298	DRAWING No:

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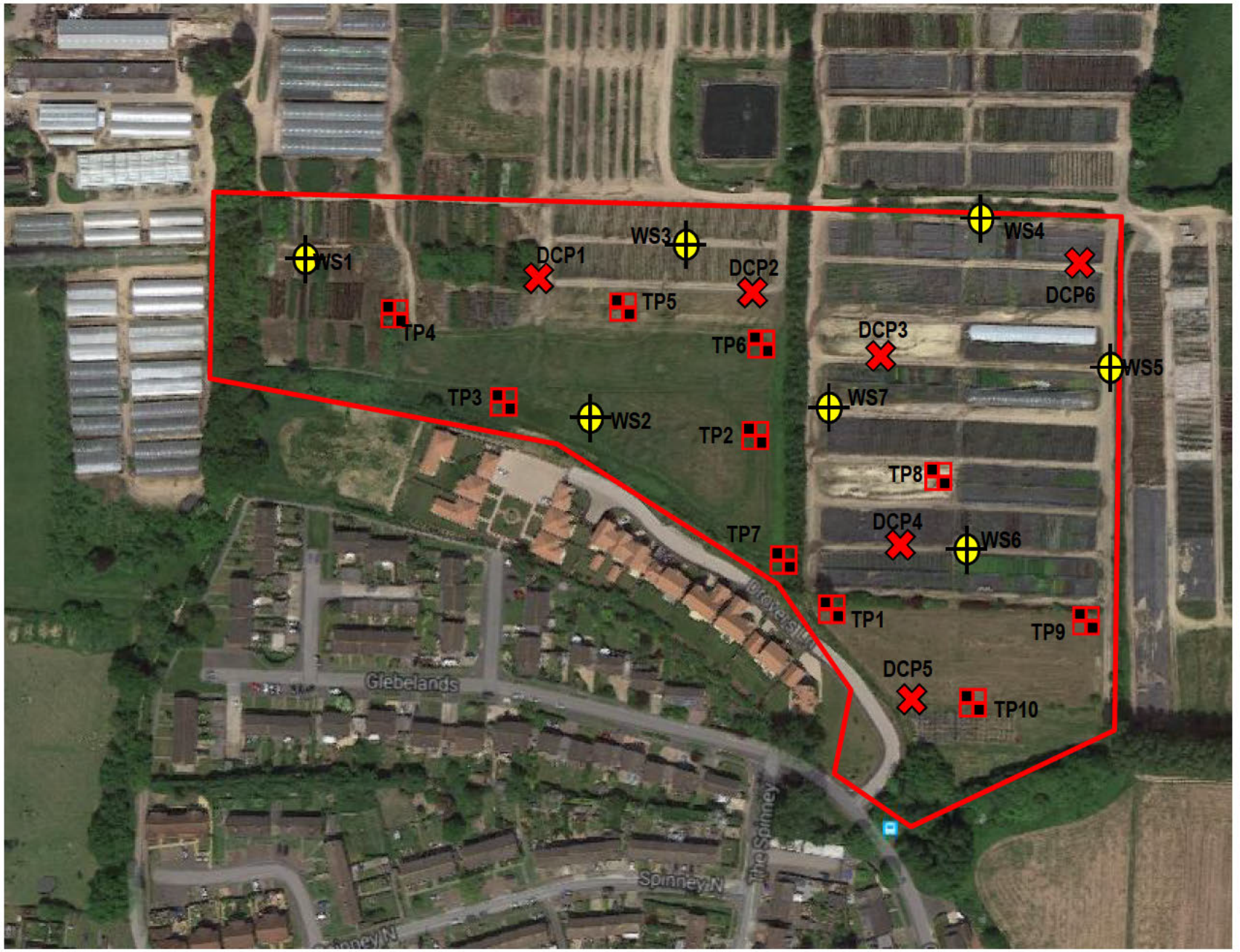

DO NOT SCALE

NOTES:

Approximate Site Boundary

TP1 Trial Pit

WS1 WS Borehole (with gas and water monitoring standpipe)

DCP1 DCP Location

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CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: Exploratory Hole Location Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : KH	DATE: 03/2016
PROJECT No: P7298	DRAWING No:

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APPENDIX D

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Trial Pit Log

Trial Pit No TP01
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505775 E 119113 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20 - 2.00	ES D		0.30			Medium dense dark grey slightly clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chert and sandstone. TOPSOIL
	0.50 0.60	D B					Medium dense orangish brown mottled grey silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chalk. HEAD
	1.10	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
Damp strata at base of hole.

Trial Pit Dimensions (m):
0.60 × 2.10

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP02
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505743 E 119183 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20	D ES		0.30			Loose to medium dense dark grey to dark brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. TOPSOIL
	0.60	D					Medium dense brown to dark brown very silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chalk. Local pockets of silt. HEAD
	1.20	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
Slightly damp strata throughout.

Trial Pit Dimensions (m):
1.10 × 2.10

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP03
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505644 E 119196 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D					Medium dense dark grey and dark brown clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. TOPSOIL
	0.30	ES		0.40			
	0.60	D					Medium dense brown to orangish brown silty fine to medium SAND. Locally very silty. Local pockets of clay. HEAD
	0.90	D		0.80			Medium dense orangish brown mottled grey very silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HEAD
	1.20	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.90 × 2.00

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP04
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505617 E 119227 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	D					Loose brownish grey slightly silty fine to medium SAND. TOPSOIL
	0.20	ES		0.30			
	0.60	B					Medium dense orangish brown mottled grey very silty fine to medium SAND. Some clay pockets evident. HEAD
	0.70	D					
	1.00	D		0.90			Firm approximately medium strength, orangish brown very sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone. HEAD
	1.60	D		1.40			Medium dense orangish brown and reddish brown silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. Occasional boulders of sandstone. HYTHE FORMATION
	1.75	D					*Becomes very gravelly and locally lithified.*
	2.00	D		1.80			Very weak to weak reddish brown and grey SANDSTONE. Locally weathered and recovered as sandy gravel. HYTHE FORMATION
				2.00			End of Pit at 2.00m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracekd Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed

Trial Pit Dimensions (m):
0.60 × 2.40

Reason for termination of Trial Pit:
Hard digging - no progress

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP05
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505695 E 119237 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	D					Medium dense dark grey to dark brown clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. TOPSOIL
	0.20	ES		0.30			
	0.60	D					Medium dense orangish brown very silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone and chalk. Local pockets of clay. HEAD
				1.10			
	1.40	D					Medium dense greyish brown silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HYTHE FORMATION
							Becomes dense and gravelly to very gravelly. Hard digging.
	1.60	D					
				1.70			Weak grey and brown SANDSTONE. HYTHE FORMATION
				1.80			End of Pit at 1.80m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 1.90

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP06
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505748 E 119237 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	D					Loose to medium dense dark grey to dark brown clayey SAND. TOPSOIL
	0.10	ES		0.20			Loose to medium dense brown to dark brown very silty slightly gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded chalk and chert. Some pockets of clay evident. HEAD
	0.60	B					
	0.60	D					
				1.40			Medium dense brown to reddish brown silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HYTHE FORMATION
	1.80	D					
							Becomes gravelly to very gravelly and locally lithified.
	2.20	D					
	2.70	D					
	3.00	D		3.00			End of Pit at 3.00m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 2.60

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP07
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505754 E 119130 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	D					Loose to medium dense dark grey to dark brown clayey SAND. TOPSOIL
	0.20	ES		0.30			
	0.70	D					Loose to medium dense brown to orangish brown very silty fine to medium SAND. Some clay pockets evident. HEAD
	1.70	D					
	2.50	D					
				2.60			Medium dense brown to yellowish brown slightly silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HYTHE FORMATION
	2.80	D					
				3.00			End of Pit at 3.00m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 2.10

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP08
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505815 E 119168 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	D					Very loose to loose yellow fine to coarse SAND. TOPSOIL
	0.10	ES		0.20			
	0.50	D					Loose to medium dense brown mottled grey silty fine to medium SAND. Local pockets of clay evident. HEAD
				1.20			Medium dense brown and greenish grey silty SAND. Locally reddish brown. HYTHE FORMATION
	1.50	D					
							Becomes more reddish and slightly gravelly.
	2.00	D					
				2.30			Extremely weak greenish grey and reddish brown fine to coarse grained SANDSTONE. Recovered as sandy gravel. Locally weathered to sand. HYTHE FORMATION
	2.40	D					
	2.50	D		2.50			End of Pit at 2.50m

1 2 3 4

Date Excavated: 04/03/2016
Date Backfilled: 04/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 2.30

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP09
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505875 E 119114 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	D					Loose to medium dense dark grey to dark brown silty SAND. TOPSOIL
	0.10	ES		0.20			
	0.30	D					Medium dense to dense orangish brown to brown and reddish brown silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. Local pockets of clay evident. Becomes more dense and gravelly with depth. HYTHE FORMATION
				0.50			Extremely weak weathered brown to reddish brown SANDSTONE locally weathered to sandy gravel. HYTHE FORMATION
	0.90	D					
				1.10			Weak brown fine to medium grained SANDSTONE. Recovered as sandy gravel. HYTHE FORMATION
	1.20	D		1.30			End of Pit at 1.30m

1
2
3
4

Date Excavated: 04/03/2016
Date Backfilled: 04/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 2.70

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Trial Pit Log

Trial Pit No TP10
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505836 E 119083 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	D					Loose to medium dense dark grey to dark brown silty fine to coarse SAND.
	0.10	ES		0.20			TOPSOIL
	0.50	D					Medium dense brown to reddish brown silty gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded sandstone. Becomes more gravelly with depth
							HYTHE FORMATION
	1.30	D					
				1.40			Extremely weak greyish brown to brown and reddish brown fine to medium grained SANDSTONE. Recovered as sandy gravel.
	1.50	D					HYTHE FORMATION
				1.60			*Hard digging.*
	1.70	D		1.70			Weak greyish brown to brown and reddish brown fine to medium grained SANDSTONE. Recovered as sandy gravel.
							HYTHE FORMATION
							End of Pit at 1.70m

1
2
3
4

Date Excavated: 04/03/2016
Date Backfilled: 04/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.60 × 2.40

Reason for termination of Trial Pit:
Hard digging - no progress.

General Remarks:

Strata consistencies/densities determined by observation only

Version:

Scale: 1:25

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Windowless Sample Borehole

Borehole No WS1

Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505565 E 119251 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20 0.20	D ES			0.30			Medium dense brown to greyish brown slightly clayey gravelly SAND. Gravel is fine to coarse angular to subrounded chert and sandstone. TOPSOIL
		0.90 1.00	D S	N=14 (3,3/4,3,3,4)					Medium dense brown and orangish brown clayey gravelly SAND. Gravel is fine to coarse angular to subrounded chert and sandstone. Locally silty. HEAD
		1.60 1.70	S D	N=50 (25 for 125mm/50 for 150mm)		1.50 1.80			Very dense reddish brown to brown slightly clayey gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HYTHE FORMATION End of Borehole at 1.80m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: Barrel refusal

Groundwater Remarks:

No groundwater observed

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

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Windowless Sample Borehole

Borehole No WS2
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505686 E 119189 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	D						Medium dense brown slightly clayey SAND. TOPSOIL
		0.20	ES			0.30			
		0.90	D						Medium dense brown to reddish brown silty fine to medium SAND. HEAD
		1.00	S	N=10 (1,2/2,2,3,3)					
						1.30			
		1.70	D						Very loose to loose brown and reddish brown clayey gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. Local lithorelicts. Locally very clayey with local clay bands. HEAD
		2.00	S	N=3 (1,1/1,0,1,1)					
		2.50	D						
						2.70			Dense to very dense brown to reddish brown fine to medium SAND. Locally weakly cemented. HYTHE FORMATION
		2.90	D						
		3.00	S	N=50 (2,3/50 for 85mm)		3.00			End of Borehole at 3.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: SPT refusal.

Groundwater Remarks:
No groundwater observed.

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

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Windowless Sample Borehole

Borehole No WS3

Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505710 E 119259 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20 0.20	D ES						Medium dense reddish brown to greyish brown clayey gravelly SAND. Gravel is fine to coarse subangular to subrounded chert and sandstone. MADE GROUND
						0.40			
		0.70	D						Medium dense to dense brown to orangish brown clayey gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded sandstone. Locally very clayey. Locally a clay. HEAD
						0.90			
		0.95 1.00	D S	N=50 (3,4/50 for 205mm)		1.00			Dense to very dense brown and greyish brown fine to medium SAND. Weakly cemented. HYTHE FORMATION
									End of Borehole at 1.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: SPT and barrel refusal

Groundwater Remarks:
No groundwater observed

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

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Windowless Sample Borehole

Borehole No WS4

Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505830 E 119269 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	D						Medium dense brown and grey clayey gravelly SAND. Gravel is fine to coarse angular to subrounded sandstone and chert. Occasional organic material present.
		0.20	ES						TOPSOIL
						0.40			Firm to stiff approximately medium to high strength, medium to high strength, orangish brown to brown and reddish brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone.
		0.80	D						HEAD
		1.00	S	N=10 (1,2/1,2,3,4)					
						1.40			Medium dense brown to reddish brown clayey gravelly SAND. Local lithorelicts. Locally weakly cemented.
		1.50	D						HYTHE FORMATION
		1.90	D						
		2.00	S	N=50 (2,3/50 for 10mm)		2.00			End of Borehole at 2.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: SPT refusal.

Groundwater Remarks:

No groundwater observed.

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

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Windowless Sample Borehole

Borehole No WS5

Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505874 E 119212 N

Installation/ Backfill	Water Strike	Samples/Tests: Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20 0.20	D ES						Medium dense grey and brown clayey gravelly SAND. Gravel is fine to coarse angular to subrounded chert and sandstone with traces of brick. MADE GROUND
						0.40			Firm to stiff, approximately medium to high strength, brown to orangish brown very sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded chert and sandstone. HEAD
		0.90	D						
		1.00	S	N=15 (2,2/3,3,4,5)					
						1.10			Medium dense brown to orangish brown silty to very silty, slightly gravelly to gravelly fine to medium SAND. Gravel is fine to coarse angular to subrounded chert and sandstone. HEAD
		1.30	D						
						1.50			Dense brown and grey to reddish brown slightly silty SAND. Locally very weakly cemented. Local lithorelict structure. HYTHE FORMATION
		1.90	D						
		2.00	S	N=50 (6,7/50 for 285mm)		2.00			End of Borehole at 2.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: SPT refusal

Groundwater Remarks:

No groundwater observed

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

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Windowless Sample Borehole

Borehole No
WS6
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates
505826 E
119142 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	D						Medium dense grey and brown slightly clayey gravelly SAND. Gravel is fine to coarse angular to subrounded chert and coal.
		0.20	ES			0.30			MADE GROUND
									Medium dense orangish brown to brown mottled grey very silty SAND. Locally a clay. HEAD
		0.90	D						
		1.00	S	N=13 (2,3/4,3,3,3)					
						1.40			Firm to stiff, approximately medium to high strength, reddish brown mottled grey very sandy CLAY. HYTHE FORMATION
		1.60	D	N=8 (5,5/1,0,2,5)					
		1.60	S			1.70			Dense to very dense brown to reddish brown mottled grey weakly cemented SAND. Locally lithified. HYTHE FORMATION
		1.90	D						
						2.00			End of Borehole at 2.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: Barrel refusal

Groundwater Remarks:
No groundwater observed.

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

GRM Development Solutions Ltd
Laurus House,
First Avenue, Centrum 100,
Burton-on-Trent, DE14 2WH
Tel (HQ): 01283 551249
Email: info@grm-uk.com

Windowless Sample Borehole

Borehole No WS7
Sheet 1 of 1

Site Name: Land to the north east of Glebelands, Pulborough

Ground Level (mAOD)

Client: Catesby PEstates Ltd

GRM Project Ref: P7298

Coordinates 505773 E 119196 N

Installation/ Backfill	Water Strike	Samples/Tests Depth	Type	Result	Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	D						Loose grey and brown gravelly SAND. Gravel is fine to coarse angular to subrounded brick, chert and tarmac. MADE GROUND
		0.20	ES			0.30			Firm, medium strength, orangish brown mottled grey sandy to very sandy CLAY. HEAD
		1.00	S	N=9 (1,2/2,3,2,2)					
		1.50	D						
		1.90	D			1.80			Medium dense brown to reddish brown mottled grey very silty fine to medium SAND. HYTHE FORMATION
		2.00	S	N=13 (0,0/0,4,4,5)					
		2.70	D			2.60			Dense to very dense brown and locally reddish brown fine to medium SAND. Locally very weakly cemented. Local lithorelict structure. HYTHE FORMATION
		3.00	S	N=50 (6,6/50 for 120mm)		3.00			End of Borehole at 3.00m

1 2 3 4

Crew: Borehole Solutions **Logger:** AS

Equipment: Dando Terrier

Reason for termination of borehole: SPT refusal.

Groundwater Remarks:
No groundwater observed.

General Remarks:

Geotechnical Testing

Depth	Liquid Limit	Plasticity Index	Percentage <0.425mm

Geotechnical Chemistry Testing

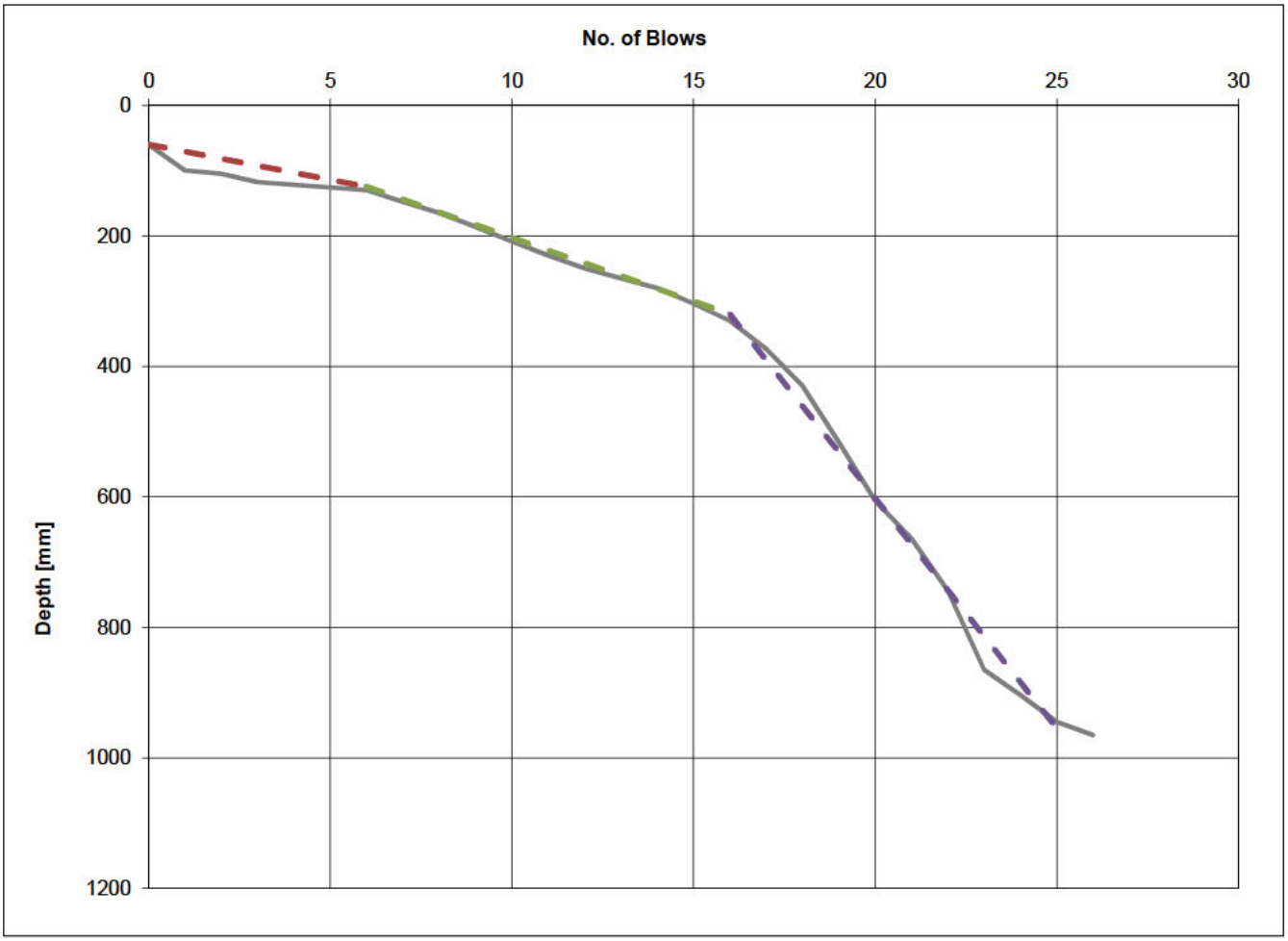
Depth	Determinand Name	Result	Unit

Hole Started: 02/03/2016 **Hole Complete:** 02/03/2016 **Version:** **Scale:** 1:25

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough		
Contract No	P7298	Start Depth mm	60
Client:	Catesby Estates	Final Depth mm:	965
Engineer:	GRM	Date	04/03/2016
Equipment:	Labquip DCP		

Test Location
DCP6



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.13	24.3
CBR 2	0.13	0.32	13.1
CBR 3	0.32	0.96	3.4

CBR Calculated using TRL equation

Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

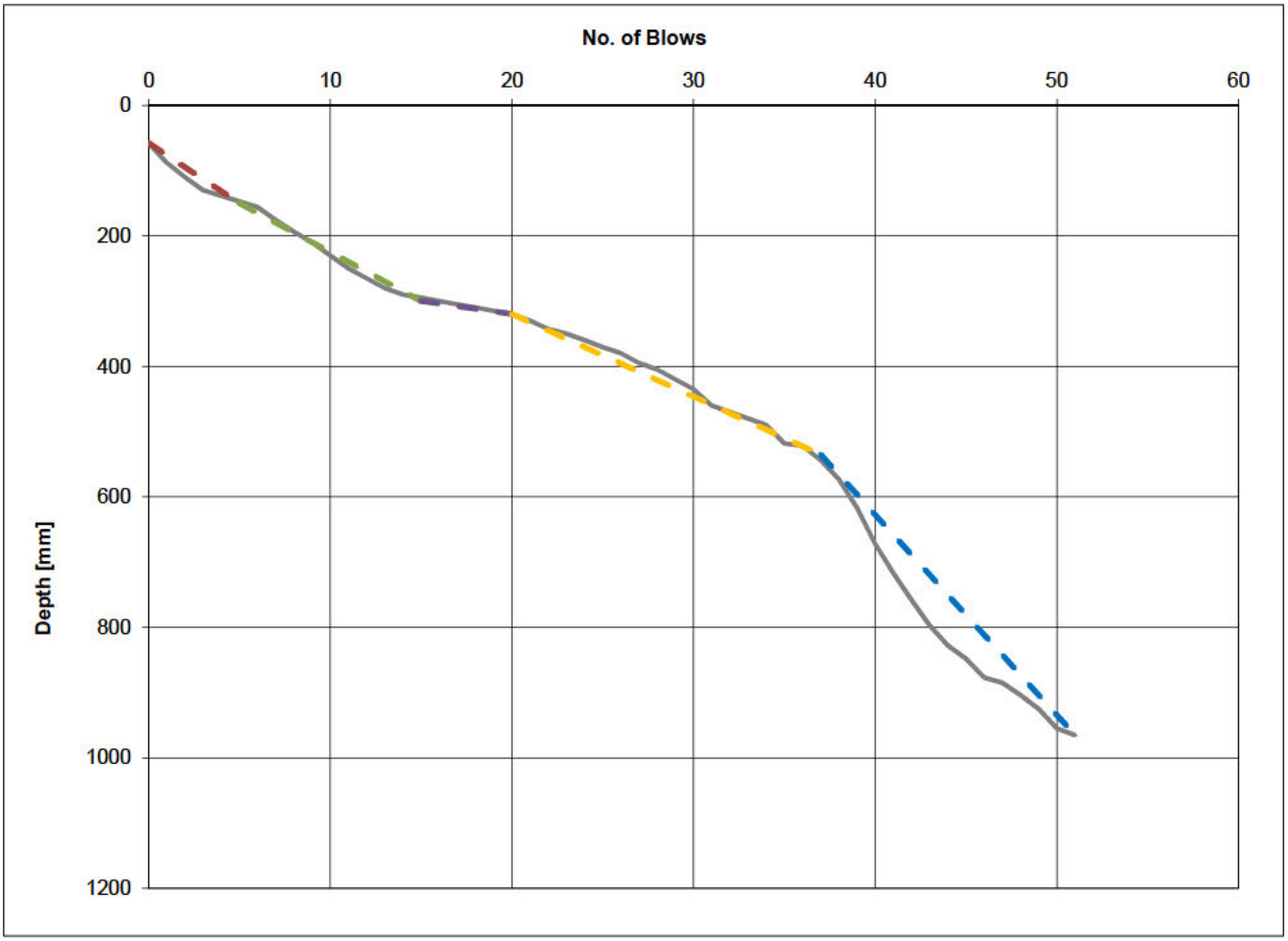
Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough		
Contract No	P7298	Start Depth mm	58
Client:	Catesby Estates	Final Depth mm:	965
Engineer:	GRM	Date	04/03/2016
Equipment:	Labquip DCP		

Test Location
DCP5



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.15	13.9
CBR 2	0.15	0.30	17.3
CBR 3	0.30	0.32	69.8
CBR 4	0.32	0.54	20.7
CBR 5	0.54	0.97	8.1

CBR Calculated using TRL equation

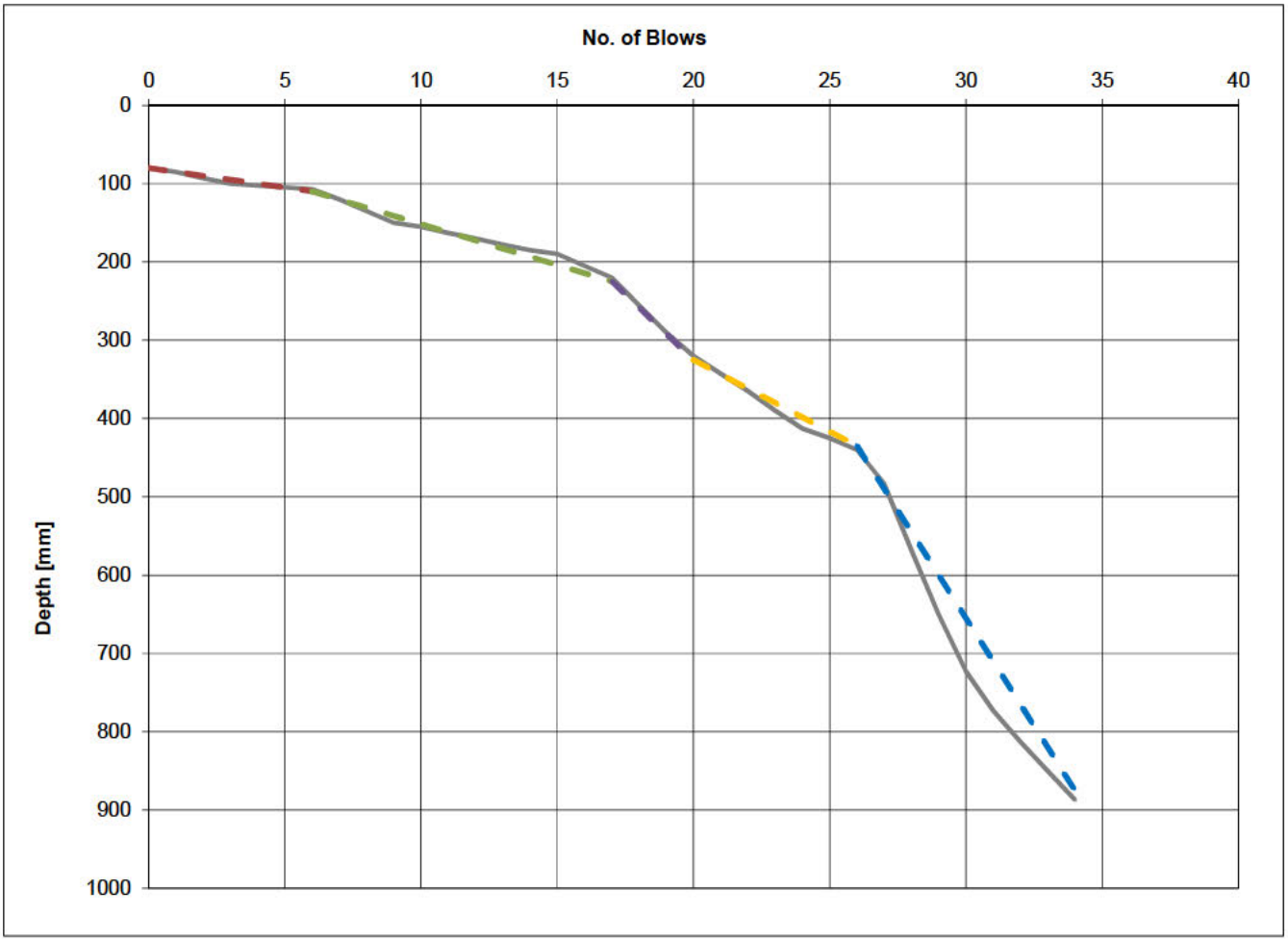
Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough			
Contract No	P7298	Start Depth mm	80	Test Location
Client:	Catesby Estates	Final Depth mm:	965	**DCP4**
Engineer:	GRM	Date	04/03/2016	
Equipment:	Labquip DCP			



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.11	55.1
CBR 2	0.11	0.23	25.3
CBR 3	0.23	0.33	7.4
CBR 4	0.33	0.44	14.0
CBR 5	0.44	0.88	4.4

CBR Calculated using TRL equation

Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

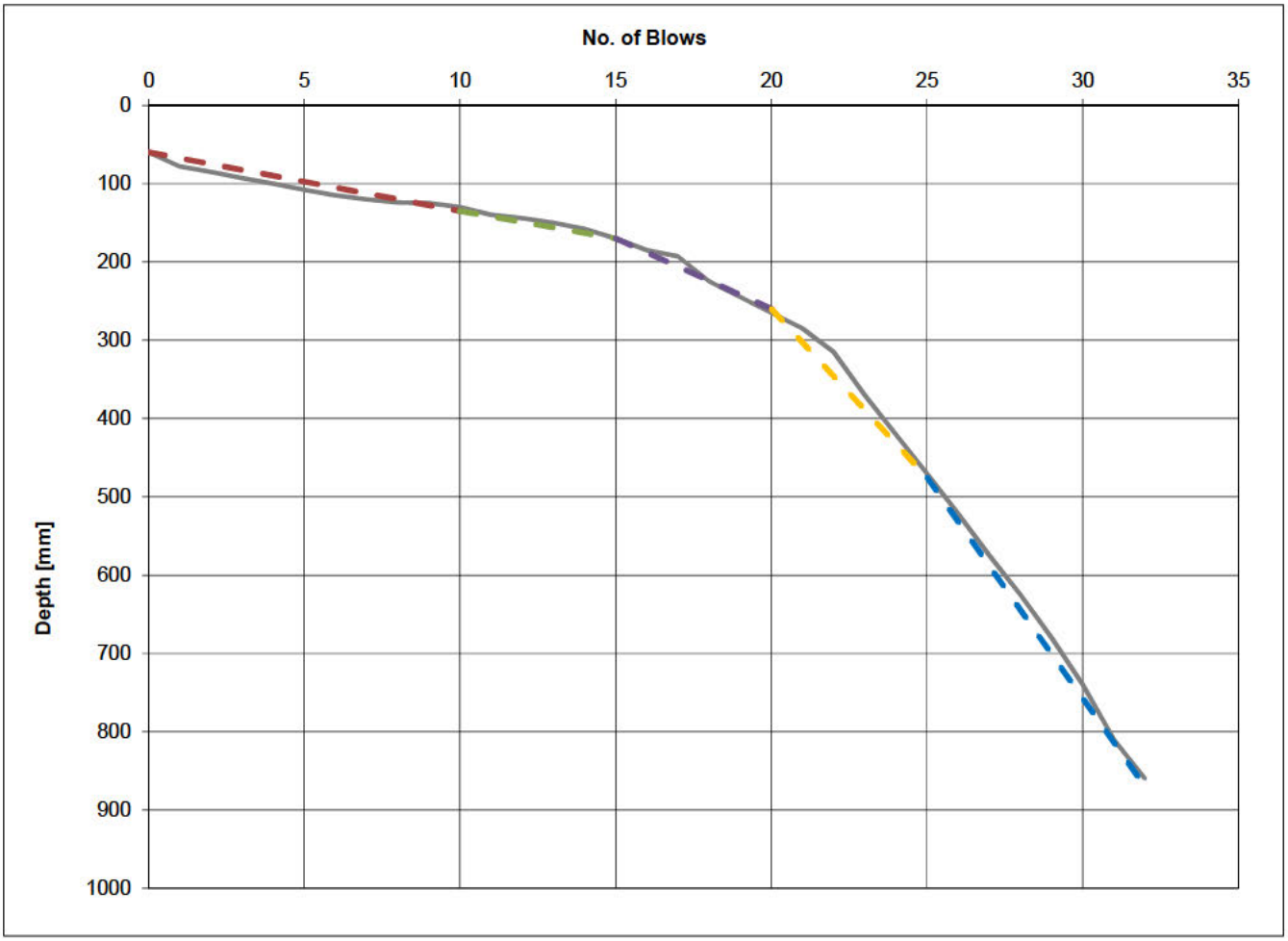
Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough		
Contract No	P7298	Start Depth mm	60
Client:	Catesby Estates	Final Depth mm:	955
Engineer:	GRM	Date	04/03/2016
Equipment:	Labquip DCP		

Test Location
DCP3



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.14	35.9
CBR 2	0.14	0.17	38.6
CBR 3	0.17	0.26	14.2
CBR 4	0.26	0.48	5.7
CBR 5	0.48	0.87	4.3

CBR Calculated using TRL equation

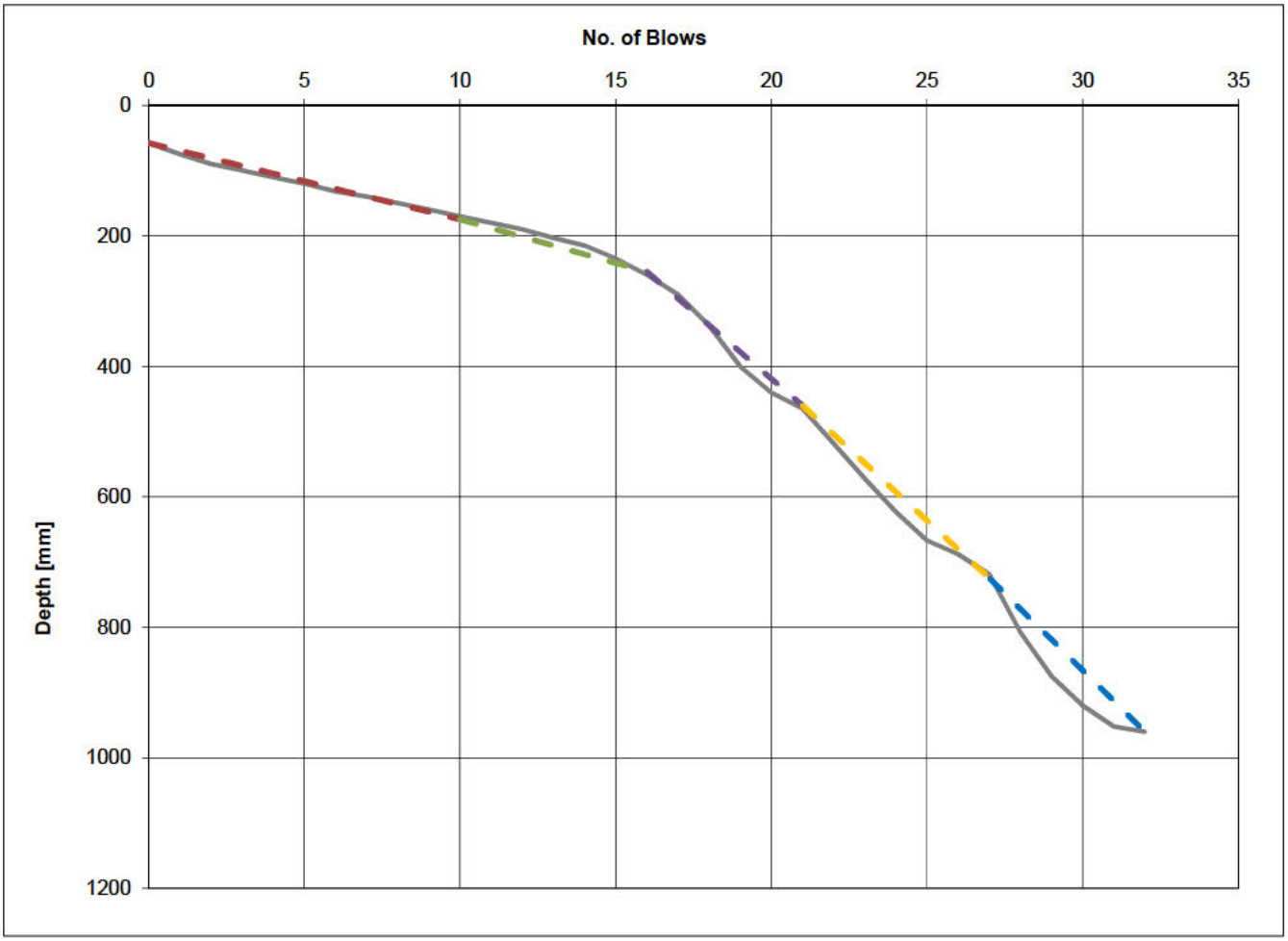
Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough			
Contract No	P7298	Start Depth mm	58	Test Location
Client:	Catesby Estates	Final Depth mm:	960	**DCP2**
Engineer:	GRM	Date	04/03/2016	
Equipment:	Labquip DCP			



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.18	22.4
CBR 2	0.18	0.26	19.5
CBR 3	0.26	0.46	6.0
CBR 4	0.46	0.73	5.5
CBR 5	0.73	0.96	5.2

CBR Calculated using TRL equation

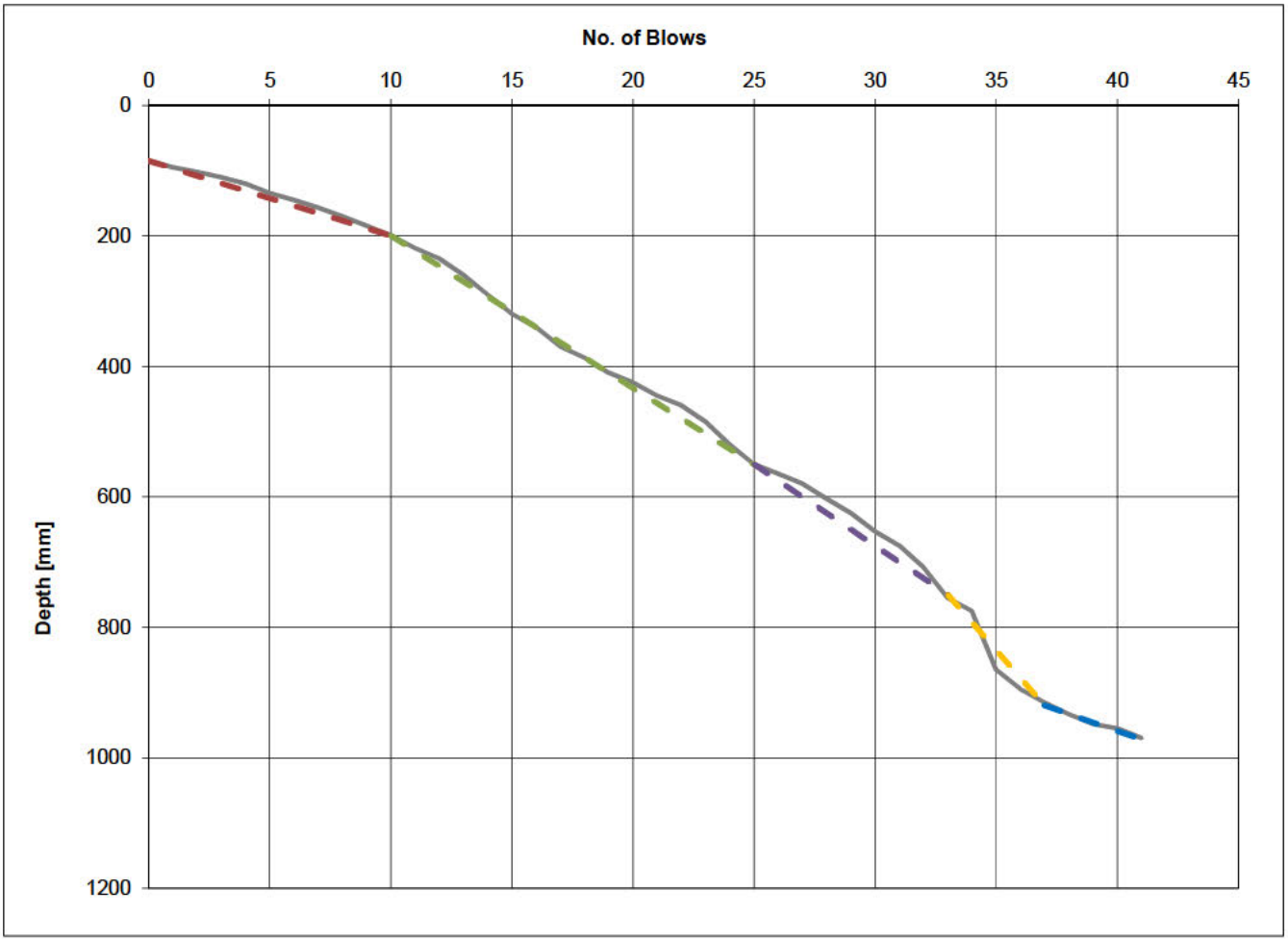
Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS

Contract Name	Drover's Lane, Pulborough			
Contract No	P7298	Start Depth mm	85	Test Location
Client:	Catesby Estates	Final Depth mm:	970	**DCP1**
Engineer:	GRM	Date	04/03/2016	
Equipment:	Labquip DCP			



CBR RESULTS

TEST No	Depth m From	Depth m To	CBR Value %
CBR 1	0.00	0.20	22.8
CBR 2	0.20	0.55	10.8
CBR 3	0.55	0.75	10.1
CBR 4	0.75	0.92	5.7
CBR 5	0.92	0.97	20.1

CBR Calculated using TRL equation

Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data. Transport and Road Research Laboratory, 1990

APPENDIX E

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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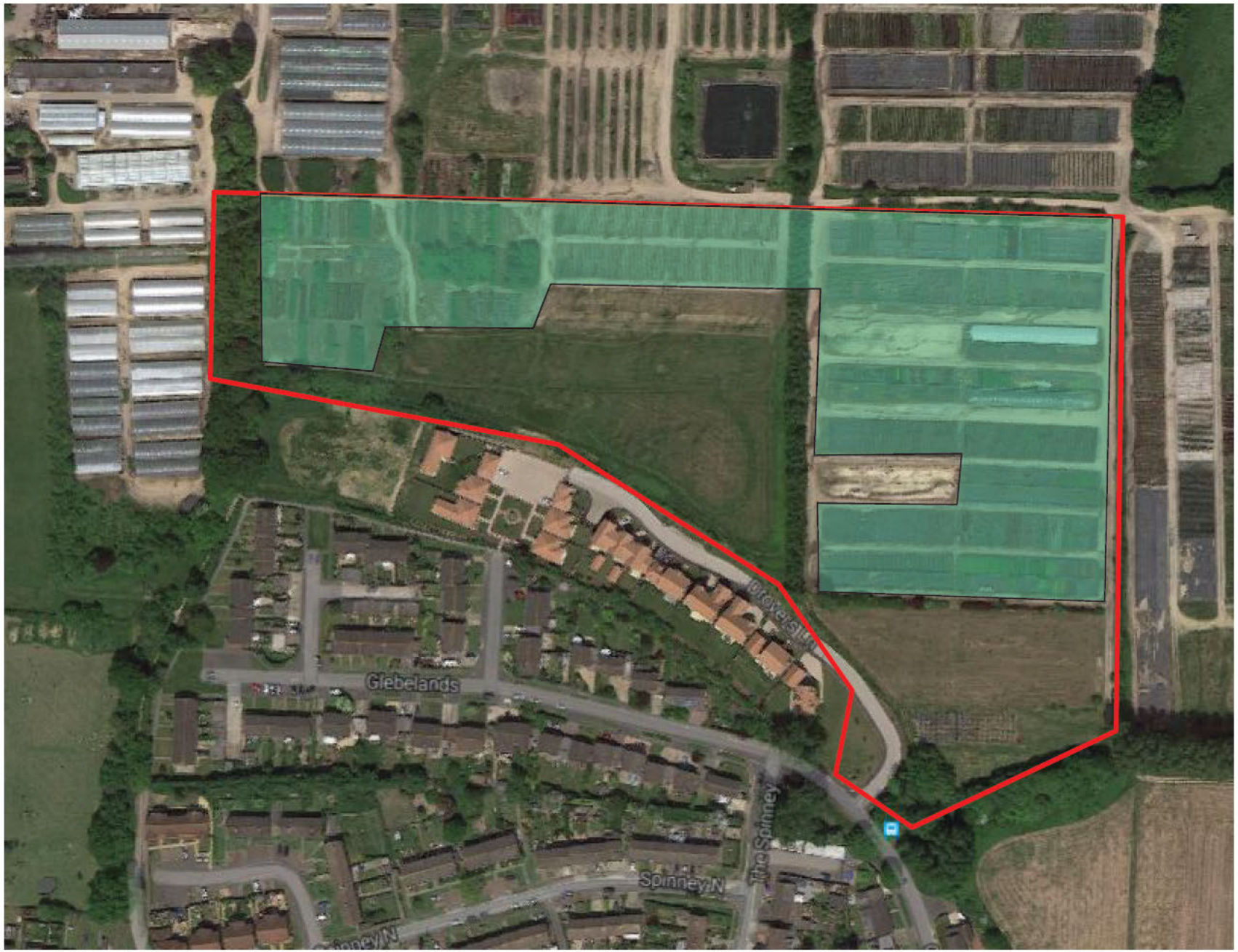

DO NOT SCALE

NOTES:

Areas largely inaccessible due to planted beds

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Burton-on-Trent, Staffordshire
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mail@grm-uk.com www.grm-uk.com

CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: ConstraintsPlan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : KH	DATE: 01/2016
PROJECT No: P7298	DRAWING No:

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APPENDIX F

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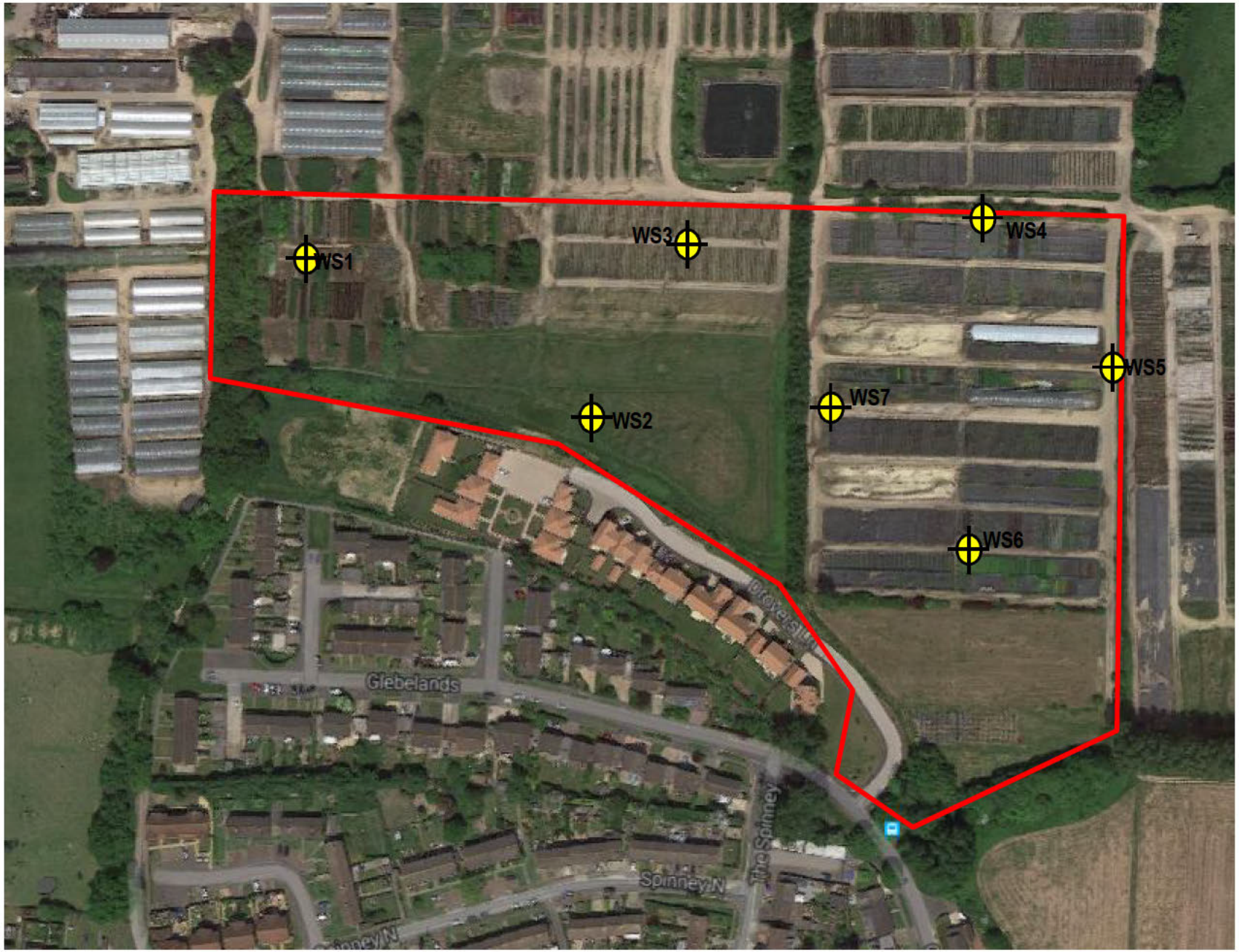

DO NOT SCALE

NOTES:

Approximate Site Boundary

WS1 — WS Borehole (with gas and water monitoring standpipe)

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mail@grm-uk.com www.grm-uk.com

CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: Gas Monitoring Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : KH	DATE: 03/2016
PROJECT No: P7298	DRAWING No:

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APPENDIX G

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In-Situ Gas Monitoring Results

Project Name:	Land off Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	17 March 2016
Weather:	Dry
Atmospheric Pressure (mb):	1024
Pressure Trend:	
Equipment:	Gas Data GFM430
Operator:	Tony Heron

Ground Gases														Groundwater	
Well ID	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS1	0.8	1.8	NAT	0.00	0.00	0.90	0.90	14.90	14.90	0.00	0.00	N/R	N/R	N/D	2.00
WS2	1.0	3.0	NAT	0.00	0.00	1.00	1.00	19.50	19.50	0.00	0.00	N/R	N/R	N/D	3.36
WS3	0.5	1.0	NAT	0.00	0.00	4.50	4.50	7.70	7.70	0.00	0.00	N/R	N/R	N/D	1.30
WS4	1.0	2.0	NAT	0.00	0.00	2.30	2.30	17.00	17.00	0.00	0.00	N/R	N/R	N/D	1.89
WS5	1.0	2.0	NAT	0.00	0.00	1.40	1.40	16.50	16.50	0.00	0.00	N/R	N/R	1.67	2.13
WS6	1.0	2.0	NAT	0.00	0.00	1.70	1.70	16.20	16.20	0.00	0.00	N/R	N/R	N/D	2.09
WS7	1.0	3.0	NAT	0.00	0.00	0.00	0.00	19.90	19.90	0.00	0.00	N/R	N/R	N/D	2.60

Comments:

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

APPENDIX H

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Leicester
LE1 4DH

GRM Development Solutions Ltd
Laurus House
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Centrum 100
Burton on Trent
Staffordshire
DE14 2WH

Analytical Test Report: L16/0579/GRM/001 - Amendment A

Your Project Reference:	**Drovers Lane, Pulborough**	Samples Received on:	08.03.2016
Your Order Number:	P7298	Testing Instruction Received:	08.03.2016
Report Issue Number:	2	Sample Tested:	08 to 30.03.2016
Samples Analysed:	19 Soils 4 Leachates	Report issued:	30.03.2016

Signed

[redacted]

James Gane
Manager - Data Logistics
Nicholls Colton Analytical

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report with the exception of the abestos test portion which is held for 6 months unless otherwise requested.

Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

With the exception of Sulphate, which is crushed over the 2mm test sieve, concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve. As received samples have been corrected for moisture content but not stone content.

Samples were supplied by customer.

Asbestos

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Deviant Samples

Samples were received in suitable containers	**Yes**
A date and time of sampling was provided	**Yes**
Sample handling times were exceeded prior to analysis of determinants	**No**

Where samples do not meet one or more of the above criteria they will be classed as deviant, this means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

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Leicester
LE1 4DH

L16/0579/GRM/001 - Amendment A

Project Reference - Drovers Lane, Pulborough

Analytical Test Results - GRM Brownfield Suite

NCA Reference			16-7259	16-7260	16-7261	16-7262	16-7263	16-7264
Client Sample Reference			TP03	TP06	TP07	TP08	TP10	WS1
Client Sample Location			TP03	TP06	TP07	TP08	TP10	WS1
Depth (m)			0.30	0.10	0.20	0.10	0.10	0.20
Date of Sampling			04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016
Time of Sampling			Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Sample Matrix			Loam	Sand	Clay	Sand	Sand	Loam
Determinant	**Units**	**Accreditation**						
Arsenic	(mg/kg)	MCERTS	< 10	< 10	< 10	< 10	< 10	< 10
Cadmium	(mg/kg)	MCERTS	0.4	0.3	0.3	< 0.2	0.3	0.3
Chromium (Total)	(mg/kg)	UKAS	9.5	8.7	10.5	34.2	12.9	11.7
Copper	(mg/kg)	MCERTS	19.0	32.5	17.1	6.4	12.1	23.4
Lead	(mg/kg)	MCERTS	23.1	20.2	19.2	6.0	14.1	18.1
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	7.2	6.7	6.8	4.5	7.6	7.0
Selenium	(mg/kg)	u	< 8	< 8	< 8	< 8	< 8	< 8
Zinc	(mg/kg)	MCERTS	53.3	47.4	41.0	18.9	40.6	52.6
Total Phenols	(mg/kg)	MCERTS	< 1	< 1	< 1	< 1	< 1	< 1
Cyanide (Total)	(mg/kg)	MCERTS	< 1	< 1	< 1	< 1	< 1	< 1
Chromium (Hexavalent)	(mg/kg)	u	< 1	< 1	< 1	< 1	< 1	< 1
pH	pH Units	u	6.8	7.1	6.5	6.5	6.6	6.6
SOM	(%)	UKAS	3.4	<1.7	<1.7	<1.7	<1.7	1.9
Sulphate	(mg/l)	u	<10	<10	<10	<10	<10	<10
Acenaphthene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	(mg/kg)	UKAS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	(mg/kg)	UKAS	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (a) anthracene	(mg/kg)	MCERTS	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (a) pyrene	(mg/kg)	MCERTS	0.09	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.10	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.08	<0.02	<0.02	<0.02	<0.02	0.03
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	(mg/kg)	MCERTS	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	(mg/kg)	MCERTS	0.13	0.05	0.03	<0.02	0.02	0.04
Fluorene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	0.05	<0.02	<0.02	<0.02	<0.02	<0.02
Naphthalene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	(mg/kg)	MCERTS	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene	(mg/kg)	MCERTS	0.13	0.04	0.03	<0.02	<0.02	0.04
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	0.89	0.42	0.39	<0.32	0.38	0.44
Asbestos	-	UKAS	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Pesticide Screen	(mg/kg)	u	Detected <1, DDE, DDT	Detected >1, DDE, Dieldrin	Undetected <1	Undetected <1	Undetected <1	Undetected <1

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LE1 4DH

L16/0579/GRM/001 - Amendment A

Project Reference - Drovers Lane, Pulborough

Analytical Test Results - GRM Brownfield Suite

NCA Reference			16-7265	16-7266	16-7267	16-7268	16-7269	16-7270
Client Sample Reference			WS2	WS3	WS4	WS5	WS6	WS7
Client Sample Location			WS2	WS3	WS4	WS5	WS6	WS7
Depth (m)			0.20	0.20	0.20	0.20	0.20	0.20
Date of Sampling			04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016
Time of Sampling			Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Sample Matrix			Loam	Sand	Sand	Loam	Loam	Sand
Determinant	**Units**	**Accreditation**						
Arsenic	(mg/kg)	MCERTS	< 10	12.9	< 10	< 10	< 10	< 10
Cadmium	(mg/kg)	MCERTS	0.3	0.8	< 0.2	0.4	0.4	0.3
Chromium (Total)	(mg/kg)	UKAS	10.9	10.3	6.9	10.7	11.5	10.7
Copper	(mg/kg)	MCERTS	19.6	28.8	10.6	12.8	17.3	15.5
Lead	(mg/kg)	MCERTS	19.2	148	15.6	19.1	20.8	14.9
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	5.9	9.0	6.2	7.9	10.5	7.6
Selenium	(mg/kg)	u	< 8	< 8	< 8	< 8	< 8	< 8
Zinc	(mg/kg)	MCERTS	47.1	146	37.8	48.8	42.3	51.9
Total Phenols	(mg/kg)	MCERTS	< 1	< 1	< 1	< 1	< 1	< 1
Cyanide (Total)	(mg/kg)	MCERTS	< 1	< 1	< 1	< 1	< 1	< 1
Chromium (Hexavalent)	(mg/kg)	u	< 1	< 1	< 1	< 1	< 1	< 1
pH	pH Units	u	6.5	8.6	7.8	8.4	8.5	7.9
SOM	(%)	UKAS	2.8	<1.7	<1.7	<1.7	<1.7	2.2
Sulphate	(mg/l)	u	<10	<10	<10	<10	<10	27
Acenaphthene	(mg/kg)	MCERTS	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Acenaphthylene	(mg/kg)	UKAS	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Anthracene	(mg/kg)	UKAS	<0.02	0.02	<0.2	<0.02	<0.02	0.31
Benzo (a) anthracene	(mg/kg)	MCERTS	<0.02	0.07	<0.2	<0.02	<0.02	0.56
Benzo (a) pyrene	(mg/kg)	MCERTS	0.05	0.10	0.35	0.03	<0.02	0.78
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.04	0.10	0.36	0.03	0.03	0.67
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.04	0.07	0.41	0.03	0.03	0.61
Benzo (k) fluoranthene	(mg/kg)	MCERTS	<0.02	0.05	<0.2	<0.02	<0.02	0.32
Chrysene	(mg/kg)	MCERTS	<0.02	0.07	<0.2	<0.02	<0.02	0.56
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Fluoranthene	(mg/kg)	MCERTS	0.07	0.23	0.44	0.04	0.04	1.44
Fluorene	(mg/kg)	MCERTS	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	0.03	0.06	0.28	<0.02	<0.02	0.41
Naphthalene	(mg/kg)	MCERTS	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Phenanthrene	(mg/kg)	MCERTS	<0.02	0.07	<0.2	<0.02	<0.02	0.47
Pyrene	(mg/kg)	MCERTS	0.06	0.19	0.48	0.05	0.04	1.43
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	0.53	1.14	4.62	0.43	0.40	8.66
Asbestos	-	UKAS	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Pesticide Screen	(mg/kg)	u	Undetected <1	Detected >1, DDE, Dieldrin	Undetected <1	Detected >1, DDE	Undetected <1	Detected, DDE

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L16/0579/GRM/001 - Amendment A

Project Reference - Drovers Lane, Pulborough

Analytical Test Results - GRM Brownfield Suite

NCA Reference			16-7271	16-7272	16-7273	16-7274	16-7275	16-7276
Client Sample Reference			TP06	TP07	TP08	TP09	WS1	WS4
Client Sample Location			TP06	TP07	TP08	TP09	WS1	WS4
Depth (m)			1.80	0.70	2.40	0.90	0.90	0.80
Date of Sampling			04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016
Time of Sampling			Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Sample Matrix			Clay	Clay	Sand	Sand	Clay	Clay
Determinant	**Units**	**Accreditation**						
Arsenic	(mg/kg)	MCERTS	-	-	-	-	-	-
Cadmium	(mg/kg)	MCERTS	-	-	-	-	-	-
Chromium (Total)	(mg/kg)	UKAS	-	-	-	-	-	-
Copper	(mg/kg)	MCERTS	-	-	-	-	-	-
Lead	(mg/kg)	MCERTS	-	-	-	-	-	-
Mercury	(mg/kg)	UKAS	-	-	-	-	-	-
Nickel	(mg/kg)	MCERTS	-	-	-	-	-	-
Selenium	(mg/kg)	u	-	-	-	-	-	-
Zinc	(mg/kg)	MCERTS	-	-	-	-	-	-
Total Phenols	(mg/kg)	MCERTS	-	-	-	-	-	-
Cyanide (Total)	(mg/kg)	MCERTS	-	-	-	-	-	-
Chromium (Hexavalent)	(mg/kg)	u	-	-	-	-	-	-
pH	pH Units	u	7.8	6.9	6.9	9.0	7.0	6.9
SOM	(%)	UKAS	-	-	-	-	-	-
Sulphate	(mg/l)	u	<10	<10	<10	23	<10	68
Acenaphthene	(mg/kg)	MCERTS	-	-	-	-	-	-
Acenaphthylene	(mg/kg)	UKAS	-	-	-	-	-	-
Anthracene	(mg/kg)	UKAS	-	-	-	-	-	-
Benzo (a) anthracene	(mg/kg)	MCERTS	-	-	-	-	-	-
Benzo (a) pyrene	(mg/kg)	MCERTS	-	-	-	-	-	-
Benzo (b) fluoranthene	(mg/kg)	MCERTS	-	-	-	-	-	-
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	-	-	-	-	-	-
Benzo (k) fluoranthene	(mg/kg)	MCERTS	-	-	-	-	-	-
Chrysene	(mg/kg)	MCERTS	-	-	-	-	-	-
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	-	-	-	-	-	-
Fluoranthene	(mg/kg)	MCERTS	-	-	-	-	-	-
Fluorene	(mg/kg)	MCERTS	-	-	-	-	-	-
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	-	-	-	-	-	-
Naphthalene	(mg/kg)	MCERTS	-	-	-	-	-	-
Phenanthrene	(mg/kg)	MCERTS	-	-	-	-	-	-
Pyrene	(mg/kg)	MCERTS	-	-	-	-	-	-
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	-	-	-	-	-	-
Asbestos	-	UKAS	-	-	-	-	-	-
Pesticide Screen	(mg/kg)	u	-	-	-	-	-	-

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Project Reference - Drovers Lane, Pulborough

Analytical Test Results - GRM Brownfield Suite

NCA Reference			16-7277
Client Sample Reference			WS5
Client Sample Location			WS5
Depth (m)			0.80
Date of Sampling			04.03.2016
Time of Sampling			Not provided
Sample Matrix			Clay
Determinant	**Units**	**Accreditation**	
Arsenic	(mg/kg)	MCERTS	-
Cadmium	(mg/kg)	MCERTS	-
Chromium (Total)	(mg/kg)	UKAS	-
Copper	(mg/kg)	MCERTS	-
Lead	(mg/kg)	MCERTS	-
Mercury	(mg/kg)	UKAS	-
Nickel	(mg/kg)	MCERTS	-
Selenium	(mg/kg)	u	-
Zinc	(mg/kg)	MCERTS	-
Total Phenols	(mg/kg)	MCERTS	-
Cyanide (Total)	(mg/kg)	MCERTS	-
Chromium (Hexavalent)	(mg/kg)	u	-
pH	pH Units	u	7.5
SOM	(%)	UKAS	-
Sulphate	(mg/l)	u	13
Acenaphthene	(mg/kg)	MCERTS	-
Acenaphthylene	(mg/kg)	UKAS	-
Anthracene	(mg/kg)	UKAS	-
Benzo (a) anthracene	(mg/kg)	MCERTS	-
Benzo (a) pyrene	(mg/kg)	MCERTS	-
Benzo (b) fluoranthene	(mg/kg)	MCERTS	-
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	-
Benzo (k) fluoranthene	(mg/kg)	MCERTS	-
Chrysene	(mg/kg)	MCERTS	-
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	-
Fluoranthene	(mg/kg)	MCERTS	-
Fluorene	(mg/kg)	MCERTS	-
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	-
Naphthalene	(mg/kg)	MCERTS	-
Phenanthrene	(mg/kg)	MCERTS	-
Pyrene	(mg/kg)	MCERTS	-
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	-
Asbestos	-	UKAS	-
Pesticide Screen	(mg/kg)	u	-

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Project Reference - Drovers Lane, Pulborough

Analytical Test Results - Pesticides

NCA Reference			16-7259	16-7260	16-7266	16-7268	16-7270
Client Sample Reference			TP03	TP06	WS3	WS5	WS7
Client Sample Location			TP03	TP06	WS3	WS5	WS7
Depth (m)			0.30	0.10	0.20	0.20	0.20
Date of Sampling			04.03.2016	04.03.2016	04.03.2016	04.03.2016	04.03.2016
Time of Sampling			Not provided	Not provided	Not provided	Not provided	Not provided
Sample Matrix			Loam	Sand	Sand	Loam	Sand
Determinant	**Units**	**Accreditation**					
Organochlorine Insecticides							
Hexachlorocyclohexane	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorobenzene	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Aldrin	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulphan	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
DDE	(mg/kg)	u	0.06	0.22	0.02	0.07	0.05
Dieldrin	(mg/kg)	u	<0.01	<0.01	0.01	0.15	0.03
Endrin	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
DDD	(mg/kg)	u	<0.01	<0.01	<0.01	0.03	0.01
DDT	(mg/kg)	u	<0.02	<0.02	<0.02	<0.02	<0.02
Organophosphorus Insecticides							
Dichlorvos	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Mevinphos	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Dimethoate	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Diazinon	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Primiphos methyl	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Malathion	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Fenitrothion	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01
Azinphos methyl	(mg/kg)	u	<0.01	<0.01	<0.01	<0.01	<0.01

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Project Reference - Drovers Lane, Pulborough

Analytical Test Results - GRM Leachate Suite

NCA Reference			16-7259	16-7266	16-7268	16-7269
Client Sample Reference			TP03	WS3	WS5	WS6
Client Sample Location			TP03	WS3	WS5	WS6
Depth (m)			0.30	0.20	0.20	0.20
Date of Sampling			04.03.2016	04.03.2016	04.03.2016	04.03.2016
Time of Sampling			Not provided	Not provided	Not provided	Not provided
Sample Matrix			Leachate	Leachate	Leachate	Leachate
Determinant	**Units**	**Accreditation**				
Arsenic	(µg/l)	u	< 2.5	9	3	< 2.5
Cadmium	(µg/l)	u	< 2.5	< 2.5	< 2.5	< 2.5
Chromium (Total)	(µg/l)	u	< 2.5	< 2.5	< 2.5	< 2.5
Copper	(µg/l)	u	25	< 1	< 1	< 1
Lead	(µg/l)	u	< 1	1	< 1	< 1
Mercury	(µg/l)	u	< 1	< 1	< 1	< 1
Nickel	(µg/l)	u	< 2.5	< 2.5	< 2.5	< 2.5
Selenium	(µg/l)	u	< 1	< 1	< 1	< 1
Zinc	(µg/l)	u	7	< 1	< 1	< 1
Phenol (Total)	(µg/l)	u	7.9	5.9	7.5	7.5
Cyanide (Total)	(mg/l)	u	<0.5	<0.5	<0.5	<0.5
pH	pH Units	UKAS	6.6	7.5	7.8	7.8
Sulphate (as SO_4)	(mg/l)	u	<10	<10	<10	<10
Ammonical Nitrogen (as N)	(mg/l)	u	<0.002	<0.002	<0.002	<0.002
Benzo (a) pyrene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01
Benzo (g, h, i) perylene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01
Indeno (1, 2, 3,-cd) pyrene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01
Naphthalene	(µg/l)	u	<0.01	<0.01	<0.01	<0.01

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Project Reference - Drovers Lane, Pulborough

Sample Descriptions

NCA Reference	Client Sample Reference	Sample Depth (m)	Description	Moisture Content (%)	Stone Content (%)
16-7259	TP03	0.30	Brown slightly sandy clayey silt with organic matter.	31	0
16-7260	TP06	0.10	Dark brown silty sand.	17	0
16-7261	TP07	0.20	Brown slightly silty slightly sandy clay.	18	0
16-7262	TP08	0.10	Light brown sand.	13	0
16-7263	TP10	0.10	Brown clayey sand with organic matter.	17	0
16-7264	WS1	0.20	Brown sandy silt with organic matter.	30	0
16-7265	WS2	0.20	Brown sandy silt with organic matter.	25	4.3
16-7266	WS3	0.20	Brown silty gravelly sand.	10	23
16-7267	WS4	0.20	Brown silty gravelly sand with limestone.	15	23
16-7268	WS5	0.20	Brown sandy silt.	21	3.9
16-7269	WS6	0.20	Brown sandy gravelly silt with crushed rock.	9.5	38
16-7270	WS7	0.20	Dark brown silty gravelly sand.	8.7	46

NCA Reference	Client Sample Reference	Sample Depth (m)	Description	% Passing 2mm BS test sieve
16-7271	TP06	1.80	Orange/brown sandy clay.	100
16-7272	TP07	0.70	Brown sandy silty clay.	100
16-7273	TP08	2.40	Light brown sand and sandstone.	100
16-7274	TP09	0.90	Grey/brown sand and sandstone.	100
16-7275	WS1	0.9	Orange/brown sand silty clay.	100
16-7276	WS4	0.8	Brown gravelly silty clay.	100
16-7277	WS5	0.8	Light brown sandy silty clay.	100

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Project Reference - Drovers Lane, Pulborough

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	Metals	Air Dried	In house method statement - MS - CL - ICP metals
Soil	PAH	As Received	In house method statement - MS - CL - PAH (As received)
Soil	Phenols	As Received	In house method statement - MS - CL - Phenols (Skalar)
Soil	Chromium (hexavalent)	As Received	In house method statement - MS - CL - Chromium (Hexavalent)
Soil	Cyanide	As Received	In house method statement - MS - CL - Cyanide by Skalar
Soil	pH	As Received	In house method statement - MS - CL - pH (Soil) using a 1:3 soil to water extraction
Soil	SOM	Air Dried	In house method statement - MS - CL - TOC
Soil	Sulphate	Air Dried	In house method statement - MS - CL - Anions (Aquakem)
Soil	Asbestos	As Received	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
Soil	Pesticide Screen	As Received	In house method statement - MS - CL - Pesticide Screen
Soil	Pesticide Quantificaiton	-	Subcontract Analysis
Soil	Leaching	As Received	NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio
Leachate	Metals	As Received	In house method statement - MS - CL - ICP Metals Water
Leachate	PAH	As Received	In house method statement - MS - CL - PAH Water
Leachate	Phenol	As Received	In house method statement - MS - CL - Phenols (HPLC)
Leachate	pH	As Received	BS 1377, Part 3, 1990
Leachate	Cyanide	As Received	In house method statement - MS - CL - Cyanide
Leachate	Sulphate	As Received	In house method statement - MS - CL - Anions (Aquakem)
Leachate	Ammonia	As Received	In house method statement - MS - CL - Ammonia

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APPENDIX I

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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- Structural Engineering Services
- Construction Management
- Site Services

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

Drovers Lane, Pulborough

Report no. L16/0579/GRM/002			
Order reference: P7298	Date of receipt: 08/03/2016	Date of testing: 10/03/2016 to 16/03/2016	Date of issue: 18/03/2016

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity index (%)**	**Moisture content (%)**
16-7255	TP4	Disturbed	1.0	Brown slightly silty gravelly clay.	95	**37**	**19**	**18**	**27**
16-7257	WS4	Disturbed	0.8	Brown gravelly silty clay.	91	**38**	**19**	**19**	**25**
16-7258	WS7	Disturbed	1.5	Brown slightly silty slightly gravelly clay.	99	**36**	**18**	**18**	**26**

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.2 .
4. The material was prepared from its natural state.

[redacted]use 9 is not included in the report. The information will be provided if requested.

[redacted]

.....

Nicholls Colton Analytical

GRM Development Solutions Ltd
Laurus House
First Avenue
Centrum 100
Burton Upon Trent
Staffordshire
DE14 2WH

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Leicester
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Cover Sheet

GRM Development Solutions Ltd
Laurus House
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Burton on Trent
Staffordshire
DE14 2WH

Analytical Test Report: L16/0579/GRM/003

Your Project Reference:	**Drovers Lane, Pulborough**	*Date of Testing*	*10 to 11.03.2016*
Your Order Number:	P7298	Tests Undertaken	3 Soils
Report Issue Number:	1	Report issued:	18.03.2016

Signed

[redacted]

James Gane
Manager - Data Logistics
Nicholls Colton Analytical

Notes:

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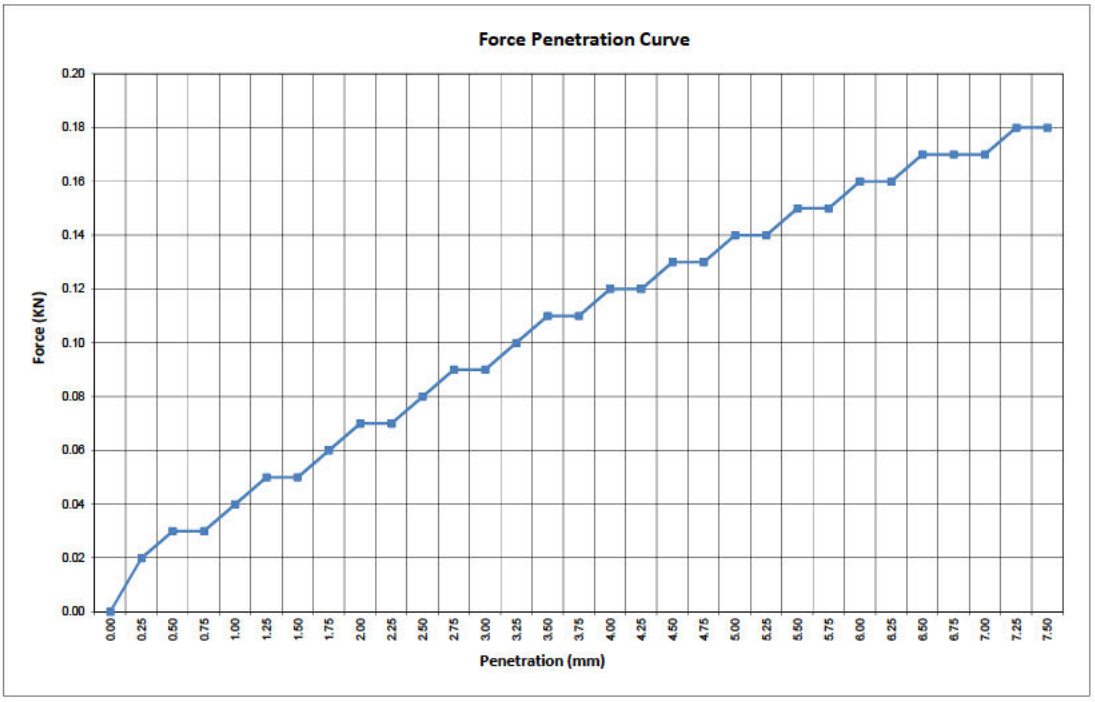
L16/0579/GRM/003
Project Reference - Drovers Lane, Pulborough
Test Result - BS 1377 Laboratory CBR value - Top only

NCA Reference	16-7253		
Location/client reference :	TP1	Sample Depth (m):	0.6 m
Type of sample and visual description :	Light brown clayey silty sand with occasional sandstone		
Initial Bulk Density (Mg/m3) :	1.95	Initial Dry Density (Mg/m3) :	1.57
Material retained on 20mm test sieve (%) :	1.1	Moisture content (%) :	24
California Bearing Ratio (CBR) % :	**0.7**		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with *cl.7.2.4.4 method 5 4.5kg rammer*
3. The test specimen *was not soaked prior to testing*
4. *The test sample classified as 'not appropriate' for testing in accordance with BS1377:Part 4:1990 Clause 7.2.1.2. Testing has been carried out in agreement with our client.*
5. *As the individual results deviate by more than 10% from the mean, this value has not been recorded.*
6. *Maximum limit of load measuring device reached therefore tests terminated.*
7. *A correction has been applied to the CBR values for the top of the sample as per clause 7.5.1.2.*

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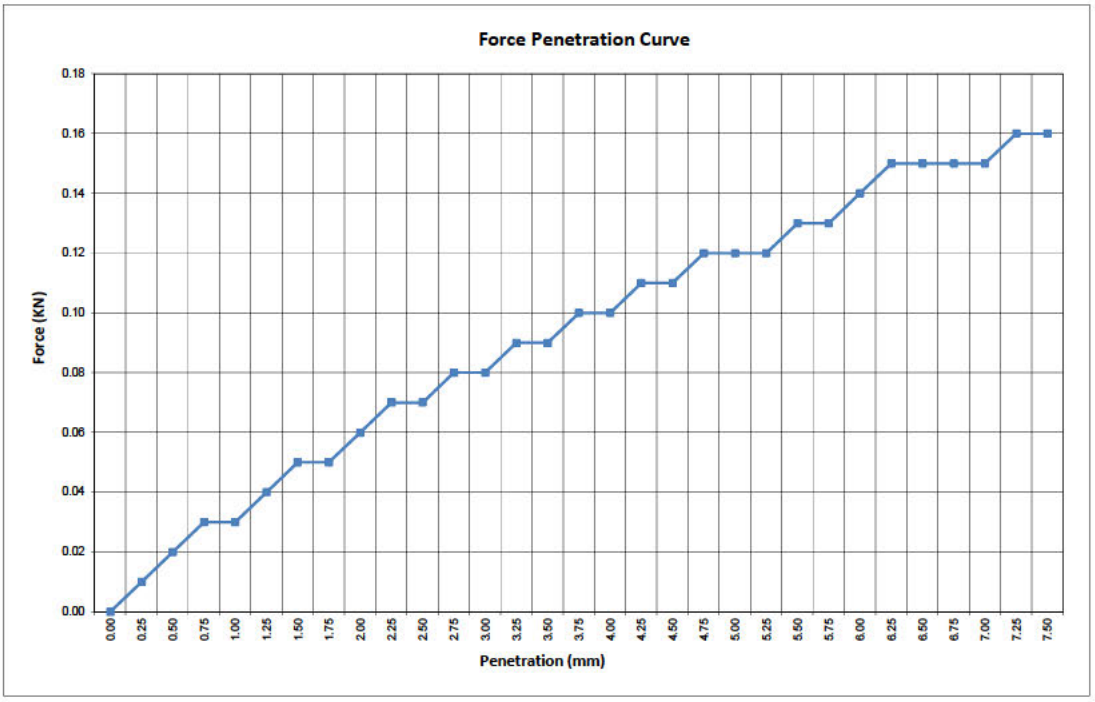
L16/0579/GRM/003
Project Reference - Drovers Lane, Pulborough
Test Result - BS 1377 Laboratory CBR value - Top only

NCA Reference	**16-7254**		
Location/client reference :	TP4	Sample Depth (m):	0.6 m
Type of sample and visual description :	Light brown clayey sandy silt with occasional sandstone		
Initial Bulk Density (Mg/m3) :	1.98	Initial Dry Density (Mg/m3) :	1.61
Material retained on 20mm test sieve (%) :	0.6	Moisture content (%) :	23
California Bearing Ratio (CBR) % :	**0.6**		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with *cl.7.2.4.4 method 5 4.5kg rammer*
3. The test specimen *was not soaked prior to testing*
4. *The test sample classified as 'not appropriate' for testing in accordance with BS1377:Part 4:1990 Clause 7.2.1.2. Testing has been carried out in agreement with our client.*
5. *As the individual results deviate by more than 10% from the mean, this value has not been recorded.*
6. *Maximum limit of load measuring device reached therefore tests terminated.*
7. *A correction has been applied to the CBR values for the top of the sample as per clause 7.5.1.2.*

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Centrum 100
Burton on Trent

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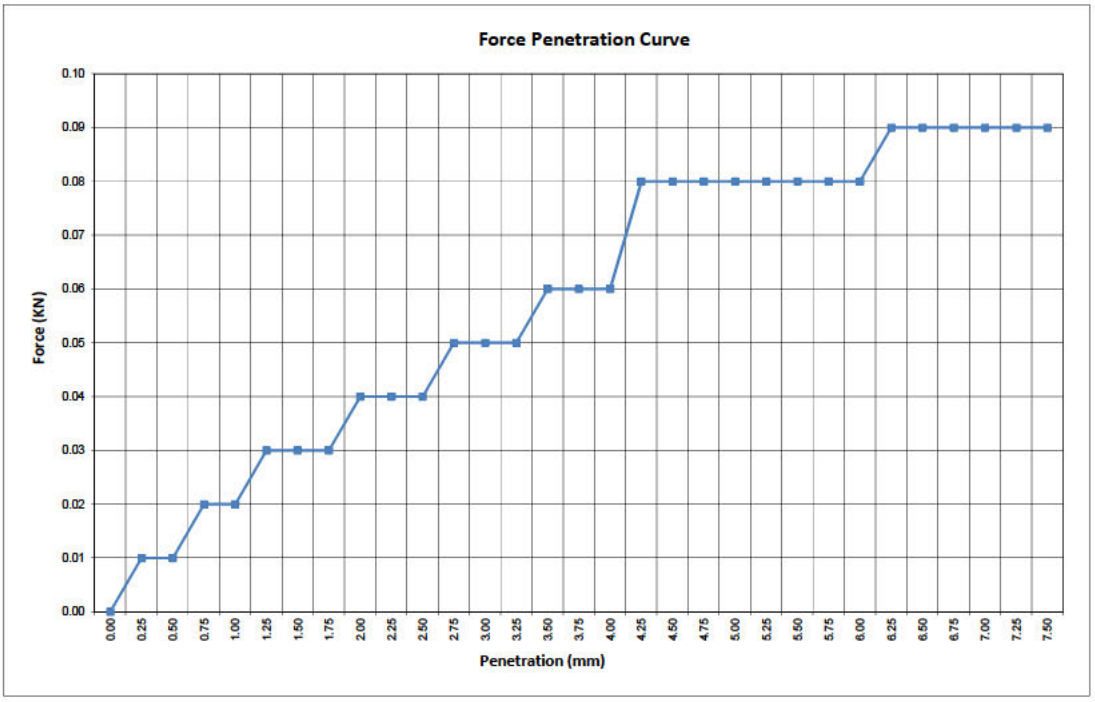
Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

L16/0579/GRM/003
Project Reference - Drovers Lane, Pulborough
Test Result - BS 1377 Laboratory CBR value - Top only

NCA Reference	16-7256		
Location/client reference :	TP6	Sample Depth (m):	0.6 m
Type of sample and visual description :	Light brown clayey sandy silt with occasional mudstone		
Initial Bulk Density (Mg/m3) :	2.03	Initial Dry Density (Mg/m3) :	1.72
Material retained on 20mm test sieve (%) :	0.5	Moisture content (%) :	18
California Bearing Ratio (CBR) % :	**0.4**		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with *cl.7.2.4.4 method 5 4.5kg rammer*
3. The test specimen *was not soaked prior to testing*
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5. *As the individual results deviate by more than 10% from the mean, this value has not been recorded.*
6. *Maximum limit of load measuring device reached therefore tests terminated.*
7. *A correction has been applied to the CBR values for the top of the sample as per clause 7.5.1.2.*

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APPENDIX J

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Table 1a

UKDWS			EQS (µg/l)*
Parameter	**Concentration**	**Units**	
Acrylamide	0.1	µg/l	-
Aluminium	200	µgAl/l	-
Ammonium	0.5	mgNH4/l	0.2
Antimony	5	µgSb/l	-
Arsenic	10	µgAs/l	50 (dissolved)
Benzene	1	µg/l	10
Boron	1	mgB/l	2000
Bromate	10	µgBrO3/l	-
Cadmium	5	µgCd/l	See Table 2b
Chromium	50	µgCr/l	-
Chromium (III)		µg/l	4.7
Chromium (VI)		µg/l	3.4
Chloride (i)	250	mgCl/l	250
Conductivity (i)	2500	µS/cm at 20°C	-
Copper(ii)	2	mg/l	See Table 2a
Cyanide	50	µgCN/l	1
1, 2 dichloroethane	3	µg/l	10
Dichloromethane		µg/l	20
Epichlorohydrin	0.1	µg/l	-
Fluoride	1.5	mgF/l	1 (Hardness <50mg/l $CaCO_3$) 2 (Hardness <50mg/l $CaCO_3$)
Hydrogen ion	10	pH value	-
Iron	200	µgFe/l	1000 (dissolved)
Lead (ii)	25	µgPb/l	1.2 (dissolved & bioavailable)
Manganese	50	µgMn/l	30
Mercury	1	µgHg/l	0.07 (dissolved)
Mineral Oil (TPH)	10	µg/l	5000 (total) ****
Nickel (ii)	20	µgNi/l	4 (dissolved & bioavailable)
Nitrate (iii)	50	mgNO3/l	-
Nitrite (iii)	0.5	mgNO2/l	-
Phenol	0.5	µg/l	7.7
Polycyclic Aromatic Hydrocarbons (vii) *	0.1	µg/l	-
Fluoranthene		µg/l	0.0063
Naphthalene		µg/l	2
Benzo(a)pyrene	0.01	µg/l	0.00017
Benzo(b)fluoranthene		µg/l	-
Benzo(k)fluoranthene		µg/l	-
Benzo(g,h,i)perylene		µg/l	-
Indeno(1,2,3-cd)pyrene		µg/l	-
Anthracene		µg/l	0.1
Selenium	10	µgSe/l	-
Sodium	200	mgNa/l	-
Sulphate (i)	250	mgSO4/l	-
Tetrachloroethene and Trichloroethene (viii)	10	µg/l	10
Tetrachloromethane	3	µg/l	12
Toluene	700***	µg/l	50
Xylene	500***	µg/l	30
Ethylbenzene	300***	µg/l	20**
1,1,1-Trichloroethane		µg/l	400
Trichlorobenzenes		µg/l	0.4
Trichloromethane		µg/l	2.5
Vinyl chloride	0.5	µg/l	N/A
Carbon Tetrachloride		µg/l	12
Zinc	5000	µg/l	See Table 2a

Table 1b

Pesticides			EQS (µg/l)*
Aldrin	0.03	µg/l	
Dieldrin	0.03	µg/l	
Heptachlor	0.03	µg/l	
Heptachlor epoxide	0.03	µg/l	
other pesticides	0.1	µg/l	
Cyclodiene pesticides		µg/l	0.01 (sum)
Pesticides: Total (vi)	0.5	µg/l	

Table 2a

EQS for Hardness Related Substances*							
Substance	**EQS type**	**EQS (ug/l) for Hardness bands (mg/l $CaCO_3$)**					
		0-50	**>50-100**	**>100-150**	**>150-200**	**>200-250**	**>250**
Freshwaters, suitable for all fishlife							
Copper (dissolved)	Annual average	1	6	10	10	10	28
Zinc (total)	Annual average	8	50	75	75	75	125

Table 2b

Substance	EQS Type	EQS (µg/l) for hardness bands (mg/l $CaCO_3$)				
		<40	40-50	50-100	100-200	>200
Cadmium (dissolved)	Annual average	<0.08	0.08	0.09	0.15	0.25

Reference

* The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

** Provisional EQS Value

*** WHO Drinking Water Standard

**** EA PPG3

Contaminant Thresholds for Subsurface Water Pipes

Contaminant	Thresholds (mg/kg)
Corrosion	
Wrapped Steel	pH<7 Cond >400µS/cm
Wrapped Ductile Iron	pH<5 Cond >400µS/cm, he not neutral
Copper	pH<5 >8 and Eh +ve
Toxic Substances	
Chromium (total) (Cr)	Applies to above pipe materials
Organic Contaminants	
VOC's	0.5 PE/0.125 PVC
BTEX & MTBE	0.1 PE/0.03 PVC
SVOC	2 PE/1.4 PVC
Phenols	2 PE/0.4 PVC
Cresols & Chlorinated Phenols	2 PE/0.04 PVC
Mineral Oil C11-C20	10 PE
Mineral Oil C21 - C40	500
Ether/Ketone/Amines, Nitrobenzene/Aldehydes	0.5 PE/0.02-1 PVC

Notes.

It is not recommended that water pipes should be laid in sites where these substances are identified or suspected
Local Utility Companies should be consulted prior to pipe specifications being finalised.
Ref: Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. UKWIR Ref. No. 10/WM/03/21. 2010.

	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential with Plant Uptake		
CONTAMINANT	**1%**	**2.50%**	**6%**
[e] Arsenic	37	37	37
[e] Cadmium	26	26	26
[b] Chromium III	2590	2590	2590
[e] Chromium VI	21	21	21
[e] Lead	200	200	200
[c] Mercury	170	170	170
[a] Selenium	350	350	350
[a] Nickel	130	130	130
[b] Phenols	240	471	951
[b] Copper	2300	2300	2300
[b] Zinc	4590	4590	4590
[d] Cyanide	34	34	34
[e] Benzene	0.20	0.36	0.87
[b] Toluene	118	267	609
[b] Ethylbenzene	64	151	349
[b] *o* - xylene	43	101	235
[b] *m* - xylene	41	98	228
[b] *p* - xylene	40	93	217
Non Genotoxic PAHs			
[b] Acenaphthene	333	746	1450
[b] Acenaphthylene	170	407	906
[b] Anthracene	3770	7890	13700
[b] Fluoranthene	391	690	981
[b] Fluorene	166	939	849
[b] Napthalene	1.5	3.5	8.2
[b] Phenanthrene	149	316	558
[b] Pyrene	867	1560	2270
Genotoxic PAHs			
[e/f] Benzo(a)pyrene	5	5	5
ALIPHATIC HYDROCARBONS			
[b] C5-C6	28	51	105
[b] C6-C8	68	152	347
[b] C8-C10	18	43	102
[b] C10-C12	87	215	509
[b] C12-C16	709	1680	3400
[b] C16-35	128000	128000	128000
AROMATIC HYDROCARBONS			
[b] C5-7 (benzene)	64	128	271
[b] C7-8 (toluene)	118	267	609
[b] C8-C10	26	63	146
[b] C10-C12	69	165	364
[b] C12-C16	141	325	662
[b] C16-C21	264	547	938
[b] C21-C35	1120	1490	1720

Notes

a SGV (2009)

b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data.

c SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)

d Atkins ATRISKsoil Value

e C4SL - SP1010 (2014)

f Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)

NB Where C4SLs/SGVs have not been produced, all TACs have been revised in line with report SP1010 (2014), however, the default consumption rates in the CLEAv1.06 model have been retained.

GRM.TAC.08.14

APPENDIX K

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Client/client ref: Catesby Estates Ltd
Project ref: P7298
Site ref: Land to the north east of Glebelands, Pulborough
Data description: Topsoil
Contaminant(s): General suite
Test scenario: Planning
Date: 6 April 2016

	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium III (mg/kg)	Chromium VI (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Nickel (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)	Cyanide (mg/kg)	SOM (%)	Benzo(a)pyrene (mg/kg)	Napthalene (mg/kg)	Phenols (mg/kg)
Critical concentration, C_c	37	26	2590	21	200	170	350	130	2300	4590	34		5	1.5	240
Notes															
Full dataset size	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Outliers present?	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No
Number of outliers temporarily excluded			1												
Number removed by filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sample size, n	8	8	7	8	8	8	8	8	8	8	8	8	8	8	8
Sample mean, $\bar{x}$	5	0.2625	10.1571429	0.5	16.9375	1.25	4	6.4875	17.5875	42.3375	0.5	1.54375	0.0666875	0.02125	0.5
Standard deviation, s	0	0.10606602	1.98901747	0	5.20547445	0	0	0.96575285	8.16393419	11.0098576	0	1.03903716	0.11710944	0.03181981	0
Number of non-detects	8	2	0	8	0	8	8	0	0	0	8	5	5	8	8
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Distribution	Single value	Non-normal	Normal	Single value	Normal	Single value	Single value	Normal	Normal	Normal	Single value	Non-normal	Non-normal	Non-normal	Single value
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: One-sample t	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev
Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				Evidence level required:		95%	Use Normal distribution to test for outliers							
t statistic, t_0 (or k_0)	N/A	-686.3333333	-3431.655449	N/A	-99.46815514	N/A	N/A	-361.7344794	-790.750792	-1168.292311	N/A		-119.1493582	-131.4444444	N/A
Upper confidence limit (on true mean concentration, μ)	5	0.42595871	11.6179829	0.5	20.4243074	1.25	4	7.13439476	23.0559863	49.7122845	0.5	3.1450138	0.24716527	0.07028761	0.5
Evidence level	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%	100%	100%
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	lower bound	evidence level	evidence level	evidence level
Result	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc		μ < Cc	μ < Cc	μ < Cc

APPENDIX L

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Waste Classification Report

2UFAH-3R8YX-C6YCU

Job name

Drovers Lane

Waste Stream

GRM Standard Suite

Comments

Project

P7298

Site

Pulborough

Classified by

Name:
Upton, Richard
Date:
07/04/2016 08:35 UTC
Telephone:
01283 551 249

Company:
GRM Development Solutions Ltd
Laurus House
Centrum 100, First Avenue
Burton Upon Trent
DE14 2WH

Report

Created by: Upton, Richard
Created date: 07/04/2016 08:35 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazardous properties	Page
1	TP03	0.3	Non Hazardous		3
2	TP06	0.1	Non Hazardous		6
3	TP07	0.2	Non Hazardous		8
4	TP08	0.1	Non Hazardous		10
5	TP10	0.1	Non Hazardous		12
6	WS1	0.2	Non Hazardous		14
7	WS2	0.2	Non Hazardous		16
8	WS3	0.2	Non Hazardous		18
9	WS4	0.2	Non Hazardous		20
10	WS5	0.2	Non Hazardous		22
11	WS6	0.2	Non Hazardous		24
12	WS7	0.2	Non Hazardous		26

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	28
Appendix B: Notes	29

APPENDIX M

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Telephone: (01283) 551249
Fax: (01283) 211968

Date: 10th March 2016
Our Ref: P7298 – SA1

Catesby Property Group
Via email only

Attention of Rebecca Birch

Dear Rebecca,

Re: Soakaway Testing at Drovers Lane, Pulborough

Introduction

The phase II ground investigation revealed that the natural granular deposits underlying the site are potentially suitable for soakaway drainage. Due to access restrictions on the site the soakaway tests were conducted in the southern fields, under the area of the proposed surface water attenuation basins.

Fieldwork

The testing was undertaken on the 3rd and 4th March 2016 using trial pits to a depth of 1.2m, to accommodate the landowners requirement that the soakaway crates used in the testing must be level with ground surface, and so that a length of pipe could be left in them for the two days of testing without them becoming a health and safety hazard. Once the soakaway crates were installed, the trial pits were filled with water and then the water levels were monitored over time by data loggers to provide data for the calculation of infiltration rates. To accurately calculate rates all soakaway tests were run to a minimum of 75% empty. The soakaway testing was undertaken in line with the method set out in BRE 365 (1991).

Soakaway Testing

The soakaway tests were carried out in the head deposits present across the site at three locations.

A plan showing the approximate locations of the tests and the trial pit logs are attached.

Infiltration rates have been calculated for each test pit from the data obtained from site. The calculated infiltration rates are presented below in the order in which they were tested:

	Infiltration Rates		
Location	Test A	Test B	Test C
TP01	Insufficient infiltration (22% over 24 hours)	Not conducted	Not conducted
TP02	1.55×10^{-5} m/s	8.25×10^{-6} m/s	Not conducted
TP03	7.37×10^{-6} m/s	4.16×10^{-6} m/s	Not conducted

The strata at the base of TP01 was recorded as slightly damp, the soils throughout TP02 were recorded as damp and TP03 was recorded as dry, prior to the soakaway testing.

Detailed groundwater monitoring has not yet been conducted and the results may affect the site's surface water drainage design.

The results of the testing should be provided to the project's drainage engineers for inclusion within the site's surface water drainage design after taking into account suitable factors of safety.

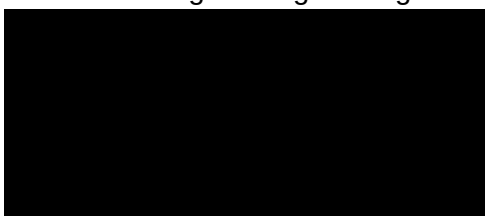
It is recommended that the Environment Agency be consulted with regards to the use of attenuation basins.

We trust this is suitable for you current requirements, should you require any further information or would like any clarification of the points raised please do not hesitate to contact us.

Yours sincerely,
GRM Development Solutions Ltd

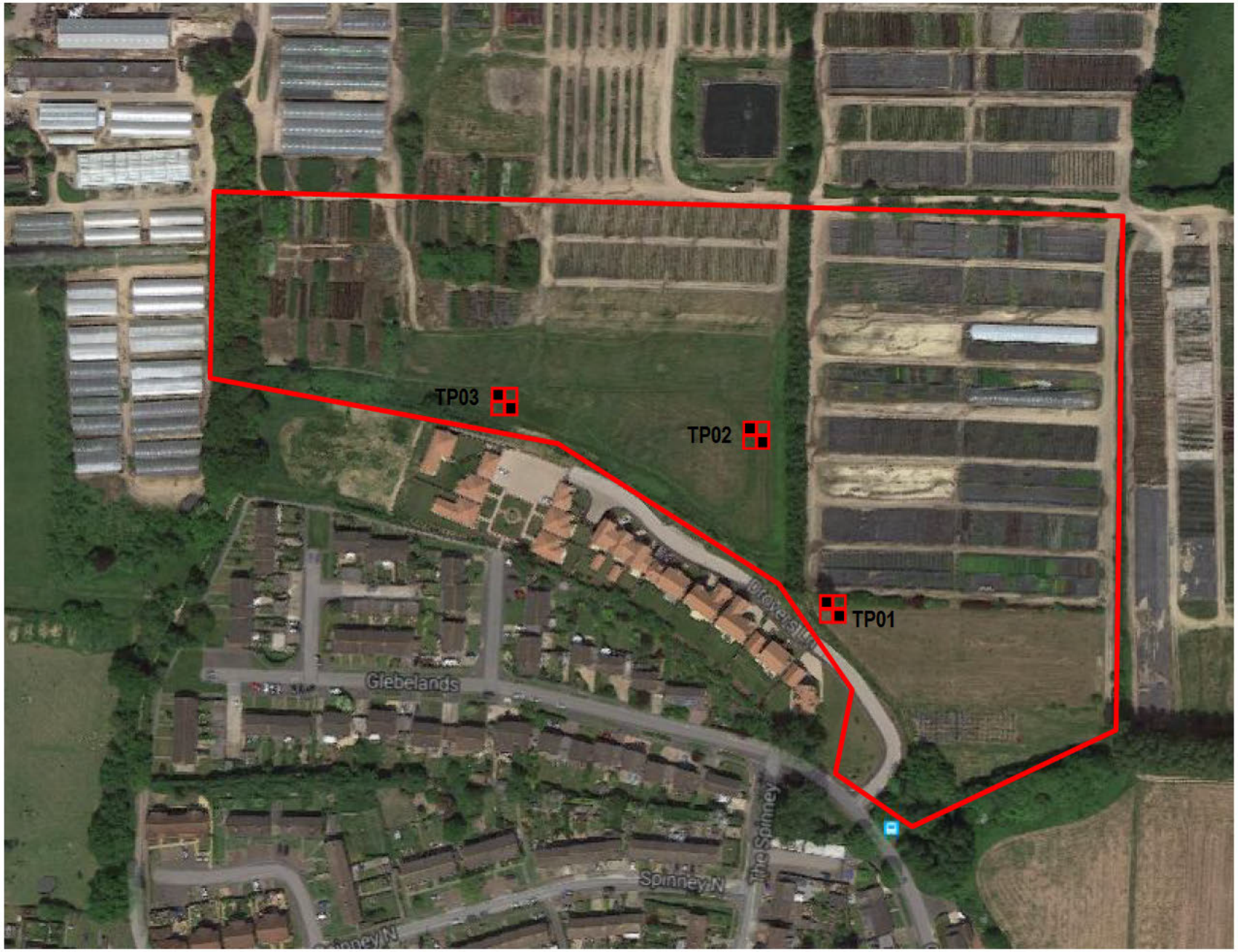


Nicola Rowley
Senior Engineering Geologist



Geoff Beckett
Principal Foundation Engineer

Enc: P7298 Soakaway location plan, P7298 Soakaway Pit Logs



DO NOT SCALE

NOTES:

Approximate Site Boundary

TP1 Soakaway Pit Location

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mail@grm-uk.com www.grm-uk.com

CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: Soakaway Pit Location Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
KH	03/2016
PROJECT No:	DRAWING No:
P7298	

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Trial Pit Log

Trial Pit No TP01
Sheet 1 of 1

Site Name: New Place Nurseries, Pulborough

Ground Level (mAOD)

Client: Catesby Property Group

GRM Project Ref: P7298

Coordinates 505775 E 119113 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20 - 2.00	ES D		0.30			Medium dense dark grey slightly clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chert and sandstone. TOPSOIL
	0.50 0.60	D B					Medium dense orangish brown mottled grey silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chalk. HEAD
	1.10	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
Damp strata at base of hole.

Trial Pit Dimensions (m):
0.60 × 2.10

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved

General Remarks:

Strata consistencies/densities determined by observation only

Version: DRAFT

Scale: 1:25

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Trial Pit Log

Trial Pit No TP02
Sheet 1 of 1

Site Name: New Place Nurseries, Pulborough

Ground Level (mAOD)

Client: Catesby Property Group

GRM Project Ref: P7298

Coordinates 505743 E 119183 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20	D ES		0.30			Loose to medium dense dark grey to dark brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. TOPSOIL
	0.60	D					Medium dense brown to dark brown very silty slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded chalk. Local pockets of silt. HEAD
	1.20	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
Slightly damp strata throughout.

Trial Pit Dimensions (m):
1.10 × 2.10

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved.

General Remarks:

Strata consistencies/densities determined by observation only

Version: DRAFT

Scale: 1:25

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Trial Pit Log

Trial Pit No TP03
Sheet 1 of 1

Site Name: New Place Nurseries, Pulborough

Ground Level (mAOD)

Client: Catesby Property Group

GRM Project Ref: P7298

Coordinates 505644 E 119196 N

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30 0.30	D ES		0.40			Medium dense dark grey and dark brown clayey slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. TOPSOIL
	0.60	D					Medium dense brown to orangish brown silty fine to medium SAND. Locally very silty. Local pockets of clay. HEAD
	0.90	D		0.80			Medium dense orangish brown mottled grey very silty gravelly SAND. Gravel is fine to coarse subangular to subrounded sandstone. HEAD
	1.20	D		1.20			End of Pit at 1.20m

1
2
3
4

Date Excavated: 03/03/2016
Date Backfilled: 03/03/2016
Shoring: None
Stability: Stable
Plant Used: Tracked Excavator
Logged by: AS

Groundwater Observations:
No groundwater observed.

Trial Pit Dimensions (m):
0.90 × 2.00

Reason for termination of Trial Pit:
Maximum depth for soakaway pit achieved.

General Remarks:

Strata consistencies/densities determined by observation only

Version: DRAFT

Scale: 1:25

APPENDIX N

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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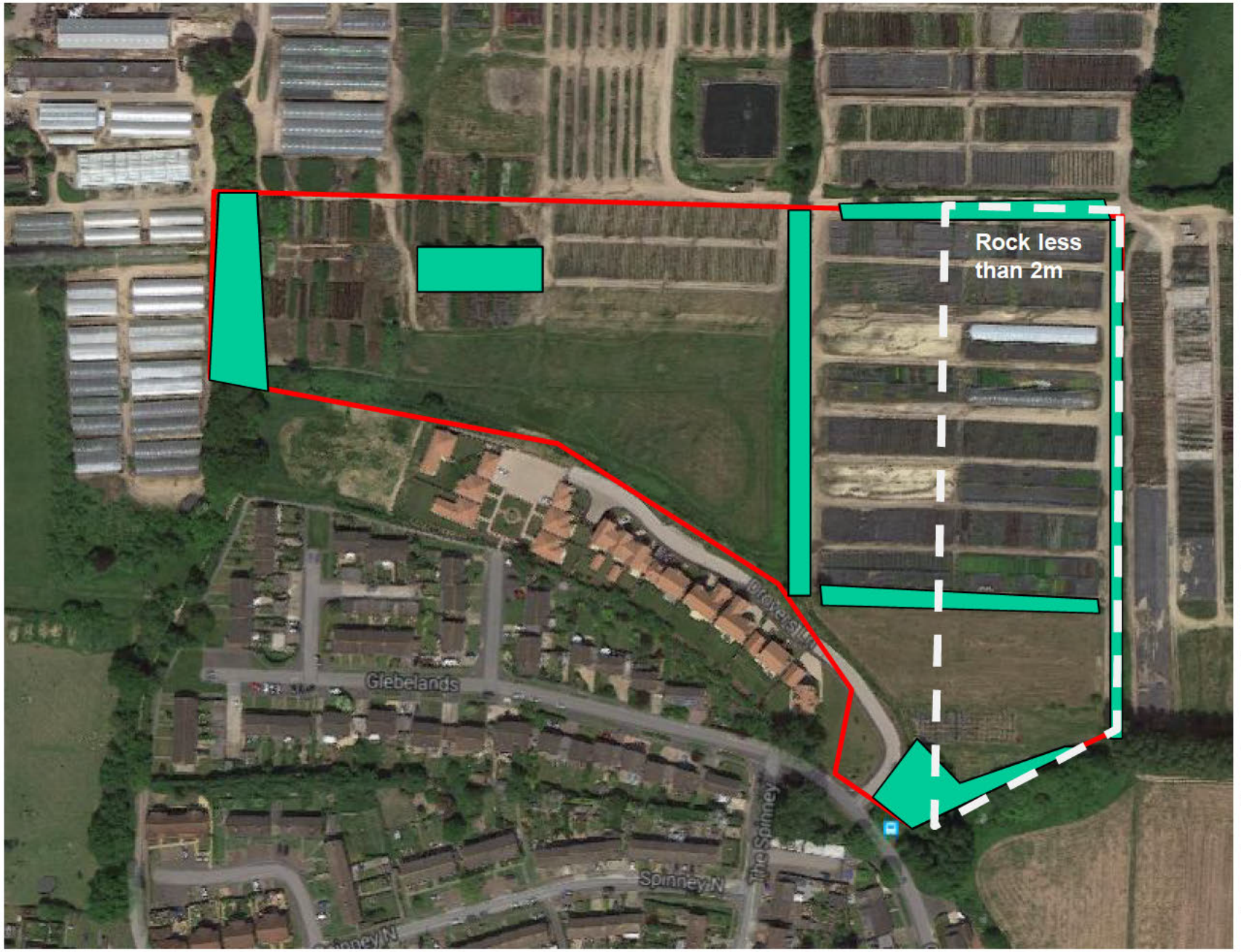

DO NOT SCALE

NOTES:

N

Areas of mature trees and hedgerows

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CLIENT: Catesby Estates Ltd

PROJECT: Drovers Lane, Pulborough

TITLE: Post Ground Investigation Hazard Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : KH	DATE: 04/2016
PROJECT No: P7298	DRAWING No:

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