APPLiED GEOLOGY

FACTUAL REPORT ON GROUND INVESTIGATION AT DOVE VALLEY PARK, DERBYSHIRE

REPORT STATUS SHEET

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Report Title:	Factual Report on Ground Investigation at Dove Valley Park, Derbyshire
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1.0 INTRODUCTION

An area of land located north of Dove Valley Park, Derbyshire is being considered for development by PGFI III Limited (the Client). Jubb Consulting Engineers (Jubb) are acting as Civil & Structural Engineers to the Client and are directing the ground investigation of the site on behalf of the Client. This report presents the results of a Factual Ground Investigation, undertaken on behalf of the Client.

It is understood that the Client is proposing to develop a commercial warehouse at the Site, however, no detailed proposals were provided at the time of reporting.

The brief for the works was defined by Jubb and was outlined in their Ground Investigation Specification Document ref. 18298-GIS-01, dated October 2018. Applied Geology proposal ref. AG18-6613let001, dated 31st October 2018 presents the agreed scope of the works.

This factual report represents the results of the fieldwork and laboratory testing undertaken, as detailed in the following Sections.

2.0 SITE DESCRIPTION AND ANTICIPATED GEOLOGY

2.1 Site Description

The site is located north of the existing Dove Valley Park industrial estate, approximately 1km south of the village of Church Broughton. It is understood the site was formerly part of RAF Church Broughton's airfield. The Ordnance Survey grid reference for the centre of the site is approximately 420163 332579, as shown on the Site Location Plan in Appendix A.

The site is roughly rectangular in plan shape covering an area of approximately 13 hectares. With the exception of peripheral bunding, the site topography is typically flat, with the site sitting at approximately 75m AOD.

A site visit was undertaken by Applied Geology, accompanied by Jubb, on 21st February 2019. Vehicular access to the site was gained from a padlocked wooden gate off Woodyard Lane, along the western boundary of the site. From the access point, a single tracked road led to a single storey residential property within the south-eastern corner of the site. At the time of the visit and the subsequent intrusive works, this property was unoccupied and boarded to prevent access.

Largely, the site as a whole comprised two open agricultural fields separated from north to south by several mature trees, with bordering post and wire fencing. The western boundary of the site was densely vegetated with mature deciduous trees present along the length of the boundary. Earth bunding from 2.00 to 3.50m above existing ground level were identified along sections of the western, south-western and south-eastern boundaries of the site. Similarly, the eastern field was separated by earth bunding. At the time of the visit several large animal burrows were identified within this section of bunding, later confirmed by an ecologist as badger setts. On this basis, a 30m restriction zone was applied in relation to the sett entrances, preventing excavation in these areas.

Stockpiles of tyres, general waste and roofing sheets (possible asbestos containing material) were located centrally onsite adjacent north of the existing access track.

A low voltage overhead cable and underground disused sewer run north to south through the site, approximately along the boundary between the two fields.

The surrounding area was typically agricultural land to the east and north, with a small publicly accessible fishing pond adjacent to the north-west of the site. As mentioned, to the west is Woodyard Lane, with a poultry farm beyond. The southern boundary of the site is bound by two commercial properties which form part of Dove Valley Park.

Photos show the unoccupied single storey residential property, the gated access and the stockpiled materials of tyres, general waste and roofing sheets (possible asbestos containing material)

Photos show the site typically comprises open agricultural fields with occasional mature trees and earth bunding predominantly around the periphery of the site.

2.2 Summary of Anticipated Geology

The published BGS Map indicates the site to be underlain by Superficial Deposits of the Glaciofluvial Terrace Deposits, which comprise sands, gravels and clays. Solid geology is indicated to comprise the Mercia Mudstone Group.

There are no records of Made Ground mapped within the boundaries of the site. However, considering the site was formerly part of RAF Church Broughton's airfield,

it is anticipated that Made Ground soils will be present. The composition of the peripheral earth bunding is unknown.

There are two BGS Archive borehole records within the boundaries of the site and these boreholes were advanced using cable percussion techniques. Within both boreholes an initial layer of topsoil was encountered, over approximately 2.25m of clayey gravelly sands and/ or silty sandy gravelly clays. Hard brown silty clays were encountered to depths of 4.45m and 6.20m below ground level (bgl), respectively, with stiff reddish-brown clayey silts, with intermittent weak green siltstone bands, encountered to the full depth of the investigation (15.45m bgl). Groundwater was encountered within one borehole at a depth of 7.00m bgl.

3.0 SITE WORK

3.1 General

Fieldwork was generally carried out, where relevant, in accordance with BS5930(2015) “Code of Practice for Site Investigations”, and was supervised by an experienced Engineering Geologist. The fieldwork was undertaken in March 2019.

The locations of the exploratory holes were determined by Jubb and were set out on site by Midland Survey Ltd. in conjunction with Applied Geology. The positions of the exploratory holes were surveyed to National Grid and levelled to Ordnance datum by Midland Survey Ltd and are present on the exploratory logs in Appendix B. It should be noted, that TP11, TP12 and CP05 were moved from their original position during the intrusive works, due to the aforementioned badger setts and the associated 30m easement. The as-dug locations are presented on the Exploratory Hole Location Plan (Drawing AG2941-18-02), included in Appendix A.

Statutory services plans were obtained by Applied Geology and prior to excavation or drilling, locations were scanned with a cable avoidance tool (CAT), Ground Penetrating Radar (GPR) and service pits excavated at borehole positions.

Due to the fact that the site was previously part of the former RAF Church Broughton Airfield, a Detailed Unexploded Risk Assessment was undertaken across the site, with respect to Unexploded Ordnance (UXO) by 1st Line Defence. From the findings of the report a Medium risk from British UXO and Low risk from foreign aerial ordnance was assessed for the site. As such, the intrusive works were supported by the presence of an on-site UXO specialist to ensure safe systems of work were in place. A copy of the Detailed UXO Risk Assessment is included in Appendix B.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in Appendix C, together with sample depths, the results of in situ geotechnical testing, comments on groundwater inflows and any other pertinent information. In-situ test results are included in Appendix D, and SPT calibration certificates for both the cable percussion rig and the rotary rig are also included in Appendix C.

Disturbed plastic pots, glass amber jars and bulk samples were recovered in accordance with the requirements of the Specification from the various strata and stored and transported in cool boxes, where relevant, for possible future chemical

or geotechnical laboratory testing. Environmental sub-samples were obtained from each trial pit and from strata at a frequency discussed and agreed with Jubb.

3.2 Machine Excavated Trial Pits

Sixteen trial pits (TP01 to TP16) were excavated on the 7th, 8th and 11th March 2019, to depths of between 0.88m (TP16) and 4.40m bgl (TP14), using either a JCB 3CX and/ or 16 tonne tracked 360 excavator. The excavations were logged from the ground surface by a Geologist. Relevant field testing was carried out on samples brought to the surface appropriate to the soils encountered. Disturbed soil samples were collected from selected horizons for subsequent laboratory testing. The trial pits were unshored and where reasonable, left open for a period of time to allow observations of pit stability and depth and inflow rate of any groundwater ingress. The excavations were photographed and were backfilled with arisings prior to moving on to the next position. Photographs are included in Appendix G.

3.3 Plate Load Tests

Four Plate Load Tests (designated to TP02, TP07, TP09 and TP14) were undertaken at shallow depths of between 0.25m (TP07) and 0.55m bgl (TP09), following a surface scrape to remove loose material, vegetation and topsoil. The surface of the test horizon was smoothed off using the excavator bucket before the plate was bedded in using dried sand. The plate load tests were carried out in general accordance with BS 1377-9: 1990 & Design Manual Roads & Bridges IAN 73/06 using a 300mm diameter plate, as specified by Jubb. Copies of the results are presented in Appendix D.

3.4 Cable Percussion Boreholes

Five cable percussion boreholes (CP01 to CP05) were drilled between the 7th and 15th March 2019.

The boreholes were drilled using a Dando 2500 rig and were advanced using equipment to bore 150mm diameter boreholes to depths of between 9.13m (CP02) and 11.32m bgl (CP04). Following completion of drilling in CP01, CP03 and CP05, the boreholes were left open for a rotary drilling rig to ‘follow on’ to advance the holes deeper and obtain core. Disturbed plastic pot, bulk and environmental samples were recovered from all deposits encountered to allow examination and laboratory. Superficial Deposits were cased off due to the potential for collapse.

In-situ Standard Penetration Tests, using Split Spoon (SPT) were undertaken in the boreholes to provide a measure of the relative density of the granular deposits or equivalent shear strength of the clay and weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT “N” value results. The SPT calibration certificate and SPT summary sheet are included in Appendix C.

Within the fine grained (cohesive) deposits, thin walled “undisturbed” UT 100mm driven open tube samples were recovered, where practicable, to provide samples for examination and laboratory testing.

On completion of the boreholes, standpipes were installed for ground gas and groundwater monitoring/sampling in all boreholes. Installation details for the standpipes were provided by Jubb.

3.5 Rotary Cored Boreholes

Rotary cored drilling was carried out in CP01, CP03 and CP05 between the 11th and 18th of March 2019.

The boreholes were drilled utilising a track mounted Commachio GEO 205 drilling rig and were advanced using equipment to drill 121mm diameter boreholes with water flush. The various near surface deposits were cased off due to their tendency to collapse. Core of approximately 92mm diameter was recovered within coreliner, from depths of between 9.32m (CP03) and 11.11m bgl (CP05) to depths of between 21.60 (CP01) and 25.05m bgl (CP03). Samples of core were obtained in 1.5m length runs and stored in core boxes. The core was photographed, logged and sub-sampled by an Applied Geology engineer. Photographs included in Appendix G.

3.6 Instrumentation

Standpipes were installed in each of the five boreholes as detailed below.

Summary of Standpipe Installations in Boreholes

Borehole No	Response Zone (m bgl)	Nominal Pipe Diameter (mm)
CP01	Sand filter- 7.50-8.50 Piezometer tip- 8.30	19
CP01	0.50 to 5.00	50
CP02	Sand filter- 7.50 to 8.50 Piezometer tip- 7.90	19
CP02	0.50 to 6.00	50
CP03	Sand filter- 7.00 to 8.00 Piezometer tip- 7.80	19
CP03	10.00 to 24.80	50
CP04	4.00 to 11.00	50
CP05	6.00 to 12.00	50

Washed silica gravel (6-10mm) was used as the filter medium around the slotted section of the 50mm diameter standpipes and, where piezometers were installed, a sand filter medium was used. Each instrument was fitted with a push-in bung and single gas tap and was finished with an upright ‘Top Hat’ metal cover concreted in place.

3.7 Gas and Groundwater Monitoring

Ground gas and groundwater monitoring visits were undertaken on 4 occasions from the 19th March to the 12th April 2019. Each monitoring well was monitored for concentrations of carbon dioxide, methane, oxygen, flow rate, differential pressures and water level. The monitoring results are included in Appendix D.

No groundwater samples were required to be collected as part of this investigation.

3.8 Preliminary Soakaway Testing

Preliminary soakaway tests were carried out in four trial pit locations (TP04, TP06, TP10 and TP16) at the request of Jubb. Applied Geology was instructed to fill the trial pits designated for soakaway testing up to base of the topsoil stratum. The soakaway tests were carried out in general accordance with BRE Digest DG365

methodology, however, due to time constraints, the tests were required to all be completed within a single day and therefore only one water fill was possible at all locations. During the period of monitoring, the pits were secured with temporary fencing.

Infiltration rates were calculated in general accordance with BRE 365 methodology, although only one filling was undertaken. Infiltration rates at all four locations were unable to be calculated due to the lack of fall in the water level. The results of the tests are included in Appendix D.

4.0 LABORATORY TESTING

4.1 Geotechnical Testing

Geotechnical testing scheduled by the Engineer was carried out in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and was undertaken by specialist accredited laboratories Geolabs (UKAS No. 1982) and PSL (UKAS No. 4043). The geotechnical testing comprised:

- 23 No Moisture Content Tests;
- 19 No Atterberg Limits Tests;
- 16 No Particle Size Distribution Tests;
- 9 No Moisture Content/Dry Density Relationship Tests;
- 3 No One Dimensional Consolidation Tests;
- 4 No Unconsolidated Undrained Triaxial Compression Tests;
- 5 No BRE “Special Digest 1” suites (greenfield with pyrite);
- 15 No axial and diametral Point Load Tests (ISRM Suggested Methods, 2007);
- 9 No Unconfined Compressive Strength Tests (ISRM Suggested Methods, 1981).

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

4.2 Chemical Testing

Chemical testing scheduled by Jubb was undertaken by specialist laboratory (Chemtest, UKAS Lab No 2183).

The testing suites were detailed by Jubb as follows:

<u>Suite G – (Greenfield Suite)</u> - 15 No. soil samples analysed.

- Arsenic (As), Boron (B) water soluble, Barium (Ba), Cadmium (Cd), Chromium (total), Chromium (Hexavalent), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Vanadium (V), Zinc (Zn);
- pH (pH units);
- Water soluble sulphate (as SO_4);
- Total organic matter (TOC);
- Total Petroleum Hydrocarbons Criteria Working Group, BTEX & MTBE;
- Speciated PAH (EPA 16);
- Phenol;
- Cyanide (total);
- Asbestos presence/absence ID.

5 No. Inert WAC suites were also carried out (WAC Suite K).

2 No UKWIR Suites were analysed on near surface soils (0.60m bgl).

The results of the chemical testing are presented in Appendix F.

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GENERAL NOTES

A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.

B) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.

C) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.

D) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.

E) The copyright of this report and other plans and documents prepared by Applied Geology is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.

F) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.

G) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.

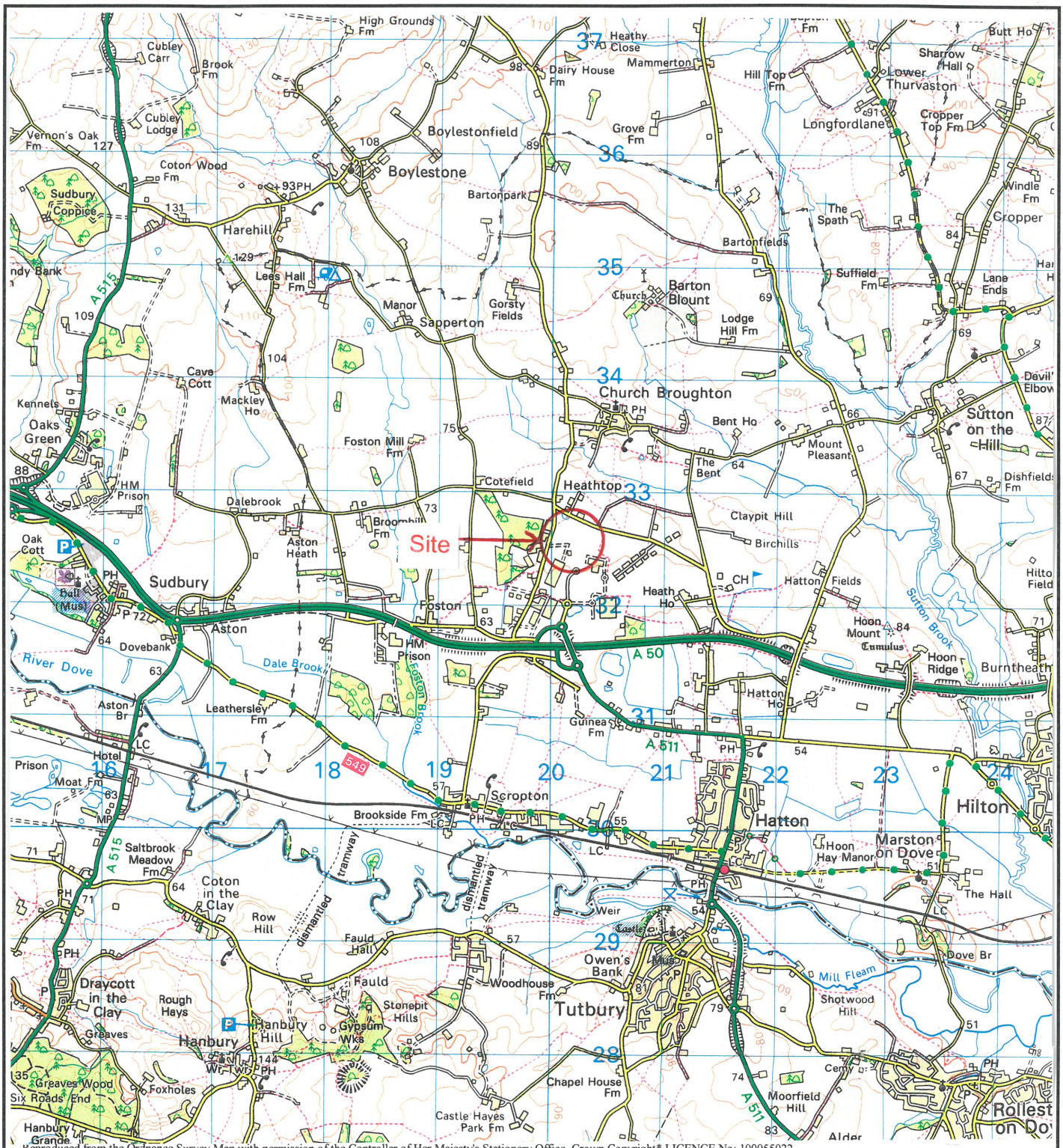
H) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.

I) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.

J) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.

K) Applied Geology operates as a Consultancy and does not operate it's own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

APPENDIX A



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Scale:	**Date:**	**NGR:**
1:50,000	02.05.2019	420163 332579
Drawing No:		**Revision:**
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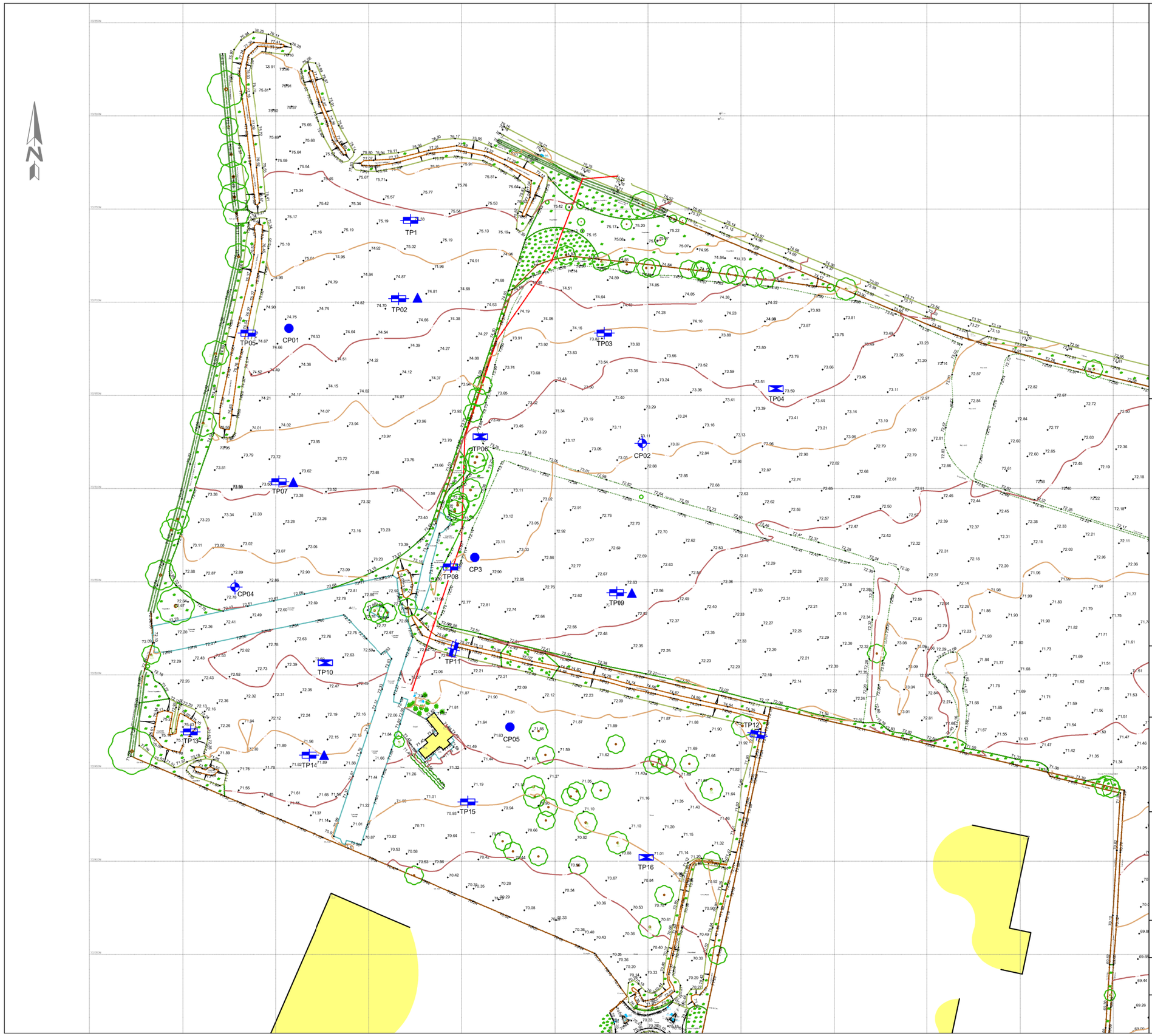
Title: SITE LOCATION PLAN



KEY:

- TP01 — Trial Pit
- BH01 — Cable Percussion Borehole
- BH01 — Cable Percussion Borehole with Rotary Follow On
- TP01 — Trial Pit Soakaway
- Plate Load Test (Undertaken in Trial Pit)

Drawing based on Greenhatch Group, drawing No:31556_T Revision 0 dated 01/10/2018.

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Project: DOVE VALLEY PARK, DERBYSHIRE

Title: EXPLORATORY HOLE LOCATION PLAN

Drawn By:	Checked By:	Paper Size:
JS	MS	A3

Scale:	Date:
1:2000	20.03.2019

Drawing No:	Revision:
AG2941-18-02	0

APPENDIX B

1ST LINE DEFENCE

Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Dove Valley Park
Client	Applied Geology
Site Address	Land near Dove Valley Park, Woodyard Lane, Foston, Derby, DE655BZ
Report Reference	DA8179-00
Date	27th February 2019
Originator	HOS

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Executive Summary

Site Location

Comprised of a plot of land located within the former RAF Church Broughton, the site is situated within the County of Derbyshire in the north midlands.
The site is bound by Woodhouse Lane in the north, whilst open vegetated ground binds the site to the north east, whilst industrial structures and a hardstanding compound bind the site to the south-east. A mixture of open ground, access ways as well as a large industrial structure binds the site to south. The site is bound by Cote Bottom Lane to the west.

The site area is occupied by a mixture of different features and ground conditions. A large area of arable land lined by vegetated hedgerows and a pond is situated in the north-west of the site, with an area of pasture occupying the eastern portion of the site. The south of the site is similarly divided. To the east, a large agricultural building fronted by an area of hardstanding ground lies surrounded by a sparse wooded area, whilst rough disused ground and further hardstanding ground leads to an access way on Woodard Lane in the west.

The site is approximately centred on the OS grid reference: **SK 2014232588**

Proposed Works

The proposed works are understood to comprise of Trial Pits, Cable percussive Boreholes and Rotary Core Boreholes, to a depth of 20m.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the Mercia Mudstone Group – Mudstone, sedimentary bedrock of the Triassic Period. The superficial deposits are comprised of Glaciofluvial deposits. Mid Pleistocene- sand and gravel formed in the Quanternary Period.

Site specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that the risk across the site is not homogenous. A **Medium Risk** from British UXO and British Practice Bombs as well as Land Service Ammunition and Small arms Ammunition has been identified across the site. The risk from German aerial-delivered ordnance and Anti-Aircraft ordnance has been assessed as **Low**.

<u>The Risk from Allied UXO</u>

- Church Broughton's primary role during WWII was for bomber training and operational bomber sorties. Due to the RAF night bombing campaign over Germany and occupied Europe, training at Church Broughton was primarily night flying and practice bombing, conducted from the base starting in August 1942, whilst bombing began in September 1942.
- Being occupied by No. 27 OTU, regular military training and practice bombing would have been conducted from the station, as evidenced by 1945 Flying Officers Control Logs. Whilst these entries indicate that by 1945 such practice bombing took place on a dedicated range at Cannock, such dedicated ranges were only established towards the end of the war, presenting the possibility that earlier practice bombing may have taken place on the airfield, and potentially within the site area. It was not uncommon for areas within historic airfields to be designated as practice bomb areas. However, the location of these areas was not often recorded.
- While no structures that would have been involved in the handling or storage of ordnance were located within the site area, its position within the runways and vacant areas presents the possibility that the area may have been used for training such as practice bombing. Due to relative lack of development undertaken in these areas following the war it is possible that ordnance resulting from training may have remained unnoticed and subsequently unreported.

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UXO Risk Assessment

- A number of aircraft accidents and crashes are noted to have taken place at the station throughout the war, including aircraft that crashed on landing. Whilst the exact positions of these crashes are not known, the nature of training conducted at the station (practice bombing and aerial gunnery) as well as the operational missions (where aircraft would have been 'bombed up'), it is possible that such accidents could have resulted in contamination from items of ordnance entering the ground. Given the number of crashes, it is conceivable that the site area could have been affected, although no direct evidence to confirm this could be found.
- 1945 Disposal Instructions for the airfield suggest that all explosives stored at the facility were to be removed by Bomber Command – follow-up documentation confirming this could not be located, but it is presumed that all stores would have been emptied. An RAF clearance certificate dating from 1956 highlight that no proactive search or clearance work from explosives was deemed necessary following the disposal of the airfield. The documents are of interest because they indicate that only a visual search was undertaken at the station – a walkover of certain areas to ascertain whether or not evidence of unexploded munitions were present on the surface. Such post-war visual searches on historic RAF airfields were often of very limited value. Generally, disposal of munitions (official or unofficial) would have been by burial or burning, leaving no evidence that such activities had occurred. It is this type of disposal that is most likely to have resulted in contamination in and around the site.
- The fact that a visual search was not adequate is demonstrated by the fact that 151 items of live unexploded ordnance were recovered to the south-west of the main landing ground during an army clearance task in 1984. No details were available about the types of munitions were recovered, but the fact that any were found indicates the potential for further contamination to be encountered. A very small area of only 0.25ha was searched.

The Risk From German Aerial Delivered UXO

- During WWII, the Rural District of Repton was subjected to a very low density of bombing campaign, with 2.1 items falling per 1,000 acres. Whilst these records were consulted, no indication could be found to suggest bombing or attacks took place at Church Broughton. Consequently, there is no evidence suggesting any items of German air-delivered ordnance falling within the site location.

Post-war Development

- The extent of works/development and depth of foundations/excavations that have been undertaken on site post-war (or during/post military use) can have a significant effect on the risk of UXO remaining in situ in those areas.
- Little development has taken place on site in post war years, aside from the partial clearance of the former RAF runway in the eastern section of the site, with much of the site retaining
- There is not considered to be any significant risk of UXO remaining at the location and down to the depth of foundations and excavations dug post-war or post-military use

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Land near, Dove Valley Park site:

All Works

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Open intrusive works (trial pits, service pits, open excavations, shallow foundations etc.)

- Non-Intrusive UXO Magnetometer Survey and Target Investigation

  Where this type of survey is not practical (due to for example terrain or ground conditions), the following is recommended to support shallow intrusive works:

- UXO Specialist On-site Support and Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

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Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
AWAS	Air Warfare Analysis Section
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti Air
HE	High Explosive
IB	Incendiary Bomb
LAA	Light Anti Air
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
MOL	Molotov (Incendiary Bomb)
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD1000	1000kg high explosive bomb
SD2	2kg incendiary
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti Air
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V1	Vengeance Weapon 1
V2	Vengeance Weapon 2
WAAF	Women's Auxiliary Air Force
X	Exploded

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Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Land near Dove Valley Park, Derby
Client: Applied Geology

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Applied Geology to produce a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at Land near Dove Valley Park, Derby.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspected device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions deposited as a result of military training and exercises.
2. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.
3. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.

This report will assess the collective factors that may contribute to the risk of UXO contamination. If a potential risk is identified, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to enable the client to understand the basis for the assessed risk level and any recommendations.

This report follows the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry'.

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2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Land near Dove Valley Park, Derby. Every reasonable effort has been made to ensure that all available historical information has been accessed and checked. Where possible, evidence has been included in the report to enable the client to understand the basis of the risk assessment.

The report will recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The risk that the site was contaminated with UXO.
2. The risk that UXO remains on the site.
3. The risk that UXO may be encountered during the proposed works.
4. The risk that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

Amongst other factors, the following will be considered:

- Historical use of the site by Allied forces.
- Evidence of WWI and WWII German aerial-delivered bombing.
- The nature and conditions of the site during WWII.
- The extent of any known post-war development and UXO clearance operations on site.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

To produce a thorough assessment of UXO risk, military records and archive material held in the public domain have been accessed. The following sources have been consulted for this report:

- The National Archives, Kew.
- RAF site plans obtained from the RAF Museum, Hendon.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Applied Geology.
- Available material from 33 Engineer Regiment (EOD) Archive.
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to the RAF Museum, Hendon and The National Archives.

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2.4. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate significant and pertinent information, and the sources consulted have been presented in this report. 1st Line Defence cannot be held accountable for any changes to the assessed level of risk or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence at the time of the report's production.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are to a degree subjective. To counter this, a range of many sources and types of information have been consulted, analysed and presented. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for inaccuracies or gaps in the available historical information.

3. Background to Historical Records

3.1. Background to Bombing Records

During WWII bombing records were gathered by the police, Air Raid Precaution (ARP) wardens and military personnel. Records were maintained in the form of local and regional written records, maps depicting the locations of individual strikes, and maps indicating the levels of damage sustained by structures. Records typically noted when, where and what types of bombs had fallen during an air raid. Records of bomb strikes were made either through direct observation or by post-raid surveys. The immediate priority was frequently focussed on assisting casualties and minimising damage. As a result some records were incomplete and contradictory.

The quality, detail and nature of record keeping could vary considerably between boroughs and towns. No two areas were collated or recorded data in the same way. Some areas maintained bomb and damage mapping, some provided grid references of strikes, and some are too vague in detail to be able to ascertain exactly where bombs fell. Many records were even damaged or destroyed in subsequent bombing raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Furthermore, records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

3.2. Background to Allied Records

During WWII considerable areas of land were requisitioned by the army for the purpose of defence, training, and the construction of airfields and facilities for munitions production. Records relating to military features vary and some areas may remain censored. Plans of varying details were kept evidencing the design and structure of an airfield, as well as station operation record books, personal memoirs, and operational plans.

4. UK Regulatory Environment

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable.

4.4. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, one may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

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4.5. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to UXO for the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a set and defined process for the management of risks associated with UXO from WWI and WWII aerial bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on the needs of the construction professional if there is a suspected UXO on site and covers issues such as what to expect from an UXO specialist.

This guidance helps clients to fulfil their legal duty under CDM2007 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. The possibility of UXO being encountered on a site falls within the category of a potentially significant risk, and it should be addressed as early as possible in the lifecycle of a project.

This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

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5. Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of UXO Specialist such as 1st Line Defence (often referred to also as UXO Consultant or UXO Contractor) is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of a UXO Specialist is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The information/resources relevant to assessing the specific risk from UXO are best assessed by a UXO Specialist, and the consultant should have in place the expert knowledge and resources to undertake a cost-effective yet robust data search of relevant information.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures.

1st Line Defence also have the capability to provide whatever UXO risk mitigation services are required in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal (JSEOD) to arrange for investigation and/or disposal. In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on JSEOD's judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. They may respond immediately or it can take 1-2 days and often longer for the authorities to respond and deal with a UXB.

Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion. The latter process is lengthy and may necessitate the establishment of addition cordons and evacuations.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high risk situations. If there are regular UXO finds on a site the JSEOD may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

Comprised of a plot of land located within the former RAF Church Broughton, the site is situated within the County of Derbyshire in the north midlands.

The site is bound by Woodhouse Lane in the north, whilst open vegetated ground binds the site to the north east, whilst industrial structures and a hardstanding compound bind the site to the south-east. A mixture of open ground, access ways as well as a large industrial structure binds the site to south. The site is bound by Cote Bottom Lane to the west.

The site is approximately centred on the OS grid reference: **SK 2014232588**

Site location maps are presented in **Annex A**.

6.2. Site Description

The site area is occupied by a mixture of different features and ground conditions. A large area of arable land lined by vegetated hedgerows and a pond is situated in the north-west of the site, with an area of pasture occupying the eastern portion of the site. The south of the site is similarly divided. To the east, a large agricultural building fronted by an area of hardstanding ground lies surrounded by a sparse wooded area, whilst rough disused ground and further hardstanding ground leads to an access way on Woodard Lane in the west.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

The proposed works are understood to comprise of Trial Pits, Cable percussive Boreholes and Rotary Core Boreholes, to a depth of 20m.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the Mercia Mudstone Group – Mudstone, sedimentary bedrock of the Triassic Period. The superficial deposits are comprised of Glaciofluvial deposits. Mid Pleistocene- sand and gravel formed in the Quanternary Period.

8.2. Site Specific Geology

Site specific geotechnical data was not available at the time of the production of this report.

9. Site History

9.1. Introduction

The site is recorded to have been positioned within the boundary of the former RAF Church Broughton, a satellite airfield for the busy RAF Litchfield. This field was home to a number of units, both training and operational, as a result, a number of bombing missions were conducted from the station.
The remainder of the report will endeavour to ascertain the extent to which the historical military usage, as well as potential German bombing of the area, has resulted in an associated ordnance contamination at the site.

9.2. Ordnance Survey Historical Maps

Historical maps were obtained for this report and are presented in **Annex D**. These maps provide an indication of the composition of the site pre and post- WWII. See below for a summary of the site on various mapping editions. Later sections of the report present and detail other available mapping, plans and photography and should be read in conjunction with this section as often civilian OS mapping does not show many of the historic features of some military airfields.

Pre-WWII		
Date	**Scale**	**Description**
1924	1:10,560	This map indicates the site to have been situated largely within an area of agricultural land to the south of a collection of structures marked as *Heathtop.* A small body of water is marked in the north-eastern section of the site, which is also intersected by a pathway. A small structure of known use is shown to have been located in the south-eastern section of the site, possibly connected to a structure marked as *Warren House* beyond the site to the east, whilst a large vegetated plantation, *Jackson Plantation* is visible to the south of the site.

Post-WWII		
Date	**Scale**	**Description**
1955	1:10,560	In the surrounding area, as expected, the presence of RAF Church Broughton has been censored on this map, with no development indicated to have taken place in the wider vicinity of the site. Structures surrounding the site that are not censored maintain much the same structural footprint as they had prior to the war.
1979	1:2,500	This map edition, now uncensored, reveals the airfields composition surrounding the site. To the north, a variety of additional structures and outbuildings have been constructed in the areas surrounding *Heathtop*, with structures now labelled as *Maple Dene, Marlpit House* and *Heathtop Farm* respectively. Two large hardstanding runways have been constructed in the south of the site, with dispersal pans and further hardstanding areas as well as a large rectangular structure are situated beyond Woodyard Lane the west. An access road and further hardstanding areas are located further to the south.

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9.3. History of RAF Church Broughton

RAF Church Broughton was acquired by the Air Ministry (AM) as a satellite station for RAF Litchfield in 1941, with construction beginning the same year. By 1942 the station was operational and under the command of No. 93 Group of Bomber Command. By August of the same year, the station was home to No. 27 Operational Training Unit, who conducted training for Royal Australian Air Force (RAAF) pilots prior to flying bombing missions over Germany and occupied Europe.

The station was used for active bombing missions from September 1942 and continuing until October 1944, with targets including Dusseldorf, Paris, Rouen and Boulogne. Throughout the war, the station was visited by many different units, including several visits from USAAF B17s, as well as a Czech training unit that became permanently based at the station. In the later stages of the war Church Broughton was also home to a Rolls Royce Experimental Flight Trails Unit that used the station to test Whittle jet and turboprop engines for then experimental Gloster Meteor jet fighter.

At the end of the war, in August 1945 the station was promptly handed over to No. 51 Maintenance Unit (MU) RAF.

9.4. Post War Usage

The station continued to be used by No. 51 MU in the immediate post war period, being used for the storage of aircraft until July 1954. By 1956 the airfield was no longer considered a necessary AM asset, and provisions were made for the airfield to be disposed of, with many buildings demolished and sold off. During this period one B1 Hangar was turned over to civilian use, whilst the other buildings were allowed to deteriorate. The final buildings and site was auctioned off in May 1975, when the MoD ceased ownership.

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10. Introduction to Allied Ordnance

10.1. General

RAF Church Broughton was predominantly used as a Bomber station during WWII. The tables below depict a selection of ordnance typical of that which might be expected at such an RAF station. RAF bomber aircraft, such as the Vickers Wellingtons fielded from the station by No. 27 OTU, were broadly equipped with .303 Mk II Browning machine guns, and a could carry a large capacity of aerially dropped bombs.

The range below is representative of the aircraft most commonly employed during WWII, and other weapons may have been present at the airfield. For example of British aerial delivered ordnance, see **Annex E**.

Other Allied military ordnance was utilised within airfields as a result of the military presence there. As a military installation, Allied munitions would have been stored and used in areas around the base. RAF station were often manned in the case of invasion and live ammunition, items of both Land Service Ammunition and Small Arms Ammunition, was most likely to be used in training or practice at the station. This could include organised defence exercises, completed to prepare for a land invasion of the country. These exercises often involved the usage of live ammunition.

10.2. Typical Bomber Aircraft Munitions

Typical Bomber Ammunition	
Item	**Description**
Browning Machine Gun	WWII bomber aircraft were typically equipped with one of several types of Browning machine gun. Variants include the .30 06 calibre M1919 used by US forces, the .303 calibre Mk II used by the Commonwealth or the .50 Cal M2/3 Browning. Browning machine gun ammunition would typically be considered SAA (See Section 11.11).
Hispano Suiza HS.404	Owing to the inability of the Browning machine-gun to penetrate some armoured aircraft, some fighters were re-equipped with the Hispano Suiza HS.404. The Hispano Cannon was typically equipped with a 130g incendiary or HE round, of 20mm calibre. The round contained between 6 and 11 grams of explosive.
General Purpose/Medium Capacity HE Bombs	During WWII RAF and USAAF Light and Heavy bombers deployed a range of conventional HE bombs. Typical HEs ranged from 100lbs (54kg) to 2000lbs (1061kg). Higher capacity general purpose bombs weighed 4000lbs (2122kgs). Allied general purpose bombs typically carried a filling weight 1/3 of total weight.
Heavy Bombs	In addition to general purpose HE bombs the Allies produced a range of heavy capacity HE bombs for the purpose of targeting U-boat bunkers, coastal batteries, and other heavily armoured defensive positions. The Barnes Wallis 'Tallboy' and 'Grandslam' weighed 12,000 lb (5,400 kg) and 22,000 lb (10,000 kg) respectively. The tallboy had a filling weight of 5,200 lb (2,400 kg), around 700 were deployed in WWII. The Grandslam had a filling weight of 22,000 lb (10,000 kg), around 43 were deployed during WWII. Considering the size of the heavy bombs it is highly unlikely that one would have been incorrectly disposed of within an RAF airfield.
Armour Piercing HE Bombs	Armour Piercing bombs were typically used when attacking heavily armour German Shipping. Armour piercing HE bombs typically weighed either 1000lbs (114kg) or 1600lbs (215kg) bombs.
Incendiary Bombs	The 4lb Incendiary bomb was the standard light incendiary bomb used by Bomber Command during the Second World War. The bomb consisted of a magnesium body with a cast iron/steel nose. The bomb could be dropped individually but was usually carried in a 250lb small bomb container. 90 bombs were usually carried per container. Cluster versions of the 4lb incendiary were introduced in 1944, these

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	being 500lb, 750lb and 1000lb which contained 106, 158 and 235 4lb bombs. There were also a high explosive variants which were intended to hinder fire services. Production peaked in 1943 with 3 million IBs produced per month.
Chemical Weapons	Chemical weapons were not used by the Allies during WWII. The use of chemical weapons was banned by the Geneva convention in 1925. In spite of this the USAAF maintained a chemical weapons arsenal for the purposes of deterrent. Chemical weapons used the agents Phosgene and Mustard Gas.

Examples of munitions typically used by fighter and bomber aircraft are presented in **Annex E.**

10.3. British Practice Bombs

During WWII the RAF practiced for bombing raids on mainland Europe using practice bombs. These items of ordnance, commonly between 8.5lb-25lb in weight, often contained a small explosive charge or emitted coloured smoke to simulate bombing raids. It is possible that practice bombing was undertaken at RAF Church Broughton by the OTUs based there. Practice bombing is considered to have taken place at most locations under the control of Bomber Command and could even include the landing grounds of RAF stations, which were sometimes used as makeshift target areas during the early stages of WWII; prior to the establishment of dedicated inland ranges. Dedicated records concerning specific incidents of practice bombing are however rare. Examples of British practice bombs can be found in **Annex F**.

10.4. Flares

In addition to HE bombs, RAF bomber aircraft were equipped with flares. Flares were large items used to illuminate target areas prior to bombing. Although flares did not contain an especially large high explosive element, the illuminating compound may be hazardous to human health. They may have been discarded within an airfield or deployed during training. The most commonly deployed Allied flares are presented in **Annex F.**

10.5. Land Service Ammunition

The term Land Service Ammunition (LSA) covers items of ordnance that are propelled, placed, or thrown during land warfare. These items may be filled or charged with explosives, smoke, incendiary, or pyrotechnics and can be divided into five main groups:

Land Service Ammunition	
Item	Description
Mortar Rounds	Mortar rounds are normally nosed-fused and fitted with a propelling charge. The flight is stabilised by the use of a fin. They are usually tear-drop shaped (though older variants are parallel sided), with a finned 'spigot tube' screwed or welded to the rear end of the body which houses the propellant charge. Mortars are either High Explosive or Carrier (i.e. smoke, incendiary, or pyrotechnic).
Grenades	A grenade is a short range weapon designed to kill or injure people. It can be hand thrown or fired from a rifle or a grenade launcher. Grenades either contain high explosive or smoke producing pyrotechnic compounds. The common variants have a classic 'pineapple' shape.
Projectiles	A projectile (or shell) is propelled by force, normally from a gun, and continues in motion using its kinetic energy. The gun a projectile is fired from usually determines its size. A projectile contains a fuzing mechanism and a filling. Projectiles can be high explosive, carrier or Shot (a solid projectile).
Rockets	Rockets were commonly designed to destroy heavily armoured military vehicles (anti-tank weapon). The device contains an explosive head (warhead) that can be accelerated using internal propellants to an intended target. Anti-aircraft rocket batteries were also utilised as part of air defence measures.

Landmines	A landmine is designed to be laid on or just below the ground to be exploded by the proximity, or contact of a person or vehicle. Landmines were often placed in defensive areas of the UK to obstruct potential invading adversaries.

Images of the most commonly found items of LSA are presented in **Annex G.**

10.6. Small Arms Ammunition

Both aircraft and aircrews were equipped with a range of SAA. Even those airmen stationed at airfields without an armoury or ammunition store are likely to have been armed with some degree of SAA.

SAA refers to the complete round or cartridge designed to be discharged from varying sized hand-held weapons such as rifles, machine guns and pistols. SAA can include bullets, cartridge cases and primers/caps. Example imagery of SAA are presented in **Annex H.**

10.7. Air Defence at RAF Church Broughton

During WWII the Ministry of Defence employed a number of defence tactics against the Luftwaffe. Anti-Aircraft strategy can be divided into passive and active defences.

Active Defences	Passive Defences
• Fighter aircraft to act as interceptors. • Anti-aircraft gun batteries to engage enemy aircraft. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes.

Active defences such as anti-aircraft artillery and rocket batteries present a greater risk of UXO contamination than passive defences and are the primary focus of this section. Ordnance relating to unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

Anti-Aircraft Artillery				
Item	Description			
Heavy Anti-Aircraft Artillery (HAA)	Heavy Anti-Aircraft Artillery (HAA), used large calibre weapons, such as the 3.7" QF (Quick Firing) gun. HAA batteries fired large HE shells. HAA projectiles consisted of high explosive shells, usually fitted with a time delay or a barometric pressure fuze to make them explode at a pre-determined height. If they failed to explode or strike an aircraft they would eventually descend back to earth.			
Light Anti-Aircraft (LAA)	Light Anti-Aircraft (LAA) batteries were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. These batteries were mobile and could be moved to new positions with relative ease when required, as a result records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE shells per minute to over 1800m.			
Variations in HAA and LSA Ammunition	**Gun type**	**Calibre**	**Shell Weight**	**Shell Dimensions**
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
3in Unrotated Projectile (UP) Anti-Aircraft	The Z battery was a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early period of World War II. The UP was also used in ground-based single and 128-round			

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Rocket ("Z" Battery)	launchers known as Z Batteries. Shells consisted of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor.
Spigot Mortars/Blacker Bombards	The Spigot Mortar/Blacker Bombard was an adapted anti-tank/anti-personnel weapon. The Spigot Mortar was not an effective method of air defence and was mainly used in defensive positons at key locations. If encountered a spigot mortar round will resemble a mortar shell, but with an elongated metal tail rod.
Quick Firing (QF) 1 and 2 Pounder	QF 1 and 2 Pounders, or 'pom poms' were a light battery most often used by the navy. During the early years of WWII they were used to defend targets in the absence of more effective LAA or HAA.
Machine Gun Posts	Machine Gun posts were established at some significant military and industrial positions. All airfields were defended by machine gun positions. Machine guns were a largely ineffective form of AAA. Machine guns usually fired the .303 Round.

The conditions in which AA projectiles may have *fallen* unnoticed within a site area are analogous to those regarding aerial delivered ordnance. For detailed analysis on the ground conditions and access frequency within the proposed site, see the evaluation of German Bombing Records in, **Section 13**.

Unexploded anti-aircraft ammunition is likely to be found close to WWII ground level. This can result from the storage, transport, and dispersal of artillery used for defence at a given RAF station. If encountered, the high explosive fill and fragmentation hazard of these items could present a significant risk to workers and equipment. 40mm projectiles are similar in appearance and effect to SAA. However, they remain dangerous as they were fitted with an impact initiated explosive fuse that may cause harm if detonated.

Example Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex I**.

11. The Likelihood of Contamination from Allied Military Ordnance

11.1. Introduction

When undertaking work within or immediately adjacent to an historic military airfield, it can be assumed that the risk of contamination from explosive ordnance is elevated above the 'background' level of the surrounding area. This assumption of risk is based on the following reasoning:

- In the vast majority of cases, explosive ordnance would have been stored and available for use at military airfields. Ordnance ranged from small arms and land service ammunition, to high explosive cannon rounds and large high explosive bombs.
- The military generally did not anticipate that the land would be sold for civilian development, and consequently appropriate ordnance disposal procedure was not always adhered to. It was not uncommon for excess or unwanted ordnance to be buried or burnt within the airfield as a means of disposal. Records of such practice were rarely kept. During increased periods of activity ordnance was also frequently lost in transit, either between stores or else between stores and aircraft.

There are several factors that may serve to either affirm, increase, or decrease the level of risk within an airfield. Such factors are typically dependent upon the proximity of the proposed area of works to a number of airfield features. The risk from Allied ordnance may also relate to the function of the airfield, the presence of any military training activities and any aviation incidents recorded within, or proximate to an airfield.

This section will examine the history of the airfield and assess to what degree, if any, the site could have become contaminated as a result of the historic military use of the surrounding area.

11.2. Operations at RAF Church Broughton

During WWII, RAF Church Broughton was an active RAF station under the control of Bomber Command. It was primarily used as a training airfield, but operational bombing missions targeting Germany and occupied Europe were launched from the station from 1942-1944.

11.2.1. Wartime usage: August 1942 to October 1945

From it's opening as an RAF station in August 1942, Church Broughton became home to the No.27 Operational Training Unit, which was established in 1941 to train night bomber crews for bombing missions over Germany and occupied Europe. This training consisted of night flying exercises, practice bombing and aerial gunnery, with turret gunners trained to accurately hit target drogues being towed by tug aircraft. During its stay, No. 27 OTU was equipped with Vickers Wellington bombers, a twin-engine medium bomber aircraft renowned for its rugged reliability that would become the most produced British Bomber of WWII. From 1942, a Czech flight, No. 1429 was brought to Church Broughton joining 27 OTU for three months before it was sent to Costal Command and transferred to RAF Thornaby.

Operational missions would be conducted from the station from September 1942 onwards, with regular operational raids during 1942. Reaching a peak in 1943, operational raids were conducted from Church Broughton almost every night, without any major losses sustained. Despite this, a large number of aircraft crashes and aircraft accidents are recorded to have taken place at RAF Church Broughton, with 12 Wellingtons recorded to have crashed at or surrounding the station, mostly likely due to inexperience of pilots undergoing training, as shown in **Annex J.**

The station was also used by visiting USAAF units, including several C-47 transport aircraft that arrived to bring wounded US soldiers to the 108th General Hospital at Sudbury. From April 1944, Church

Broughton was also used by Rolls Royce to base their Experimental Flight Trials Unit. This unit was secretly tasked with testing the new Whittle jet engines intended for the Gloster Meteor fighter, using modified Vickers Wellingtons as the test platform. The 'Trent' turboprop engine was also tested as a potential power plant for the Meteor, with several test Aircraft being operated from the station into 1945. Photographs illustrating both types of trial aircraft are presented in **Annex K**.
By late 1945 Church Broughton was occupied only by Rolls Royce and the No. 51 maintenance unit, with other RAF personnel and No.27 OTU having disbanded in October.

11.2.2. Post-war years: October 1945 to May 1975

In the immediate post-war period the station remained active, with Rolls Royce retaining a hangar to house their experimental test aircraft, however by the end of 1946, the company decided to depart. From 1946 to 1956 the station was occupied by No. 51 Maintenance Unit, who used the airfield for the storage of various aircraft and RAF equipment. Following 1956 the station was declared as a non-essential RAF asset, and accordingly provisions were made to break up the airfield and to return requisitioned areas to their owners. See **Annex L** for a 1956 plan of airfield ownership. By May 1975 the final buildings on the airfield had been auctioned off and sold.

11.3. Units at RAF Church Broughton

WWII-era

- No. 27 Operational Training Unit RAF
- No. 1429 Operational Training Flight (Czech) RAF
- Rolls Royce Experimental Flight Trials Unit
- Unknown USAAF units (Visiting)
- No.51 Maintenance Unit RAF

Post-War

- Rolls Royce Experimental Flight Trials Unit
- No.51 Maintenance Unit RAF

11.4. Site Plans of RAF Church Broughton

A 1945 plan of RAF Church Broughton was obtained from the RAF Museum, Hendon. The plan identifies the buildings of the airfield and explains what they were used for. The site plan for the airfield in presented in **Annex M.**

Date Range	Comments
January 1945	This plan indicates the site to have been situated within the boundary of RAF Church Broughton in 1945, falling close to Airfield site No.1. The site is situated predominantly within the proximity of vacant grass areas and the hardstanding runways, with the centre of the site horizontally intersected by No.2 runway, and associated access ways. A selection of structures are shown to have been located within the south-western corner of the site, including a *Dispersal Hut, Watch Office, Mechanical and Electrical Plinth,* as well as several *Blast Shelters.* Additionally, a selection of structures are located within close proximity to the southernmost boundary of the site. These include a *Motor Transport Standing, Night Flying Equipment Store* and *Speech Broadcasting Building.* Further features including the *Petrol Store* and *Armoury* are noted further to the south, although these features are not within close proximity to the site. Several Sub-areas of the camp are located in the wider area, including the RAF Communal Site No.2, Sick Quarters and WAAF Communal site No.3, located to the south-west of the site area.

11.5. RAF Church Broughton Flying Officers Control Logs

Written records regarding the flying operations at Church Broughton from April to June 1945 have been obtained from the National Archives. Whilst not comprehensive, this source records the flying operations of the airfield, as well as training exercises in the immediate and surrounding area during this period. General military activity at the airfield is presented below, with examples presented in **Annex N**. It should be noted that the transcript below is only a selection of the numerous events accounted for in the record book.

Date Range	Comments
22nd April 1945	21:10- Bombing Action request that we try to contact 'L', 'B' and 'E' to pass following message. 'L' fly at odd 500ft over range, 'B' odd 1,000ft, 'E' even 1,000ft. Able to pass message to 'B' and 'E' only.
27th April 1945	22:00- First bombing detail return, weather a/s/. 22:15- EX Lich report that cloud over bombing range should disperse by midnight. Standing by. 23:45-Bombing details cancelled. It is now snowing hard at Cannock.
3rd May 1945	16:30- Night XC bombing details cancelled, have T at Litchfield. 20:45-Cross Counties Cancelled. Crews to stand by for bombing.
4th May 1945	21:30-'I' back in circuit. Weather u/s over bombing range. 21:40-Lich have cancelled all bombing details, warning us to watch weather.
12th May 1945	02:00-EX Litch they have cancelled all X.C. Bombing details, Vis detonating. 02:00-All our X.C. details landed. 02:00- As our Vis is still ok, O.C. might send off another bombing detail. 03:50- Night Flying finished, Weather unsuitable for bombing and C and Ls.
15th May 1945	00:45-All further bombing details cancelled. 100% cloud over range and no sign of a break
16th May 1945	19:40-Litchfield have scrubbed X cty's but pressing on with C and Ls and bombing. O/C night inf: We are having Xcty's standing by. 22:10- Bombing details cancelled.
18th May 1945	18:40-All XC and Bombing details cancelled crews to stand by.
22nd May 1945	11:45-'Z' in circuit says QBB over range 1500!! 16:10-N/F X Cty- bombing details cancelled-locals standing by, crews Annoyed.
25th May 1945	14:05- B/A A/B on bombing detail. 18:25- Litchfield cancel all X.C. and bombing.
26th May 1945	22:22-N/F commenced 1 C and L detail airborne, bombing details standing by. 23:00- B/M airborne, on weather list-fitness fig 3- Red, stand-down on. Bombing details cancelled.
28th May 1945	22:10-Night flying commenced, D/O airborne on bombing detail.
29th May 1945	00:10- D/U on bombing has gone unsatisfactory. Flight advises, crew changed to D/W. 03:00- Weather bad over range. Further bombing details cancelled.
30th May 1945	20:00- night flying tonight. 3 x CLYs 5 bombing and 4 C and Ls.
8th June 1945	00:40- Bombing Aircraft returned- cloud base 1,000 at range.

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11.6. 1945 RAF Disposal Instructions

RAF disposal documents dating from 1945 were obtained from The National Archives. These documents were drawn up by the RAF in order to dispose of RAF Church Broughton's assets, and appear relatively comprehensive, covering assets from technical equipment to buildings to explosives. The table below highlights RAF disposal instructions with regard to ordnance, with an example presented in **Annex O.**

1945 RAF Disposal Instructions – Annex O	
Date	**Description**
1945	(ix) Explosives: Bomber Command to report to M.P.O (Military Police Office), No.21 M.U. (Maintained Unit), Pauld for disposal instructions.

11.7. 1956 RAF Explosives Clearance Certificates

Correspondence regarding RAF explosives clearance certificates for RAF Church Broughton was obtained from The National Archives. These documents date from 1956 and discuss the consideration of clearing the airfield. The documents are presented in **Annex P**.

The documents are of interest because they indicate that only a visual search was undertaken at the airfield – a walkover of certain areas to ascertain whether or not evidence of unexploded munitions were present on the surface. Such post-war visual searches on historic RAF airfields were generally of very limited value. Generally, disposal of munitions (official or unofficial) would have been by burial or burning, leaving no evidence that such activities had occurred. The fact that a visual search was not adequate is demonstrated by the fact that 153 items of live unexploded ordnance were recovered to the south-west of the main landing ground in 1984 (see **Section 11.10.**).

11.8. WWII-Era Aerial Photography

A high resolution scan of WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photograph provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (**see Annex Q**).

WWII-Era Aerial Photography – Annex Q	
Date	**Description**
15th December 1948	This photograph shows the site after the cessation of flying operations at RAF Church Broughton. This photograph was taken whilst the airfield site was primarily used for storage by No. 51 MU, who were based at RAF Lichfield. The site is shown as partly occupied with an area of open ground and partly by a section of runway. The section of runway that occupies the eastern portion of the site is shown to contain objects, likely vehicles, aircraft parts or associated items stored by the No. 51 MU. In the wider area, other areas of runway are shown to be occupied with storage.
15th December 1948	This photograph taken slightly to the west of the above image captures the wider surrounds of the site in context with the western section of RAF Church Broughton. The runways partially visible in the above image are more visible here, and highlight the number of vehicles stored at this airfield. Also visible is the Airfield Site No.1 to the south-west of the site, as well as the dispersal pans surrounding it. The Sick Quarters, site No.7 is visible to the south, with the WAAF Communal site No.3, and RAF Communal site below it visible further to the west.

11.9. Aircraft Crashes

Air crashes were common at WWII era airfields. These incidents most commonly occurred during take-off and landing. Consequently there is an increased level of risk associated to areas situated at the ends of the runways. The risk of contamination resulting from crashes depends on the nature of the incident and the aircraft involved. Airfields were not used solely by the aircraft stationed at that base, and an airfield may have been used by any aircraft during an emergency.

Due to Operational Training units located at RAF Broughton during WWII, a number of Aircraft crashes and incidents are recorded to have taken place at and surrounding the airfield. Records of these accidents are taken from Robin J. Brooks *Nottinghamshire and Derbyshire Airfields in The Second World War,* and are presented in the table below.

Aircraft Crashes– R.J. Brooks, *Nottinghamshire and Derbyshire Airfields in The Second World War*		
Date	**Aircraft**	**Incident**
7th November 1942	Vickers Wellington No.N2511	Fire when starting up engines.
20th November 1942	Vickers Wellington Mk. III No.Z1744	Crashed two miles from the airfield.
23rd December 1942	Vickers Wellington No.BJ834	Port engine fire, aircraft landed safely.
Unknown Date 1943	Vickers Wellington No.BK241	Crashed four miles north-east of the airfield, all crew killed.
16th April 1943	Vickers Wellington No.BJ989	Port wheel caught in hole left in runway by repair contractors, aircraft landing gear damaged.
Unknown Date 1943	Vickers Wellington No.X3998	Port engine failure, aircraft crashed on landing.
17th June 1943	Vickers Wellington No.BK199	Aircraft crashed on landing.
27th June 1943	Vickers Wellington No.BK453	Aircraft undershot the runway, crashed at airfield.
4th July 1943	Vickers Wellington No.BJ784	Aircraft landed heavily, damage sustained to landing gear.
Unknown Date 1943	Vickers Wellington No.BJ713	Starboard engine cut out on take-off, aircraft crashed, 2 crew killed.
3rd September 1943	Vickers Wellington No.X3727	Crash landed, no injuries to crew.
22nd September 1943	Vickers Wellington No.BK195	Swung off Runway, aircraft damaged.
18th December 1944	Vickers Wellington No.HZ533	Crashed, crew killed.

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11.10. Explosive Ordnance Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) (now part of 29 Regt) is currently facing considerable delay.

Reference was however found to an Explosive Ordnance Clearance task undertaken in 1984 at Foston Cover, approximately 1.3km to the south-west of the site area. Whilst the exact nature of this task is not known, it is likely that this involved RAF Church Broughton, and 151 items of live ordnance and 3 items of expended ordnance were found. The area that this task was conducted appears to have been part of the living quarters for the station, as opposed to an area involved in the storage of ordnance such as the armoury or bomb stores. See **Annex R** for an overlay onto aerial photography of the approximate location of this task in relation to the site.
If any further official information is received at a later date, Applied Geology will be advised.

11.11. Evaluation of Allied Records

1st Line Defence has considered the following potential sources of contamination:

Sources of Contamination	Conclusion
Site Usage *Airfields contain a number of features that may increase the risk of UXO contamination. Physical proximity to such a feature is usually indicative of risk.*	The site was situated within the boundary of RAF Church Broughton, and was located predominantly within the runway area, open areas, as well as the *Airfield Site No.1*. Several buildings are located within the south-western corner of the site, with structures including a *Watch Office, Mechanical and Electrical Plinth, Dispersal Hut* and several *Blast Shelters*. No structures such as the armoury or bomb stores were located within or close to the site area, indicating that ordnance was unlikely to have been stored within the site area. The portion of the site occupied by runways appears to have retained its composition during the active use of the station, with the number 2 runway having been cleared at some point in the post-war period.
Dispersal Pans *Dispersal pans were used to re-equip aircraft between sorties. Frequently temporary stores were located at dispersal pans.*	No evidence of dispersal pans could be found within the site area, with the closest noted dispersal pans situated approximately 120m to the west of the site.
Ordnance Stores/Armoury *Ordnance stores contained large quantifiers of munitions. Adjacent areas may have been used to bury or dispose of excess ordnance.*	No evidence of structures involved in the storage or ordnance could be found within the site area, the bomb stores are indicated to have been located approximately 1km to the south-east of the site area, whilst the armoury was located approximately 200m to the south of the site.
Proximity to Perimeter Fence *Although seemingly innocuous, areas of open ground adjacent to the perimeter fence are considered of elevated risk as they were considered prime locations for ordnance burial.*	The north-west and eastern sections of the site are situated on the Perimeter fence of the station, with a pond located on this boundary fence, located on northern boundary of the site.
Defensive Positions *Airfields were frequently defended by numerous defensive positions. It is not uncommon for items of LSA and SAA to be encountered in the vicinity of such locations.*	There is no evidence of any defensive structures in the vicinity of the site.
Firing Ranges *Firing ranges were common at most airfields. Many firing range also feature grenade pits.*	No evidence of a firing range could be found within the site area. A *Machinegun Cannon Range* was present within the boundary of RAF Church Broughton, however this is shown to have been located approximately 700m to the north-west, and was not within proximity to the site.

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Demolition Charges *Many airfields were undermined by demolition mines such as McNaughton Tubes and Pipe Mines. Many of these devices were not removed or lost.*	No evidence indicating the use of demolition charges could be found on site.
Military Camps *It was frequent for military camps to be positioned adjacent to airfields. If a military camp was located proximate to a site then it is possible unauthorised ordnance disposal may have been undertaken in the area*	No evidence of a Military Camp could be found within the site area. RAF Church Broughton was a substantial RAF station during WWII, with numerous WAAF and RAF sites located to the west of the main airfield. These are however not situated within proximity of the site. Additionally, reference to a *Labour Camp* located approximately 900m to the north-west was found within RAF Airfield Ownership Plans dating from 1956. Whilst this is mentioned, no further details indicating the nature of this camp could be found, accordingly it is not considered to have been of direct military use.
Training Exercises / Home Guard Activity *It was common for defence training activities to be undertaken in the vicinity of airfields. Such exercises frequently involved the deployment of live ordnance.*	Evidence of Home Guard training areas and activities is difficult to obtain. 1st Line Defence has no evidence of any Home Guard activities on the site.
Anti-Aircraft Defences *Airfields were defended by a range of AAA. Ordnance is frequently encountered in the vicinity of AA batteries.*	Whilst no evidence of anti-aircraft defences could be found within available records, all airfields were equipped with some form of anti-aircraft defences. Often these were mobile units, comprised of Bofors or machine gun emplacements that could be positioned at various locations around the airfield. The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. For detailed analysis on the ground conditions and access frequency within the proposed site, see the evaluation of German Bombing Records in, **Section 13.7.**
Practice Bombing *Training at airfields sometimes consisted of practice bombing within the airfield perimeter or later in the war at a dedicated range. These bombs could become buried following penetration, and may remain overlooked.*	Available Flying Officers Control Logs suggest that practice bombing was regularly undertaken from RAF Church Broughton, with references suggesting that a dedicated range was used near Cannock. These logs however only date from 1945 and cover the final operations of the airfield. It is considered likely that practice bombing was undertaken during the earlier years of the war, with the possibility that the airfield itself was used in place of a dedicated range, which began to be established in the latter years of the war.

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12. Introduction to German Aerial-Delivered Ordnance

12.1. General

During the summer of 1940 the Luftwaffe launched a major offensive against British airfields. The campaign, known as the Battle of Britain, saw the Luftwaffe attempt to attain air superiority prior to the invasion of Great Britain. To this end they extensively bombed British airfields. Although the objectives of the Luftwaffe altered in September 1940 to encompass towns, cities and industry, airfields were regularly targeted by the Luftwaffe until the conclusion of the war. No reference to Luftwaffe bombing could be encountered with regards to Church Broughton.

A proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

12.2. Generic Types of WWII German Aerial-Delivered Ordnance

An understanding of the type and characteristics of the ordnance used by the Luftwaffe during WWII allows an informed assessment of the hazards posed by any unexploded items that may remain in situ on a site. A brief summary of these characteristics is given in the table below. Examples of German air delivered ordnance are presented in **Annex S**.

Generic Types of WWII German Air Delivered Ordnance				
Type	Description	Size/Weight	Frequency	Likelihood of detecting Unexploded
High Explosive (HE) Bombs	A HE bomb typically has a strong metal casing, which provides a 'thick skin' that is designed to fragment on detonation. HE bombs possess a sufficient mass and velocity to enable penetration of the ground if they failed to explode. In addition the shape and fins are aerodynamic to keep the tip end of the bomb facing downward.	Most bombs were 50kg, 250kg or 500kg, although larger bombs of up to 1,800kg were also used. About half the weight of HE bombs comprised of explosive TNT or Amatol.	In terms of weight of ordnance dropped, HE bombs were the most frequent weapon deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following a raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see **Annex T**). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. UXBs therefore present the greatest risk to present–day intrusive works.
Aerial or Parachute Mines (PM)	Luftmines (LMA-500kg and LMB-1000kg) were magnetic sea mines which were thin walled, cylindrical in shape with a hemispherical nose, deployed by parachute. For use on land, the mines were armed with a clockwork bomb fuze which caused the bomb to explode after impact. When operating as designed they caused considerable damage due to the high weight of explosive and their detonation at or near the surface.	PMs either weighed 500kg or 1000kg (approximately 2/3 of the overall weight was explosives) depending on the type of mine. Their length ranged from 1.73-2.64m.	PMs were deployed less frequently than HE and Incendiary bombs due to their size, cost and the difficulty of their deployment.	If functioning correctly, PMs generally would have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
1kg Incendiary Bombs (IB)	1kg IB devices had a magnesium shell and were filled with thermite; both components were designed to burn after igniting on impact. They were jettisoned from air-dropped containers. Some variants had explosive heads presenting an increased risk if encountered during works.	1kg in weight and approximately 14 inches long.	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these weapons were dropped throughout the war.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bomb rubble, they could have gone unnoticed.

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Large Incendiary Bombs (IB)	Large IBs had various flammable fill materials (including oil and white phosphorus), and a small explosive charge. They were designed to explode and burn close to the surface. Although they were often the same shape as HE bombs, they were thin-skinned and did not generally penetrate the surface.	Large IBs Weighed up to 350kg.	Large IBs were not as common as the 1kg IBs, although they were more frequently deployed than the Parachute Mines and Anti-Personnel Bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Anti-personnel (AP) Bomblets	The SD2 'Butterfly Bomb' had an 8cm long, thin, cylindrical shaped, cast iron outer shell which hinged open when the bomblet deployed. A 15cm long steel cable was attached via a spindle to an aluminium fuze. They were generally lethal to anyone within a radius of 10 metres (33 ft) and could inflict serious shrapnel injuries.	The size and weight ranged depending on the type used. The SD2 weighed 2kg and contained 225 grams of TNT.	AP Bomblets were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

12.3. Failure Rate of German Aerial-Delivered Ordnance

It has been estimated that 10% of the German HE bombs dropped during WWII failed to explode as designed. There are a number of reasons why an air-delivered weapon might fail to function as designed:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many German bombs were fitted with a clockwork mechanism that could jam on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning of the bomb before it was armed or from a very low altitude. This was most likely if the bomber was under attack or crashing.

12.4. V-Weapons

From mid-1944, Hitler's 'V-weapon' campaign began. It used newly developed unmanned cruise missiles and rockets. The V-1 known as the *Flying Bomb* or *Pilotless Aircraft* and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in Scotland were too far to be considered for V-weapon strikes by the Luftwaffe.

The risk from V-weapons at Church Broughton is therefore considered negligible and will not be further addressed in this report.

12.5. UXB Ground Penetration

12.5.1. General

An important consideration when assessing the risk from an aerially delivered UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb
- Height of release
- Velocity and angle of bomb
- Nature of the ground cover
- Underlying geology

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

12.5.2. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial-delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be up to 15m.

12.6. WWII UXB Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by Bomb Disposal. Conclusions were made as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

12.7. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – Alves Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose. (This was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the lack of site specific geotechnical information. The maximum bomb penetration is however anticipated to vary significantly across the site location on account of its size and it is recommended that an assessment is made by an UXO Specialist at the each area of works on-site.

13. The Likelihood of Contamination from German Aerial-Delivered UXO

13.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. A WWI map of air raids and naval bombardments across England is presented in **Annex V.** The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. No records could be found to suggest that the site area or its environs were targeted by bombing in WWI.

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered, especially in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density the risk from WWI UXBs is considered low and will not be further addressed in this report.

13.2. World War II Bombing of RAF Church Broughton

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations.

The site was located within RAF Church Broughton, an RAF airfield that had the potential to be targeted by bombing raids. Areas of military activity made an obvious target although substantial bombing raids were usually reserved for airfields in the south and east of England. The site's position in the north-west of the country meant that RAF Church Broughton was unlikely to be extensively targeted but may have been the subject of opportunistic bombing raids. In the wider area, the Rolls Royce Factory in Derby would have provided a highly desirable target for the Luftwaffe. However the site is not considered to be sufficiently proximate to Derby to be affected by any raids targeting it.

Records of bombing incidents in the civilian areas of Derbyshire were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. Some other organisations, such as the London Port Authority and railways, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents for the Rural District of Repton are presented in the following sections.

13.3. Second World War Bombing Statistics

The following table summarises the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the Rural District of Repton between 1940 and 1945.

Record of German Ordnance Dropped on the Rural District of Repton		
Area Acreage		**65,653**
Weapons	High Explosive Bombs (all types)	139
	Parachute Mines	1
	Oil Bombs	0
	Phosphorus Bombs	0
	Fire Pot	0
	Pilotless Aircraft (V1)	0
	Long Range Rockets (V2)	0
Total		**140**
Number of Items per 1,000 acres		**2.1**

Source: Home Office Statistics
This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were designed to inflict damage and injury and should therefore not be dismissed. Therefore, they should not be overlooked in assessing the general risk to personnel and equipment. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous.

13.4. Bombing Records of RAF Church Broughton

Documents relating to the day to day operational status of the base were obtained from The National Archives, Kew. No available sources, either official, anecdotal or otherwise, detailed any record of bombing at RAF Church Broughton. It is considered unlikely that had bombing occurred at the airfield, it would have gone unrecorded in these sources. It should be noted that RAF Church Broughton was not active until 1942, after the heaviest periods of bombing in England.

13.5. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'Abandoned Bomb'.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

13.6. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date Applied Geology will be advised.

13.7. Evaluation of Bombing Records

Factors	Conclusion
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High levels of bombing density could allow for error in record keeping due to extreme damage caused to the area.*	The Rural District of Repton was subject to a **Very Low** density of bombing with 2.1 bombs recorded per 1,000 acres. This can likely be explained by the district's position in a rural area in the north-west of England. No record could be found of any bombing incidents occurring at RAF Church Broughton, including the site location.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	After the construction of RAF Church Broughton, the site was occupied by an area of runway and an area of open ground. Whilst it is possible that an item of ordnance could fall unnoticed within the open ground, it is not considered likely given the very low bombing density and the lack of evidence suggesting any bombing at the station.
Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.*	After the construction of RAF Church Broughton, the site would have received an almost constant level of access due to its location within an active airfield. It is extremely unlikely that an item of ordnance could fall unnoticed within the site location.
Damage *If buildings or structures on a site sustained bomb or fire damage any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same, or later, raids. Similarly, a High Explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked*	There is no evidence of any bomb damage within the site location. Available records do not indicate any bombing incidents at RAF Church Broughton and post-war aerial photography does not display the presence of any bomb damage indicators.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of Bomb Disposal Tasks within the site boundary and immediate area.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.

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14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German aerial delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has located and evaluated pre- and post-WWII Ordnance Survey maps, site plans of RAF Church Broughton, Flying Control Officers Logs, 1945 RAF Disposal Instructions, 1956 RAF Explosives Clearance Certificates, 1948 aerial photography, Region 3 bombing records. The record set is of an overall mixed quality. Whilst some sources such as the Flying Officers Control Logs are of good quality, they are not comprehensive covering only a short period of the war in 1945. Additionally the lack of bombing records and operational log books meant the record set was somewhat lacking in details for some activity at RAF Church Broughton.
Allied Military UXO	• Church Broughton's primary role during WWII was for bomber training and operational bomber sorties. Due to the RAF night bombing campaign over Germany and occupied Europe, training at Church Broughton was primarily night flying and practice bombing, conducted from the base starting in August 1942, whilst bombing began in September 1942. • Being occupied by No. 27 OTU, regular military training and practice bombing would have been conducted from the station, as evidenced by 1945 Flying Officers Control Logs. Whilst these entries indicate that by 1945 such practice bombing took place on a dedicated range at Cannock, such dedicated ranges were only established towards the end of the war, presenting the possibility that earlier practice bombing may have taken place on the airfield, and potentially within the site area. It was not uncommon for areas within historic airfields to be designated as practice bomb areas. However, the location of these areas was not often recorded. • While no structures that would have been involved in the handling or storage of ordnance were located within the site area, its position within the runways and vacant areas presents the possibility that the area may have been used for training such as practice bombing. Due to relative lack of development undertaken in these areas following the war it is possible that ordnance resulting from training may have remained unnoticed and subsequently unreported. • A number of aircraft accidents and crashes are noted to have taken place at the station throughout the war, including aircraft that crashed on landing. Whilst the exact positions of these crashes are not known, the nature of training conducted at the station (practice bombing and aerial gunnery) as well as the operational missions (where aircraft would have been 'bombed up'), it is possible that such accidents could have resulted in contamination from items of ordnance entering the ground. Given the number of crashes, it is conceivable that the site area could have been affected, although no direct evidence to confirm this could be found. • 1945 Disposal Instructions for the airfield suggest that all explosives stored at the facility were to be removed by Bomber Command – follow-up documentation confirming this could not be located, but it is presumed that all stores would have been emptied. An RAF clearance certificate dating from 1956 highlight that no proactive search or clearance work from explosives was deemed necessary following the disposal of the airfield. The documents are of interest because they indicate that only a visual search was undertaken at the station – a walkover of certain areas to ascertain whether or not evidence of unexploded munitions were present on the surface. Such post-war visual searches on historic RAF airfields were often of very limited value. Generally, disposal of munitions (official or unofficial) would have been by burial or burning, leaving no evidence that such

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	activities had occurred. It is this type of disposal that is most likely to have resulted in contamination in and around the site. • The fact that a visual search was not adequate is demonstrated by the fact that 151 items of live unexploded ordnance were recovered to the south-west of the main landing ground during an army clearance task in 1984. No details were available about the types of munitions were recovered, but the fact that any were found indicates the potential for further contamination to be encountered. A very small area of only 0.25ha was searched.
German Aerial Delivered Ordnance	• During WWII, the Rural District of Repton was subjected to a very low density of bombing campaign, with 2.1 items falling per 1,000 acres. Whilst these records were consulted, no indication could be found to suggest bombing or attacks took place at Church Broughton. Consequently, there is no evidence suggesting any items of German air-delivered ordnance falling within the site location.

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15. The Likelihood that UXO Remains

15.1. Introduction

The extent to which any ordnance clearance activities have taken place on site or extensive ground works have occurred is relevant, since on the one hand they may indicate previous ordnance contamination, but also may have reduced the risk that ordnance remains undiscovered.

15.2. UXO Clearance

Former military sites (or at least certain areas within them) are often subject to clearance before they are returned to civilian use by the MoD. If a site is being retained by the military, it is possible that no clearance operations have ever been undertaken. However, UXO is sometimes still discovered even on sites where clearance operations are known to have been undertaken. The detail and level of survey and targeted investigation undertaken by the military will depend on the former use of the site and purpose of the clearance (i.e. disposal, redevelopment, return to agriculture, etc.)[1]. The level of clearance will also depend on the available technology, resources and practices of the day.
In the case of Church Broughton, it appears that such clearance undertaken in 1956 consisted of a mere visual search. It is therefore possible that the EOC task undertaken in Foston in 1984 and its 151 live ordnance finds within a 0.25 hectare search was a direct result of this method of clearance.

For these reasons, it cannot be assumed that because EOC tasks have been undertaken at a former military site, the risk of UXO remaining has been completely mitigated.

15.3. Post-war Redevelopment

The extent of works/development and depth of foundations/excavations that have been undertaken on site post-war (or during/post military use) can have a significant effect on the risk of UXO remaining in situ in those areas.

Little development has taken place on site in post war years, aside from the partial clearance of the former RAF runway in the eastern section of the site, with much of the site retaining

There is not considered to be any significant risk of UXO remaining at the location and down to the depth of foundations and excavations dug post-war or post-military use.

[1] *CIRIA C681*

16. The Likelihood that UXO will be Encountered

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood that UXO will be encountered on the site will depend on various factors including the type of UXO that might be present and what intrusive works are planned on site in the future. On many sites, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Unexploded ordnance is still regularly encountered across the UK. From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg, over, 7,000 anti-aircraft projectiles and 300,000 beach mines. Press articles relating to UXO are presented in **Annex T**.

16.2. Land Service/Small Arms Ammunition Encounter

Items of LSA/SAA are generally encountered when lost, burnt, buried or otherwise discarded, and therefore are only likely to be encountered at relatively shallow depths – generally in the top 1m below ground level. Such items are therefore most likely to be encountered during open excavation works. In some cases, there is the potential that LSA or SAA may be present on the surface of the ground – especially on sites which have active military use or were recently in use by the MoD.

16.3. Aerial-Delivered Ordnance Encounter

Since an aerially dropped bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of Initiation

Unexploded ordnance will not spontaneously explode. All older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age, and the amount of energy it is struck with.

17.1. Initiation of Land Service Ammunition

Items of LSA generally do not become inert or lose their effectiveness with age. Time can cause items to become more sensitive and less stable. This applies equally to items submerged in water or embedded in silts, clays, or similar materials. The greatest risk occurs when an item of ordnance is struck or interfered with. This is likely to occur when mechanical equipment is used or when unqualified personnel pick up munitions.

If left alone, an item of LSA will pose little/no risk of initiation. Therefore if it is not planned to undertake construction/intrusive works at the site, the risk of initiation of any LSA that may be present would be negligible. Similarly, those accessing a contaminated area would be at minimal risk if they do not interfere with any UXO present on the ground. Clearly for many end uses however, the presence of UXO anywhere on a site would not be acceptable as it could not be guaranteed that the items will not be handled, struck or otherwise affected, increasing the likelihood of initiation.

17.2. Initiation of Small Arms Ammunition

Small arms ammunition (SAA) contains a small quantity of explosive propellant which is initiated by a percussive effect on firing. Items of SAA are much less likely to detonate than LSA or UXBs, but can be accidentally initiated by striking the casing, coming into contact with fire, or being tampered with/dismantled.

17.3. Initiation of Unexploded Bombs

As with LSA, unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents were fatalities have resulted (some examples are presented in **Annex U**). There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

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18. Consequences of Initiation/Encounter

18.1. General

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes.

If appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low. The primary consequence of encounter of UXO will therefore be economic. This would be particularly notable in the case of a high-profile site and sites where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time.

It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve loss of production. Generally, the first action of the police in most cases will be to isolate the locale whilst awaiting military assistance, even if this turns out to have been unnecessary.

18.2. Consequences of Detonation

The severity of an incident will depend on factors such as the type of weaponry that is initiated, its explosive content, its depth, and the proximity of receptors.

The unexpected detonation of a high explosive bomb will have much greater potential for significant damage and risk to life and limb. The initiation of an item of LSA may affect a smaller area, but could still injure and kill within proximity. Although containing as smaller quantity of explosive material the detonation of a large calibre HE aircraft projectile may still result in significant harm to persons. It is likely that the detonation of an item of SAA would result in a small explosion, as the pressure would not be contained within a barrel. However, detonation would only result in local overpressure and minor fragmentation from the cartridge case which can result in injury.

Although there is a decreased risk of fragmentation relating to the detonation of items such as flares, the chemical composition of pyrotechnics frequently included the use of many highly toxic elements. These chemicals may be an irritant or else seriously harmful if they come into contact with skin, are inhaled, or ingested. Chemical weapons such as phosgene, mustard gas and chlorine will remain seriously harmful to humans. Phosphorus content in weapons such as self-igniting phosphorus (SIP) grenades can cause severe burns and blinding.

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Assessed Risk Level

Taking into consideration the findings of this study, based on factors such as potential UXO contamination, the likelihood of UXO remaining, the risk of encountering UXO during the proposed works, and the UXO that UXO may be initiated, 1st Line Defence has assessed that the risk across the site is not homogenous. A **Medium Risk** from British UXO and British Practice Bombs as well as Land Service Ammunition and Small arms Ammunition has been identified across the site. The risk from German aerial-delivered ordnance and Anti-Aircraft ordnance has been assessed as **Low**.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
British UXO/UXB			✓	
British Practice Bombs/Projectiles			✓	
Land Service Ammunition and Small Arms Ammunition			✓	
Anti-Aircraft Artillery Projectiles		✓		
German Aerial Delivered Ordnance		✓		

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20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at Land Near Dove Valley Park, Derby:

Type of Work	Recommended Mitigation Measure
All Works	• **Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event that a suspect item is encountered. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.
Shallow Intrusive Works/Open Excavations	• **A Non-Intrusive UXO Magnetometer Survey** A Non-Intrusive survey is undertaken using a man-portable magnetometer. Data is recorded and then interpreted to map magnetic fields and model discrete magnetic anomalies which may show the characteristics of UXO. The anomalies can then be investigated by a target investigation team. Where this type of survey is not practical (due to for example terrain or ground conditions), on-site UXO specialist support is recommended. • **Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works:** When on site the role of the UXO Specialist would include • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any staff that have not already received them and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid Incident Management which would involve liaison with the local authorities and Police should ordnance be identified and present an explosive hazard. UXO Safety and Awareness briefings will be provided to all ground personnel by the UXO Specialist once on site.

In making this assessment and recommending these risk mitigation measures, if known, the proposed works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **27th February 2019**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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Site Location Maps

Annex: **A**

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Client: **Applied Geology**

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: Google Maps

Approximate site boundary

N

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Recent Aerial Photography

Annex: **B**

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Approximate site boundary

N

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: Google Earth ™ Mapping Services

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Client Provided Site Plan

Annex: **C**

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Project:	**Land near Dove Valley Park, Derby**		
Ref:	**DA8179-00**	Source: Applied Geology	

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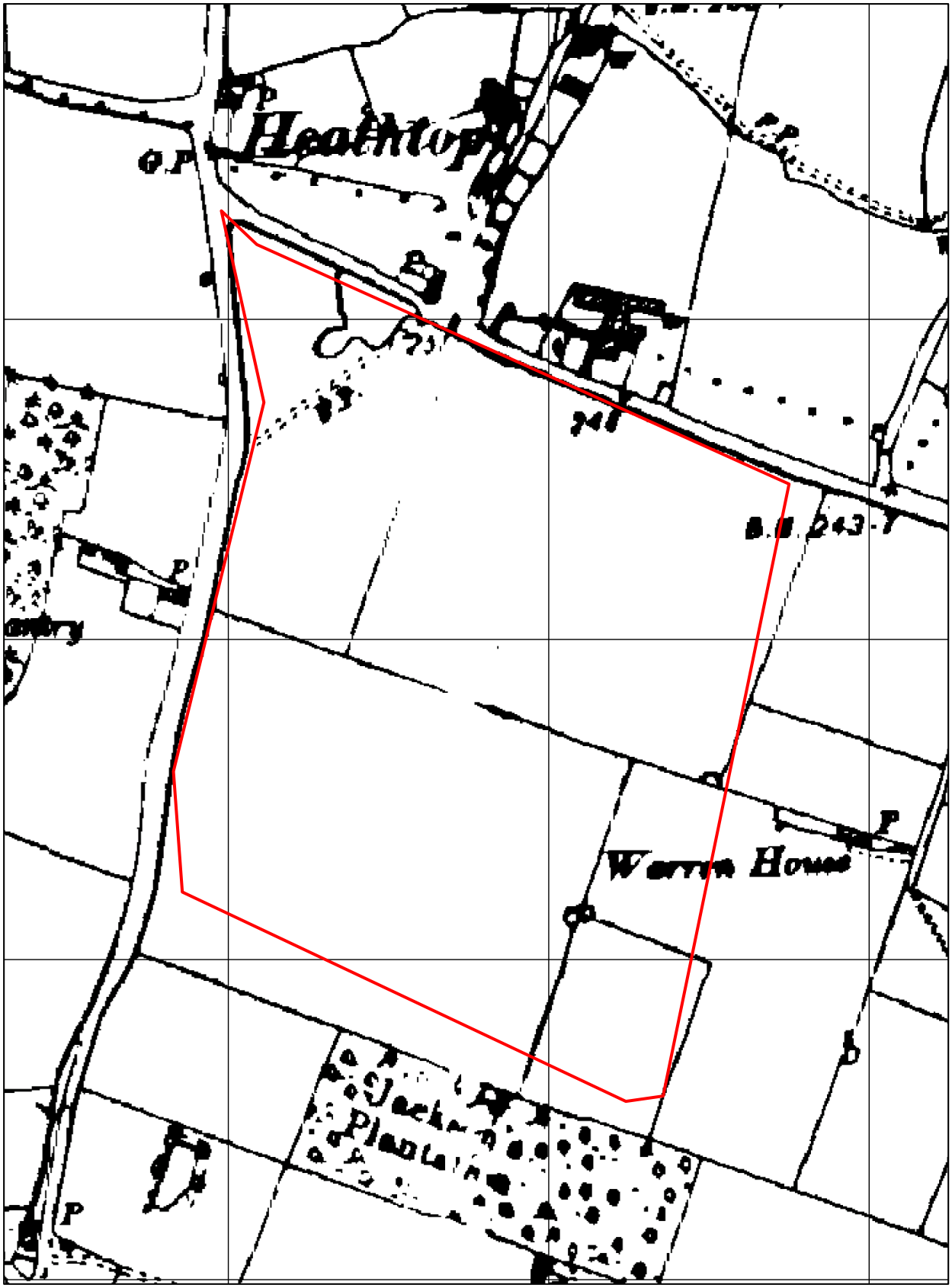
1924 Historical Map

Annex: **D1**



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Approximate site boundary

Project: **Land near Dove Valley Park, Derby**

N

Ref: **DA8179-00**

Source: Landmark Maps

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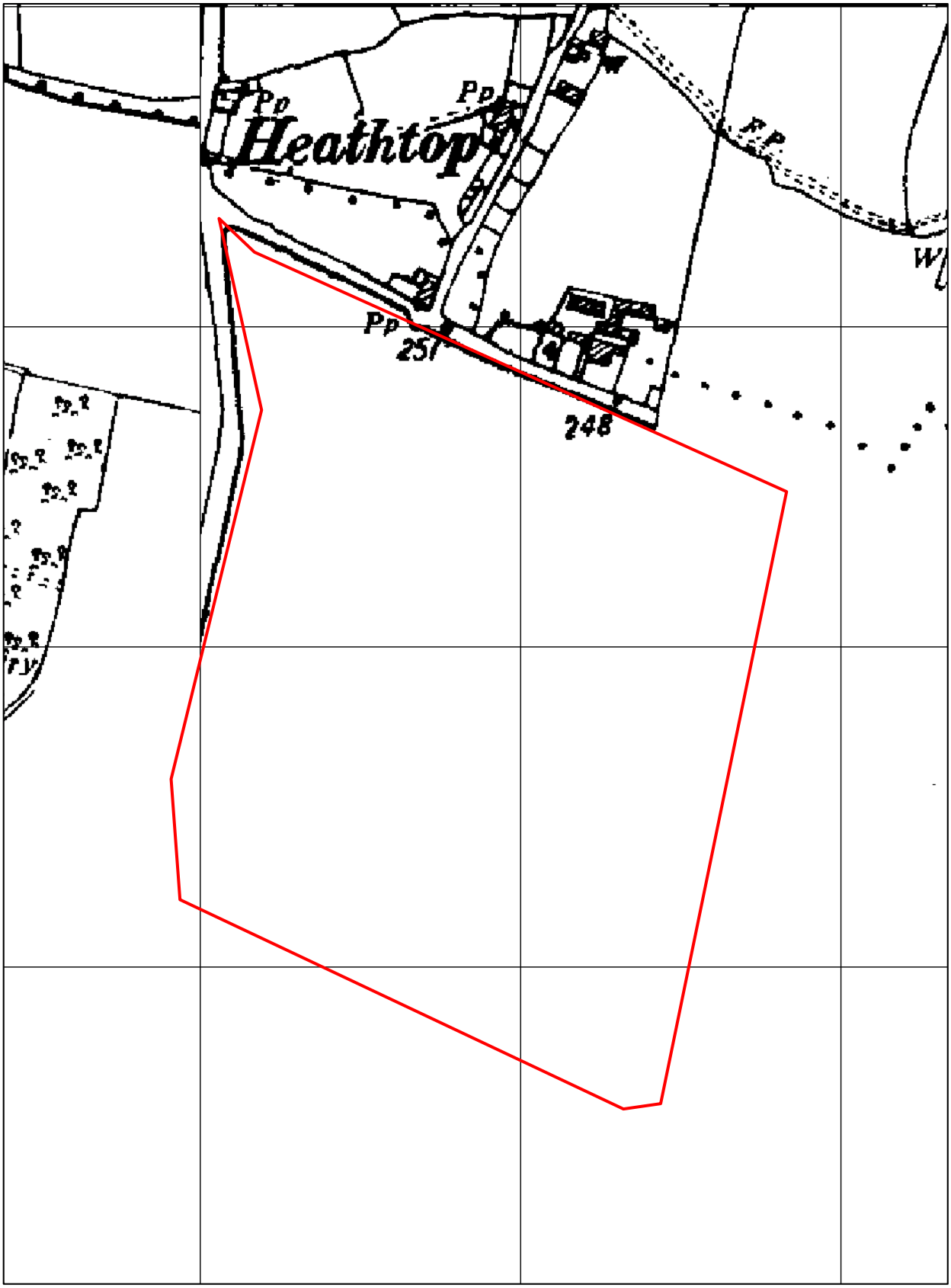
1955 Historical Map

Annex: **D2**



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Client: **Applied Geology**

Approximate site boundary

Project: **Land near Dove Valley Park, Derby**

N

Ref: **DA8179-00**

Source: Landmark Maps

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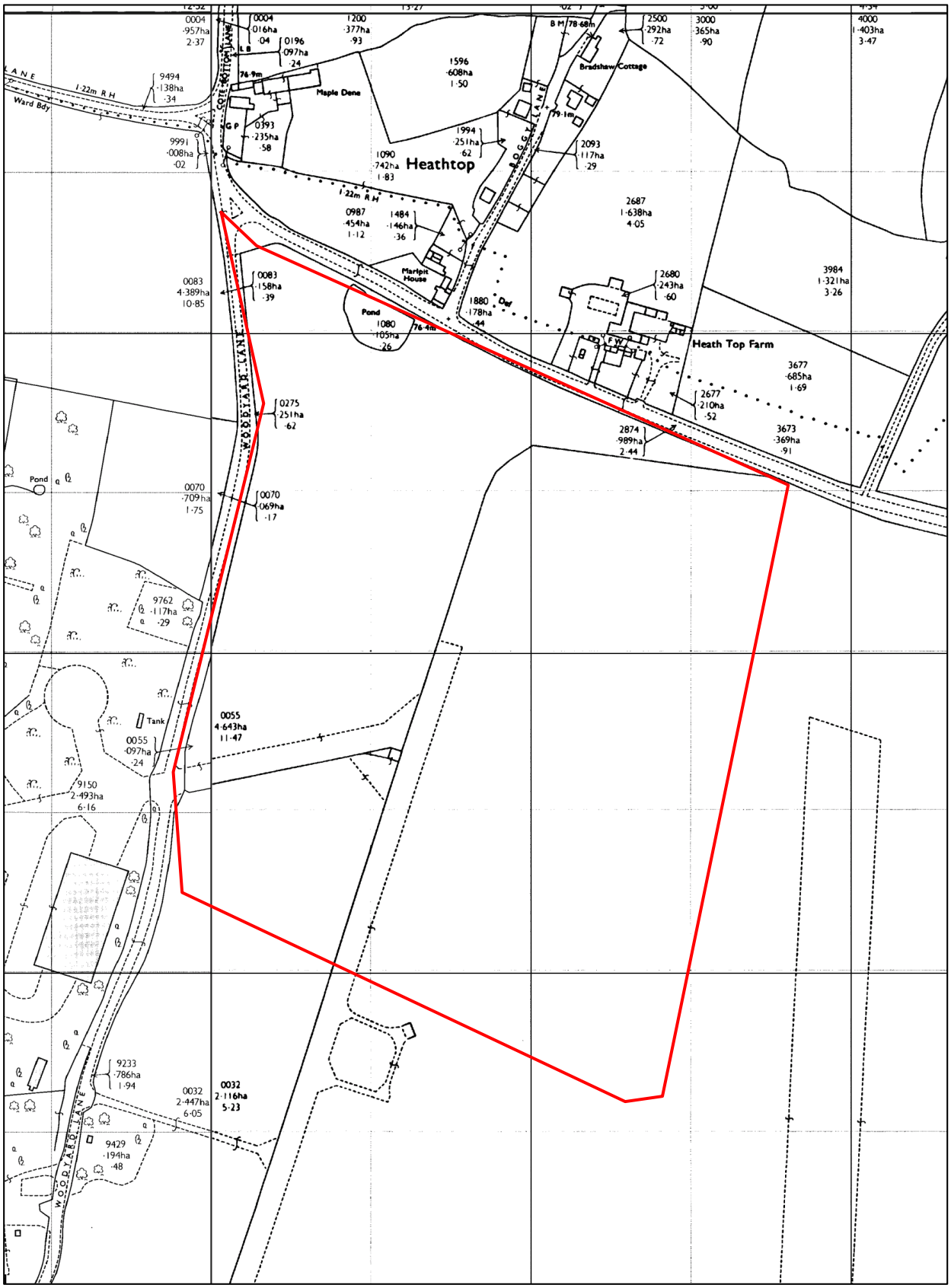
1979 Historical Map

Annex: **D3**



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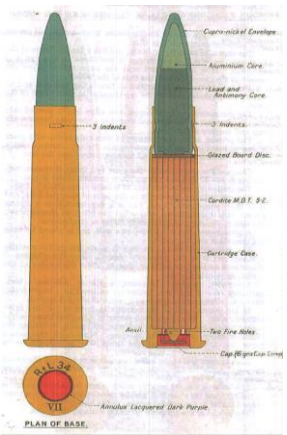
Typical British Aircraft Ordnance

Annex: **E1**

British 303. Round

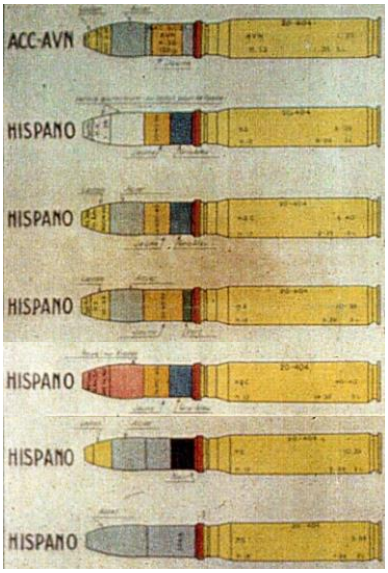
Bullet Diameter	7.92mm
Case length	56.44mm
Overall length	78.11mm
Type	Rifle Ammunition
Use	303 rounds were used in machine guns on aircraft, as well as in aircraft defence, and SAA.
Remarks	First produced in 1889 and still in use today, the .303inch cartridge has progressed through ten 'marks' which eventually extended to a total of around 26 variations.

Bullet Type	Colour of tip	Colour of Annulus
Armour Piercing	Green	Green
Ball	None	Purple
Incendiary	Blue	Blue
Observing	Black	Black
Proof	None	Yellow
Tracer Short Range	White	Red
Tracer Dark Ignition	Grey	Red
Tracer Long Range	Red	Red



Hispano Suiza HS.404

Weight	HE - 0.13kg (13lbs), complete Round 0.2kg (0.57lbs) Armour Piercing – 0.17kg (0.37lbs) complete round0.29kg (0.64lbs)
Explosive Weight	HE & HEI - 0.014kg. Armour Piercing and shot rounds may not have been filled with an explosive element.
Fuze Type	No.253 MK.1A Direct Action (Percussion) Fuse
Dimensions	20mm x 110m
Use	The Hispano Suiza HS.404 was widely used by both fighter and bomber aircraft throughout WWII
Remarks	Although relatively small, if encountered en masse unexploded HE canon round may present a risk to people and plant.



RP-3 60lbs Rocket

Weight	37kg (80lbs)
Explosive Weight	25kg (25kg)
Fuze Type	No. 899 MK 1
Dimensions	55.88cm x 11.43cm (22" x 4.5")
Use	A rocket typically deployed from the air at ground targets such as tanks, trains, and shipping.
Remarks	The RP-3 was a high explosive rocket designed to destroy armoured vehicles. If detonated an RP-3 may present a serious risk to both workers and equipment.

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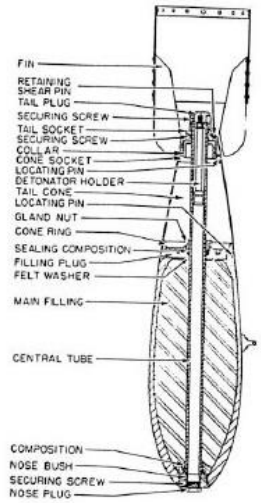
Typical British Aircraft Ordnance

Annex: **E2**

250lb General Purpose Bomb

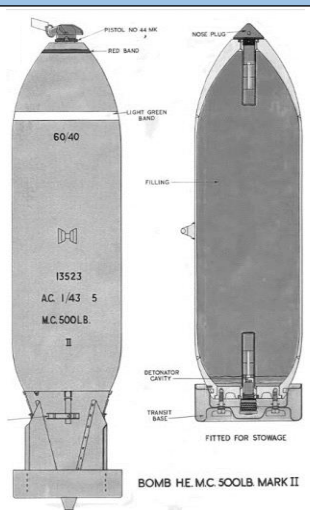
Weight	247lbs
Explosive Weight	123lbs
Fuze Type	Nose fuses included the AM-M103, M118, and M119. Tail fuses included AM-M102A2 or the M114A1
Dimensions	28” x 10.3” (137.66cm x 71.12com)
Use	The 250lbs bomb was used to target railways, small buildings, ammunition dumps, planes, and hangers. Bombs were typically mounted under the wings.
Remarks	Allied ordnance was typically ‘lustreless’ or ‘olive drab’. Bombs were typically marked with a yellow ban across the nose or the tail.



Above - A Westland Whirlwind being armed with 250lbs underwing. Below - 250s in N. Africa

500lb General Purpose Bomb

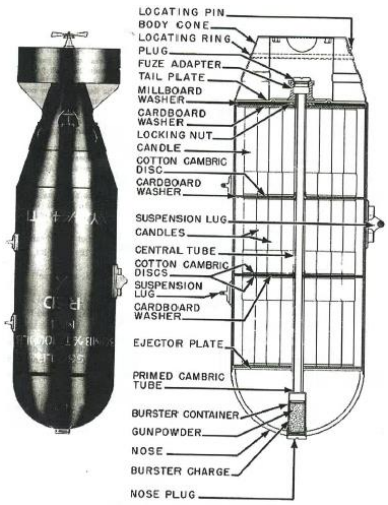
Weight	509lbs
Explosive Weight	262lbs
Fuze Type	Nose fuses included the AM-M103, M118, and M119. Tail fuses included AM-M102A2 or the M114A1
Dimensions	35.7” by 13” (90.67cm x 33.02cm)
Use	The 500lbs general purpose bomb was the most commonly deployed item, of Allied aerially delivered ordnance. 1,729,611 500lbs were deployed by the allies.
Remarks	Allied ordnance was typically ‘lustreless’ or ‘olive drab’. Bombs were typically marked with a yellow ban across the nose or the tail.



A Hawker Tempest being equipped with 500lbs general purpose bombs circa 1943 - 1945

1000lb Medium capacity bomb

Weight	1,021lbs (464.09kg)
Explosive Weight	480lbs (approx. 47% of bomb weight)
Fuze Type	Nose fuses included the AM-M103, M118, and M119. Tail fuses included AM-M102A2 or the M114A1
Dimensions	72.6” x 52.5” (184.4cm x 133.35)
Use	The bomb was usually fitted under the wings of fighter aircraft and used for the tactical bombing of strategic targets. From 1944 the bomb was rationed for the purpose of supporting land operations.
Remarks	The bomb is made of case steel with an amatol 50/50 or 60/40 amtex filling.



Above, a 1000lbs. Below, a 1000lbs being fitted to a P-40 Warhawk

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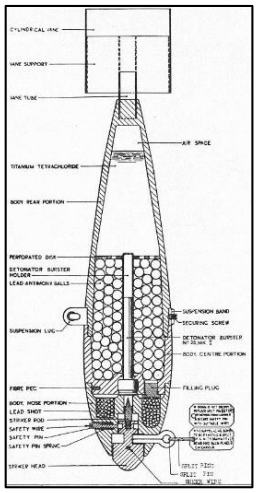
Examples of British Practice Bombs

Annex: **F1**

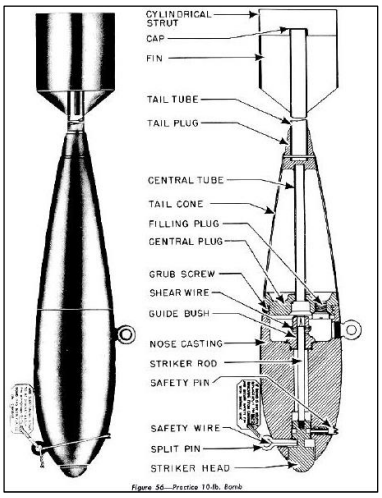
8.5 lb Practice Bomb

Bomb Weight	85 lb (approx. 3.9 kg)
Explosive Weight	1 lb (approx. 0.45 g)
Fuze Type	Explosive fuze and bursting charge.
Bomb Length	15.9 in (405 mm)
Body Diameter	Max. 2.95 in (75 mm)
Use	Dropped by Allied forces in order to practice bombing accuracy. Practice bombs used a small bursting charge to release smoke to mark their position.
Remarks	Had a moulded plastic shell. The Mk I had smoke filling and the Mk III had a flash filling, a mixture of gunpowder and magnesium turnings.



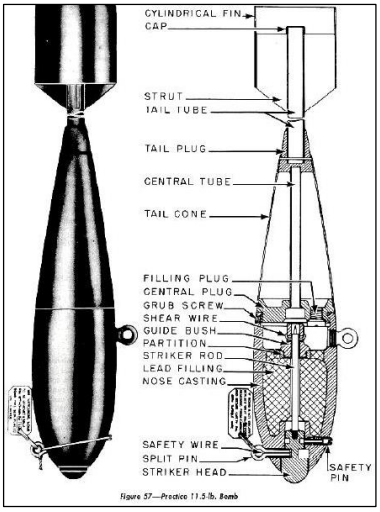
10 lb Practice Bomb

Bomb Weight	10 lb (approx. 4.5 kg)
Explosive Weight	1 lb (approx. 0.4 g)
Fuze Type	Explosive fuze and bursting charge.
Bomb Length	18 in (460 mm)
Body Diameter	Max. 3 in (76 mm)
Use	Dropped by Allied forces in order to practice bombing accuracy. Practice bombs used a small bursting charge to release smoke to mark their position.
Remarks	The Mk I had smoke filling and the Mk III had a flash filling, a mixture of gunpowder and magnesium turnings.



11.5 lb Practice Bomb

Bomb Weight	11.5 lb (approx. 5.0 kg to 5.3 kg)
Explosive Weight	1 lb (approx. 0.45 g)
Fuze Type	Explosive fuze and bursting charge.
Bomb Length	460 mm (18 in)
Body Diameter	Max. 3 in (76 mm)
Use	Dropped by Allied forces in order to practice bombing accuracy. Practice bombs used a small bursting charge to release smoke to mark their position.
Remarks	Available with smoke or flash filling. Mk II was made of Bakelite. Most often had a white shell.



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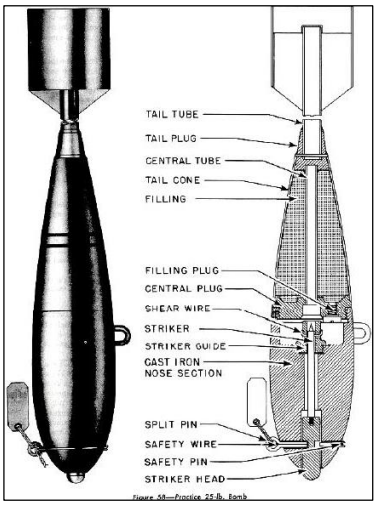
Examples of British Practice Bombs

Annex: **F2**

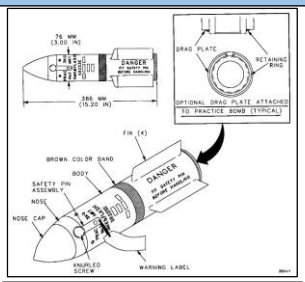
25 lb Practice Bomb

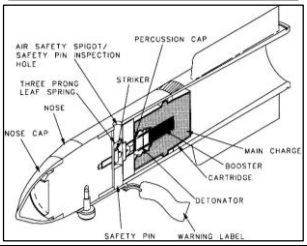
Bomb Weight	25 lb (11 – 11.5 kg)
Explosive Weight	1 lb (approx. 0.45 g)
Fuze Type	Explosive fuze and bursting charge.
Bomb Length	22 in (550 – 560 mm)
Body Diameter	4 in (100 mm)
Use	Dropped by Allied forces in order to practice bombing accuracy. Practice bombs used a small bursting charge to release smoke to mark their position.
Remarks	Mks I and IV had a smoke filling and Mks III and V had a flash filling for use at night. The 25 lb Practice Bomb was usually white with a cast iron nose.



3 kg Practice Bomb

Bomb Weight	3 kg (approx. 6.6 lb)
Explosive Weight	Contains a smoke or flash filling.
Fuze Type	Varied
Bomb Length	386 mm (15.2 in)
Body Diameter	76 mm (3 in)
Use	Dropped by Allied forces in order to practice bombing accuracy. The 3kg Practice Bomb used a traditional detonator.
Remarks	Coloured banding around the casing denotes the filing of the bomb. The image to the left is a low explosive example.





Buried and Decayed Practice Bombs

Examples of buried 3kg Practice Bombs.

Practice bombs found after a landslide in Mappleton Beach.

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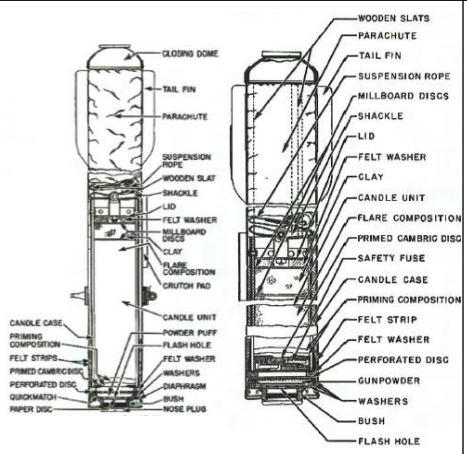
Examples of Aerially Deployed Flares

Annex: **F3**

4.5” Reconnaissance Flare

Bomb Weight	Reconnaissance Flare Mks I, II, III, IV, V, VI, VII and VIII weight 23lbs. Skymarker Flare Mks I, II, and III weight 28lbs.
Filling	Various compositions of illuminating material with a HE fuse mechanism
Fuze Type	Reconnaissance Flare Mks I, II, III, IV, V, VI, VII and VIII feature nose fuze No. 35, 42, 848, 849. May use No. 28 Mks II or III.
Dimensions	4.5” x 33”
Use	Flares were carried in batches of seven or four. Flares were used to an illuminate an area prior to bombing.
Remarks	MKI, II, and III models have longer tail fins that the MKIV.

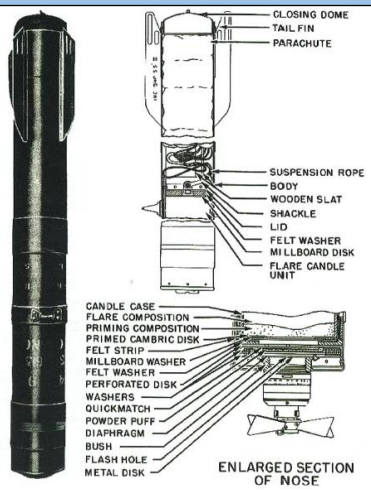


Left: 4.5” Reconnaissance Flare MKV
Right 4.5” Reconnaissance Flare MKIV

4.5” being loaded a Fairey Battle 1939

5.5” Reconnaissance Flare

Bomb Weight	41.5lbs
Filling	Various compositions of illuminating material with a HE fuse mechanism
Fuze Type	Nose Fuze No. 28B, 42, or 848, may use No. 35 or 849; No. 860 was used in special circumstances.
Dimensions	48” x 5.5”
Use	Deployed in batches of four. Used to illuminate targets during bombing raids.
Remarks	The 5.5” is black with a 1/2” red band 5” from the nose. A 5.5” flare will burn for approximately 3.5 minutes.

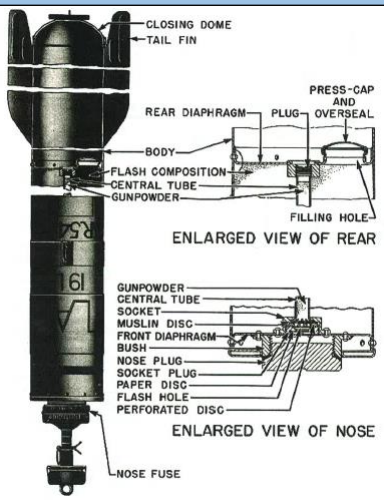


4.5” Reconnaissance Flare MKV

5.5” being loaded a Vickers Wellington 1942

Photoflash Mine

Bomb Weight	MKI & II – 19lbs Heavy Photoflash Bomb – 40lbs
Explosive	Photoflash bombs contain an HE charge that triggers a gunpowder fill which in turn ignites a photographic composition.
Fuze Type	Nose fuse No. 28B, 848, or 849, No. 860 used in special circumstances.
Dimensions	33” x 4.5”
Use	The photoflash bombs were designed to provide illumination for night time photography
Remarks	Flash is stencilled into the nose of the bomb and the tail of the bomb is red.



4.5” Photoflash Bomb

4.5” Photoflash Bomb being loaded a Lancaster 1944

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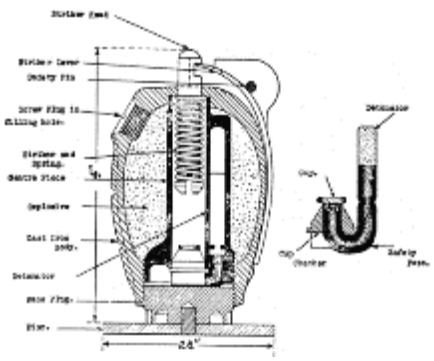
Grenades

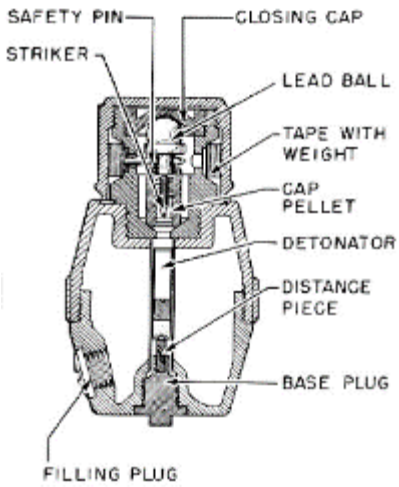
No. 36 'Mills' Grenade

Weight	760g filled (1ib 6oz)
Explosive Weight	71g (2.5 oz) Baratol filling.
Fuze Type	4 second delay hand-throwing fuze
Dimensions	95 x 61mm (3.7 x 2.4in)
Use	Fragmentation explosive at approx. 30m range 100m range of damage.
Remarks	First introduced in 1915 its classic grooved 'pineapple' design was designed to provide uniform fragmentation. Approx. over 70million were produced.



No. 69 Grenade

Weight	383g (0.81b)
Explosive Weight	93g (3.25 oz) of either Amatol, Baratol or Lyddite
Fuze Type	'All-ways' Fuze. Compromised of a safety cap, a weighted streamer attached to a steel ball bearing and a safety bolt designed to detonate from any point of impact.
Dimensions	114 x 60mm (4.5 x 2 .4 in)
Use	A blast grenade for use as an offensive weapon.
Remarks	Introduced December 1940 and made from the plastic Bakelite as opposed to conventional metals. Detection is difficult due to this low metal content.



L2 Grenade

Weight	454g (16 oz)
Explosive Weight	164g. (16 oz)
Fuze Type	Time Friction Fuze
Dimensions	Approx. 99 x 57 mm (3.9 x 2.2 in)
Use	A widely used anti-personnel grenade, a version of the American M26. Variants still see use in the present day.
Remarks	The L2 series also came as a Practice (L3) grenade and a Drill (L4) Grenade. The Drill variant, with a non-functional fuze and no filing, is visible on the far right.

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Mortars

Typical 2 Inch High Explosive Mortar

Weight	1.02kg (2.25lb)
Maximum Range	460m (500yards)
Filling	200g RDX/TNT
Dimensions	51 x 290mm (2in x 11.4 in)
Fuze Type	An impact fuze which detonates the fuze booster charge and in turn the high explosive charge.
Use	A small, portable mortar introduced into the British army in 1938. It had greater range and firepower over hand and rifle grenades, and was used to attack targets behind cover with high explosive rounds.
Remarks	Detonation causes the mortars bomb body to shatter producing optimum fragmentation and blast effect at the target.

Typical 3 inch Smoke Mortar

Weight	4.5kg (9lb 14oz)
Maximum Range	2515m (2,750 yards)
Filling	White phosphorus & smoke fill (also came in Explosive & Illuminating models)
Bomb Dimensions	490 x 76mm (19.3in x 3in)
Fuze Type	An impact fuze which initiates a bursting charge. This ruptures the mortar bomb 's body and disperses the phosphorus filler
Use	As a screening devices for unit movement or to impair enemy field of vision.
Remarks	This mortars long cylindrical body and tail sometimes causes it to be misrecognised as a German incendiary bomb.

ML 4.2 inch Mortar

Weight	9kg (19lb 13oz)
Maximum Range	3,750m (4,100 yards)
Filling	High explosive, smoke (white phosphorous or Titanium Tetrachloride) or chemical
Bomb Dimensions	500 x 105 mm (19 in x 4 in)
Fuze Type	Sensitive fuze with HE bursting charge.
Use	A widely used heavy motor which first saw use in 1942 and saw usage throughout the post-war period.
Remarks	Different markings denoted different filings. See image to the right.

L to R: HE, Smoke, Chemical, Smoke BE.

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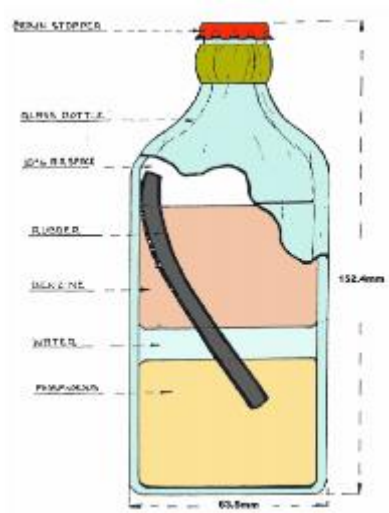
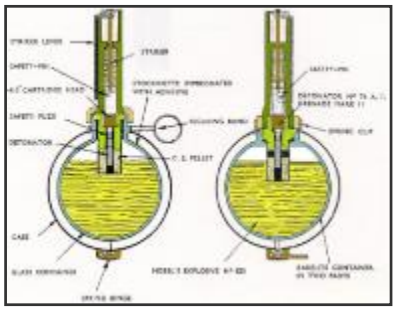
Self Igniting Phosphorous (SIP) Grenades

Weight	Various
Filling	White Phosphorous and Benzene
Design	The filling was contained in a pint sized glass bottle with water and a strip of rubber. Over time the rubber dissolved to create a sticky which would self ignite when the bottle broke.
Use	Originally intended as an anti-tank incendiary weapon deployed by hand. Designed to be produced cheaply without consuming materials needed to produce armaments on the front line.
Remarks	The Home Guard hid caches of these grenades during the war for use in the event of an invasion. Not all locations were officially recorded and some caches were lost. Occasionally discovered today. In all cases, the grenades are still found to be dangerous.



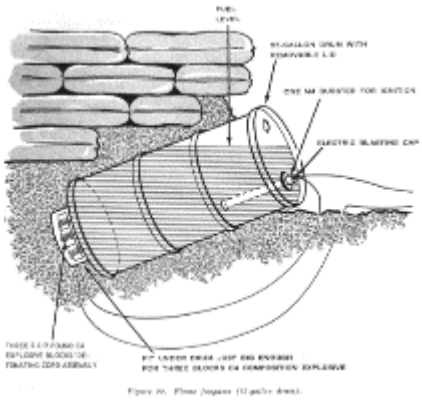
No. 74 Grenade (Sticky Bomb)

Weight	Approx. 1.1kg (2ib 4oz)
Filling	Approx. 600g Nobel's No.283 (Nitro-glycerine)
Design	A glass ball on the end of a Bakelite (plastic) handle. The inside of the ball would contain the explosive filling and the outside a very sticky adhesive coating.
Use	An anti-tank grenade primarily issued to the home guard. It required the user to come in very close proximity with the target and smash the glass explosive container against it.
Remarks	One of a number of weapons developed for use as an *ad hoc* solution to the lack of sufficient anti-tank guns in the aftermath of the Dunkirk evacuation amid fear of German invasion.



Flame Fougasse Bomb

Weight	Various
Filling	Initially a mixture of 40% petrol and 60% gas. Ammonal provided the propellant charge.
Design	Usually constructed from a 40-galleon drum dug into a roadside and camouflaged.
Use	As an improvised anti-tank bomb. When triggered the Fougasse could project a beam of burning sticky fuel in a fixed direction from up to 3m (10ft) wide and 27m (30yards) long.
Remarks	A highly unorthodox weapon designed by the Petroleum warfare department to address a critical lack of weapons in 1940. 50,000 are estimated to have been distributed around the UK.



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Cannon Ammunition

Rifle Ammunition

Buried and Decayed Ammunition

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Client: **Applied Geology**

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: Various sources

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Anti-Aircraft Projectiles

Annex: I

QF 3.7 Inch WWII Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	High Explosive Anti-Aircraft projectile. 4.5in projectiles were also used in this role.
Ceiling	30,000ft to 59,000ft

40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Proximity and Mechanical Time Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40mm x 310mm (1.6in x 12.2in)
Ceiling	23,000ft (7000m)

Unrotated Projectile (UP) – Z Battery

Projectile Weight	84lb (24.5kg)
Warhead Weight	4.28lb (1.94kg)
Warhead	Aerial Mine with a No. 700 / 720 fuze
Filling	High Explosive
Dimensions	1930mm x 82.6mm (76 x 3.25in)
Use	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries.

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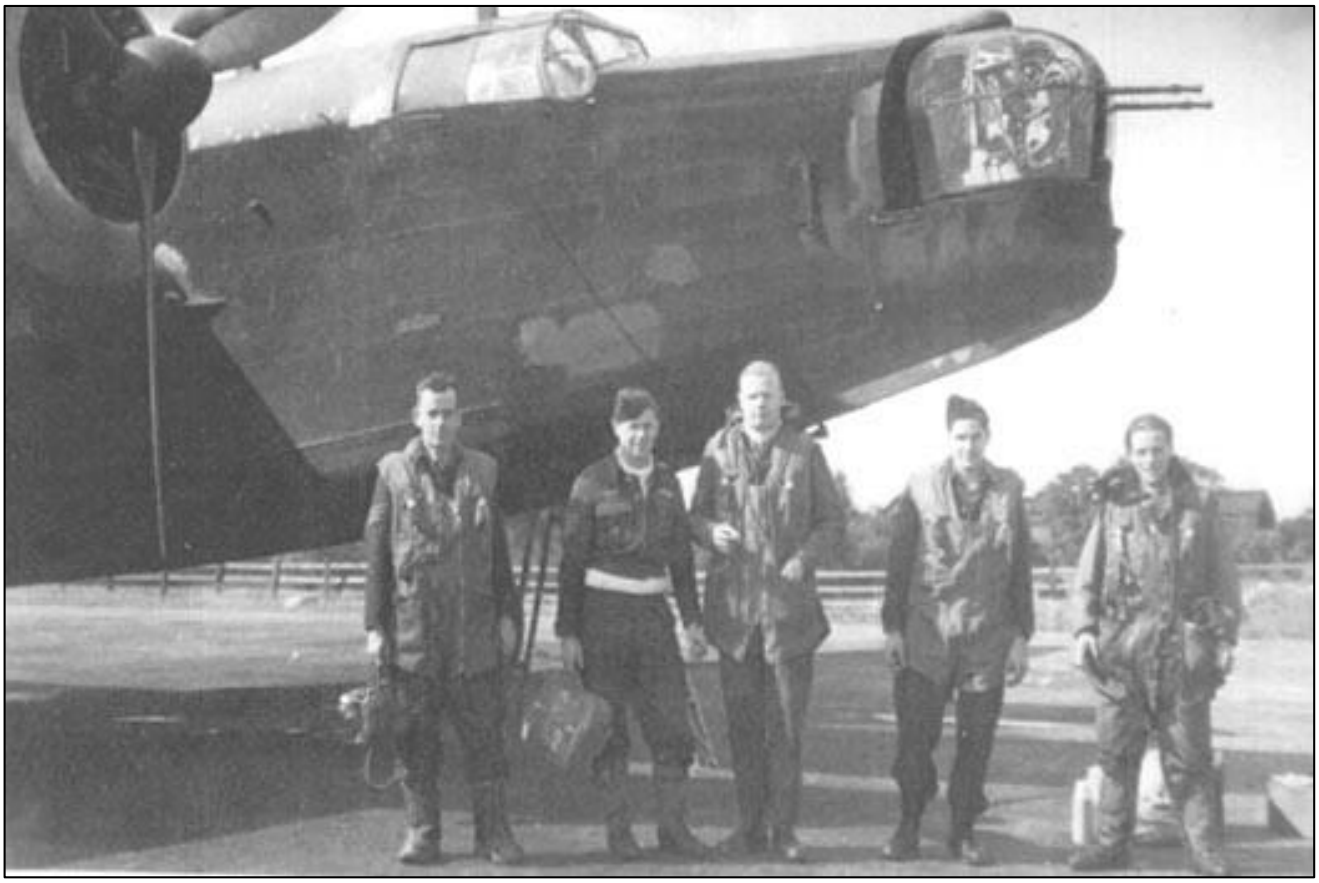

(Above) Vickers Wellington Crew at RAF Church Broughton, August 1942

Vickers Wellington from No.27 OTU flying a training mission

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Client:	**Applied Geology**
Project:	**Land near Dove Valley Park, Derby**
Ref:	**DA8179-00**
Source:	Various

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Vickers Wellington from No.27 OTU that crashed on a residential property

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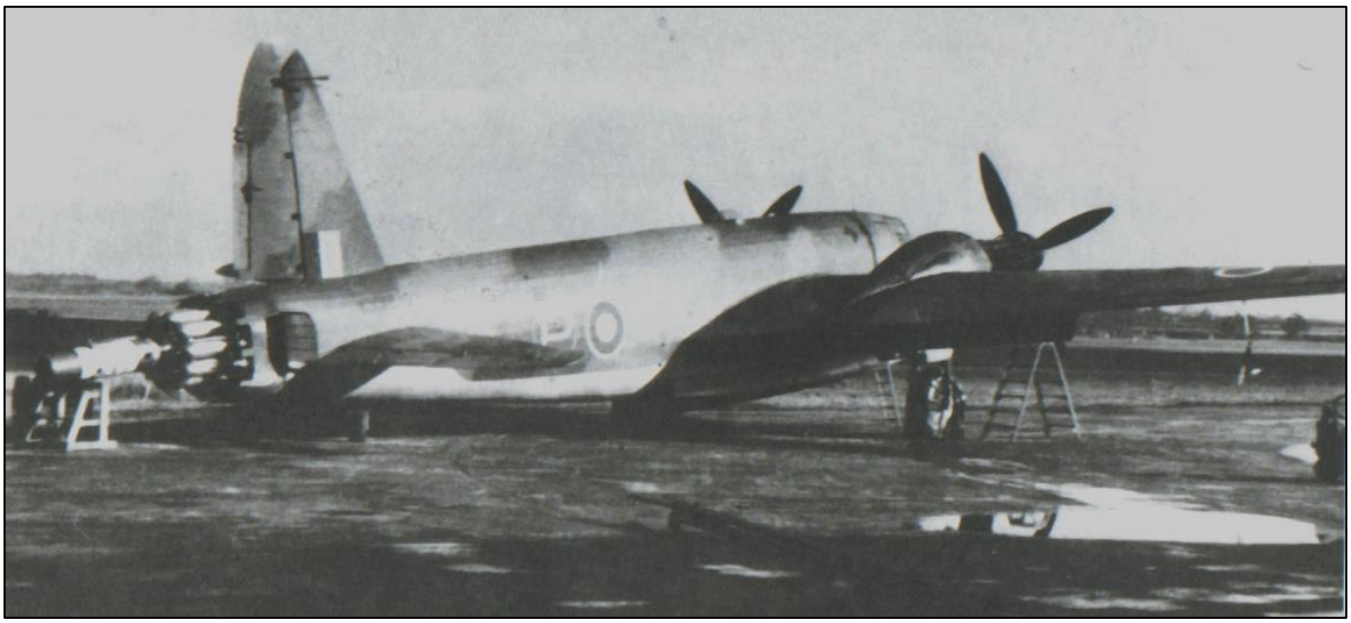

Vickers Wellington fitted with experimental Whittle Jet Engine

Rolls Royce 'Trent' Turboprop Engines fitted to a Gloster Meteor at RAF Church Broughton

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1956 Plan of Airfield Ownership

Annex: **L**

Purchased Land

Requisitioned Land

Land given to War Department

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Client: **Applied Geology**

Approximate site boundary

N

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: The National Archives, Kew

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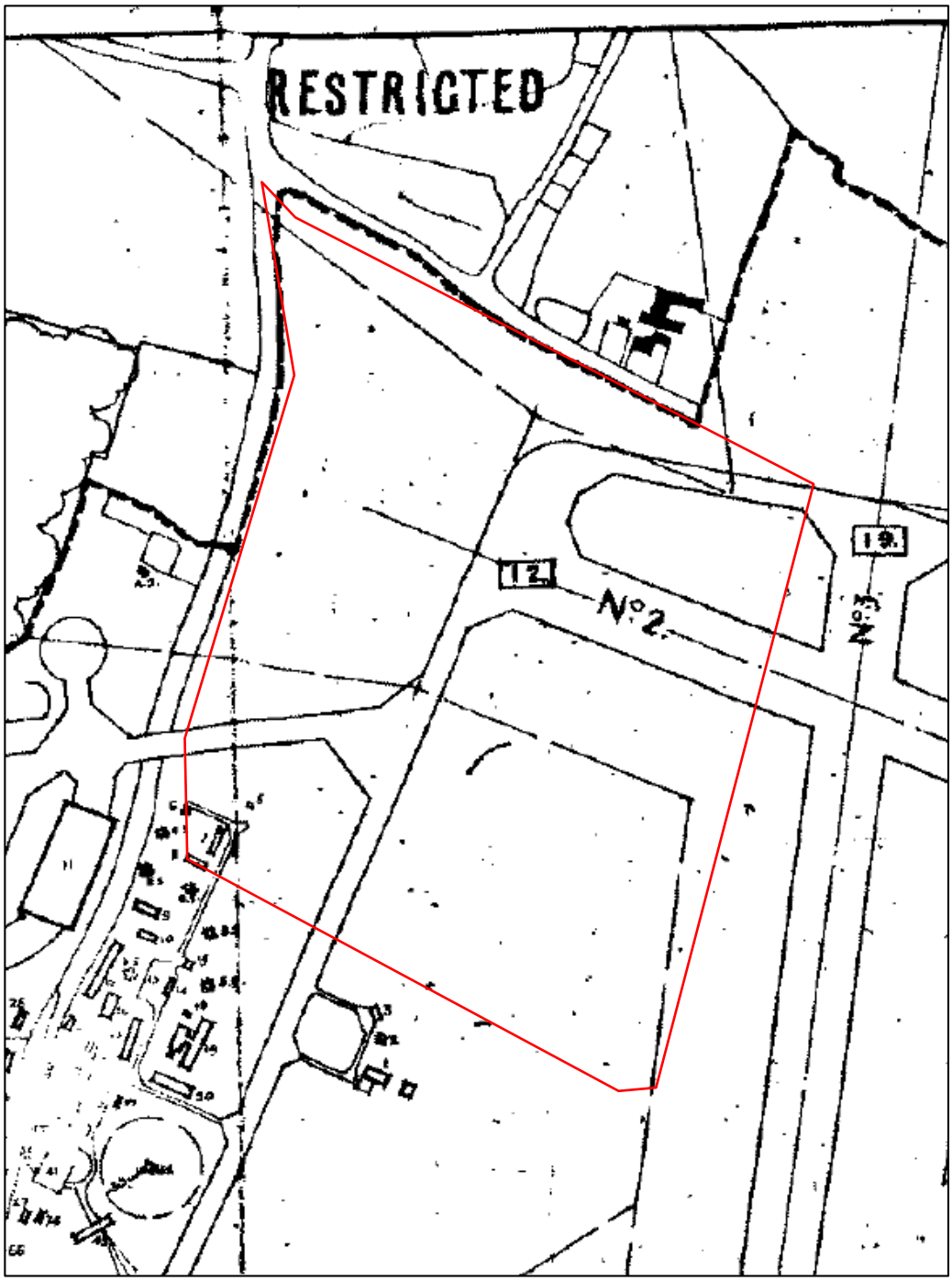
Church Broughton RAF Site Plan January 1945

Annex: **M1**



SCHEDULE OF BUILDINGS

Bldg No	DESCRIPTION	Constr	Type	Drg No
	AIRFIELD SITE No 1			
1	WATCH OFFICE	Pr Br		13726
2	SPEECH BROADCASTING BLDG	do		10786
3	N F E STORE	do		124
5	M & E PLINTH	-		Ns
6	SUB-STATION	P.B.		12641
7	LUBRICANT & INFLAMMABLE STORE	do		5941
44	DISPERSAL HUT	H		W
45				

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Client: **Applied Geology**

Approximate site boundary

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: RAF Museum, Hendon

N

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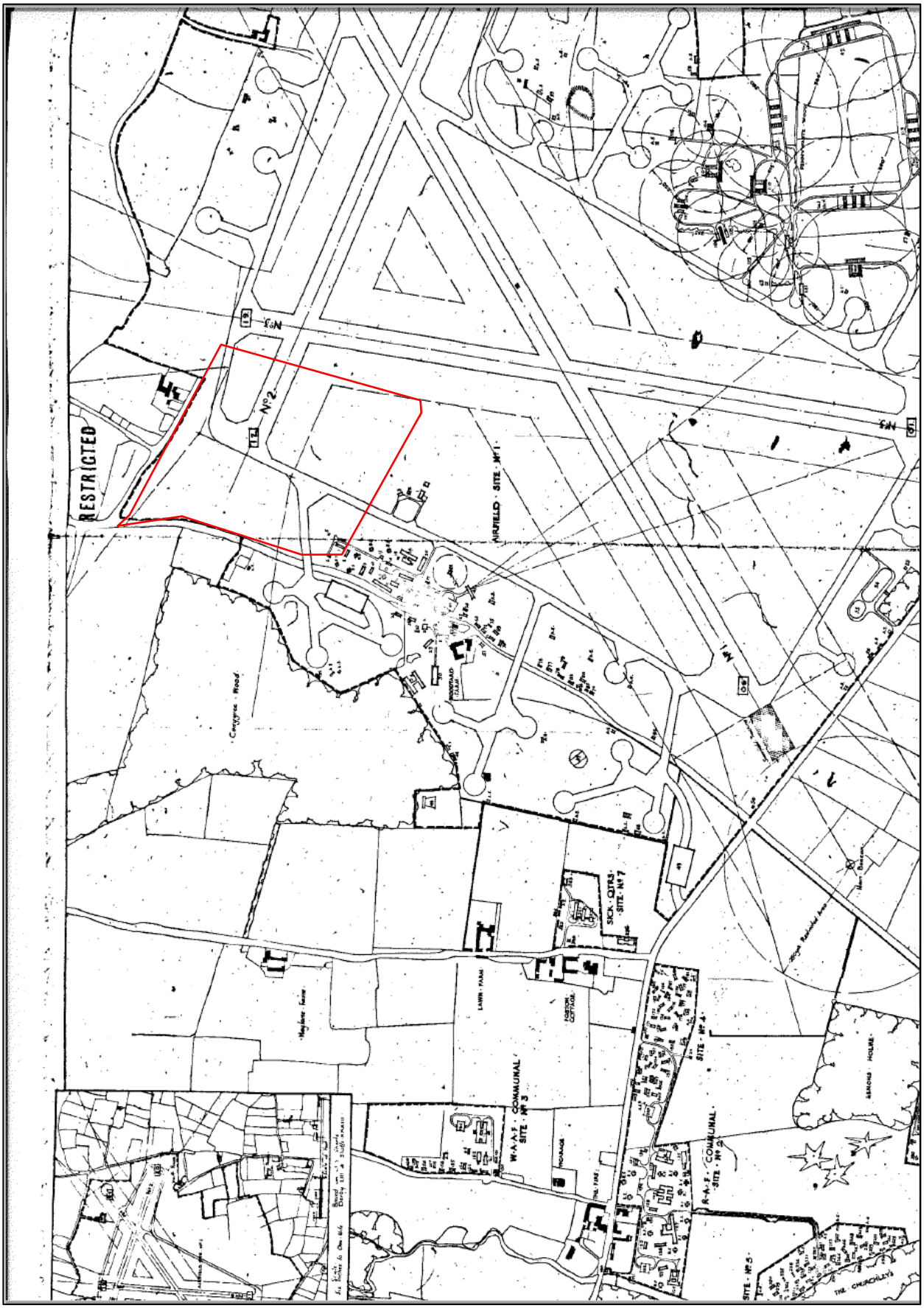
Church Broughton RAF Site Plan January 1945

Annex: **M2**



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Approximate site boundary

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: RAF Museum, Hendon

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Sunday 22nd April 1945

2110 46 Bombing section request we try & contact "B" & "E" to pass following message "B" fly at odd 500ft only. Range. "B" odd 1000ft "E" even 1000ft. Able to pass message to "B" & "E" only.

Friday 27th April 1945

2200 32 Fitness Sig 7
2200 33 First Bombing detail returns weather u/s.
2215 34 Ex Lich met. Cloud over Bombing Range should disperse by midnight. Standing by.
2300 35 Fitness Sig. 7.
2330 36 Ex Lich S/Ldr Budge. Sqdn W. Grace left Lich for here today.
2345 37 Bombing details cancelled. It is now snowing hard at Cannock & QBB is 2500ft.

Thursday 3rd May 1945

1615. [illegible] have no news yet of Lancaster I or any other members of the Crew
1630. 27 Night X.C. & Bombing details cancelled, here & at Lichfield
1730. 28. Lancaster I. landed O.K. at Middleton
1800 29 Fitness Sig 6

Friday 4th May 1945

FRIDAY MAY 4th

2130 32 I have in current - Weather u/s over Bombing Range
2140 33 Lich have cancelled all Bombers Ops. Warned us to watch weather

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Serial No. (a)	Item (b)	Action to be taken (c)
4.	EQUIPMENT (Contd.)	
	(vii) Bicycles	To be removed to R.A.F. Station Fulbeck under arrangements to be made with Maintenance Command.
	(viii) Marine Craft	N/A.
	(ix) Explosives	Bomber Command to report to M.P.O., No. 21 M.U., Fauld, for disposal instructions.
	(x) Compressed Gases	Bomber Command to return to normal 42 Group Supply Unit.
	(xi) Aviation P.O.L.	Transferred to M.A.P.
	(xii) M.T. P.O.L.	Transferred to M.A.P.
	(xiii) Synthetic Training Equipment.	Bomber Command to arrange disposal in conjunction with Air Ministry (T.O.5).
	(xiv) Solid Fuel	Bomber Command to advise Air Ministry (E.12) of surplus. E.12 to arrange disposal.
	(xv) Medical and Dental Equipment.	Any surplus to be removed under instructions issued by Air Ministry (M.A.3.)
	(xvi) Rations	All reserve rations to be disposed of.
	(xvii) Fixed Workshop Plant	N/A.
	(xviii) Local Contracts	To be reduced to the minimum necessary

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JH/COPY

MC/72218/Org.1.

HEADQUARTERS,
MAINTENANCE COMMAND,
Royal Air Force,
Amport,
Andover,
Hants.

4th April, 1956.

Sir,

Disposal of Inactive Airfields - R.A.F. Church Broughton

I have the honour to refer to Air Ministry letter A.892232/46/O.2(e) dated 1st March,1956, and to enclose three copies of redundancy proforma and plans in respect of R.A.F. Church Broughton.

2. Copies of a certificate of search and clearance of explosives are also enclosed, but it will be noted that these are qualified, as the airfield has been occupied by the War Office since 3rd October,1946. It is not considered that a physical search for explosives would serve any useful purpose, but if this is considered essential it could only be carried out with the co-operation and assistance of the War Office.

I have the honour to be,
Sir,
Your obedient Servant,

(SG.D)(J. DOHERTY)
Squadron Leader
for Air Officer Commanding-in-Chief,
Maintenance Command.

The Under Secretary of State,
Air Ministry, (O.2(e)),
London, W.C.2.

... types of huts. 110 Nissens

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Certificate of Search and Clearance of Explosives and Dangerous Missiles

Location and Map Ref: R.A.F. CHURCH BROUGHTON

O.S. DERBYSHIRE sheet LIII

O.S. STAFFORDSHIRE sheet XXXIII

Date of Search: No Search.

1. IT IS CERTIFIED THAT A THOROUGH VISUAL SURFACE SEARCH HAS BEEN CARRIED OUT IN THE AREAS DEFINED ON THE ATTACHED PLAN.

Search not considered necessary; see below.

NO/THE FOLLOWING MISSILES AND/OR OTHER DANGEROUS OBJECTS HAVE BEEN RECOVERED:-

This site has been occupied by the War Office since 3rd October, 1946 Large numbers of troops and many thousands of vehicles have been accommodated on it, and it is considered that no useful purpose would be served by carrying out a search for explosives now.

2. *THE ITEMS LISTED AT PARA.1 ABOVE HAVE BEEN REMOVED FROM THE SITE AND/OR DESTROYED IN ACCORDANCE WITH CURRENT REGULATIONS.

DATE 27th March, 1956

SIGNATURE.....

RANK.....Wg Cdr...

OFFICER COMMANDING
ROYAL AIR FORCE LICHFIELD

* DELETE AS NECESSARY.

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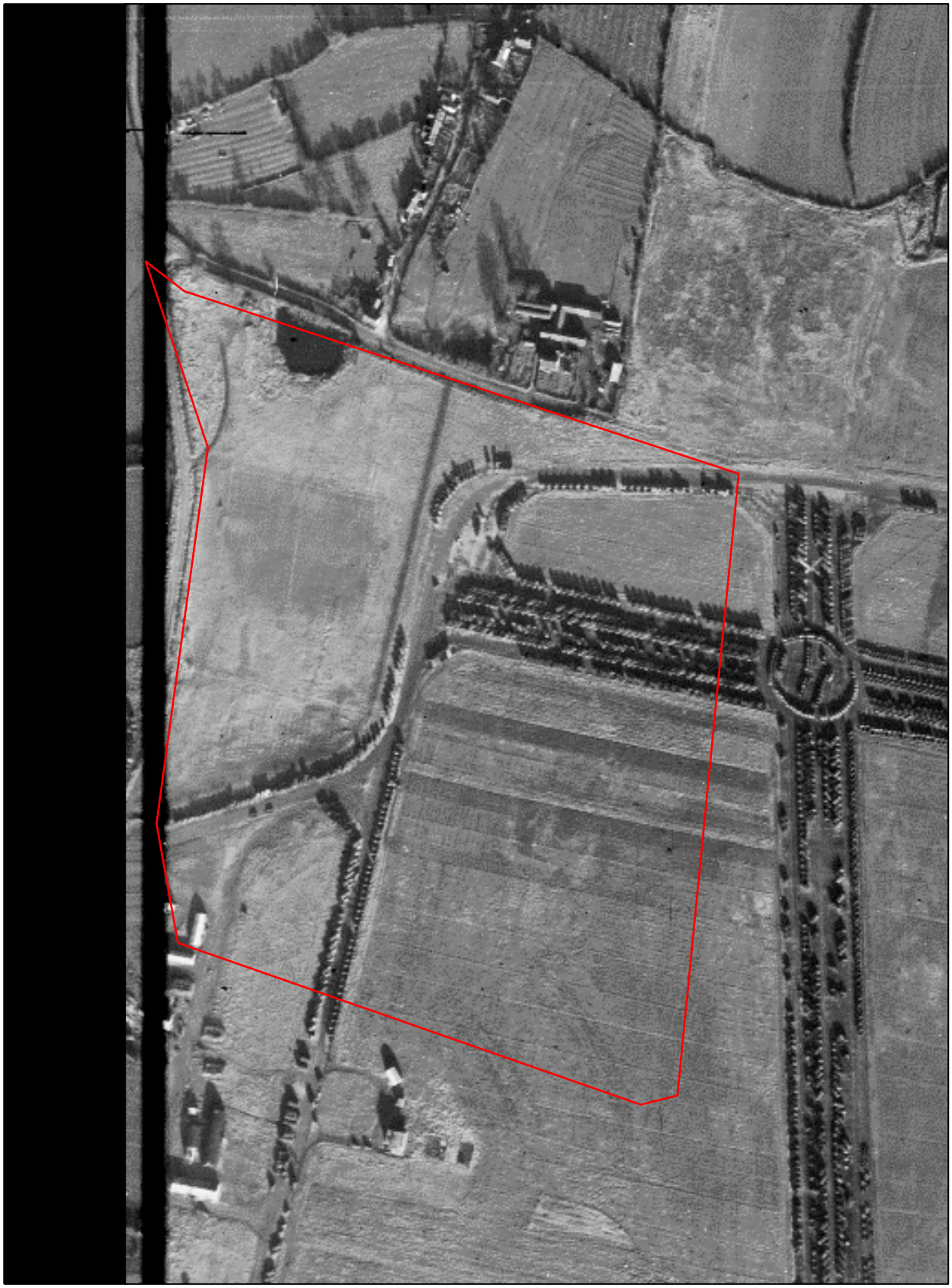
RAF Aerial Photography 15th December 1948

Annex: **Q1**



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Tel: +44 (0)1992 245 020

Client: **Applied Geology**

Approximate site boundary

N

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: National Monuments Record Office (Historic England)

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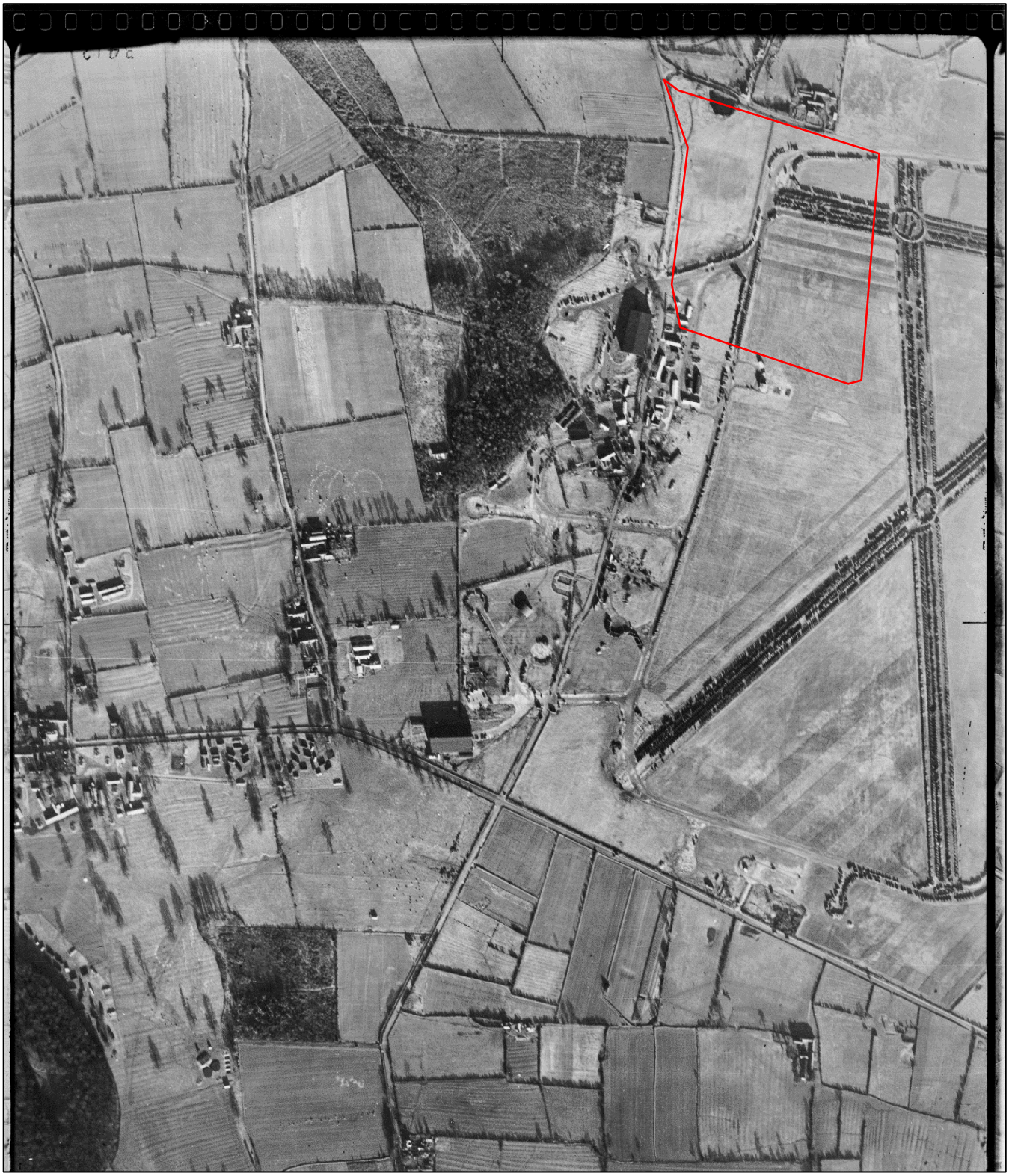
RAF Aerial Photography 15th December 1948

Annex: **Q2**



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Approximate site boundary

N

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: National Monuments Record Office (Historic England)

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1984 EOC Task Location

Annex: **R**

Mapped 1984 EOC Task Location

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Client: **Applied Geology**

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N

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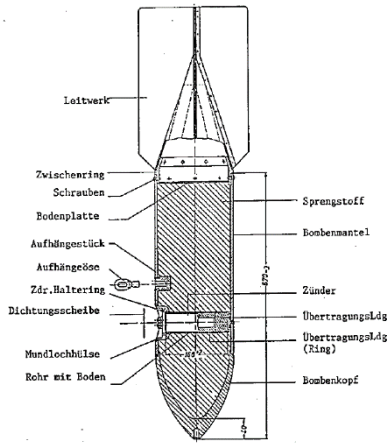
Common Types of German HE Air-Delivered Ordnance

Annex: **S1**

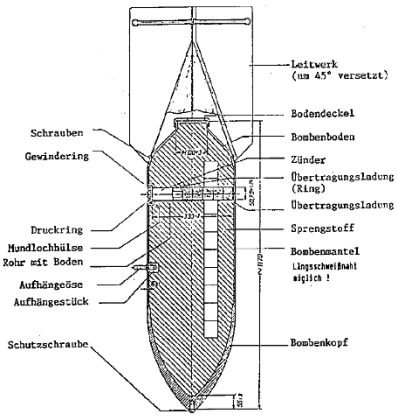
SC 50kg

Bomb Weight	40-54kg (110-119lb)
Explosive Weight	c25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



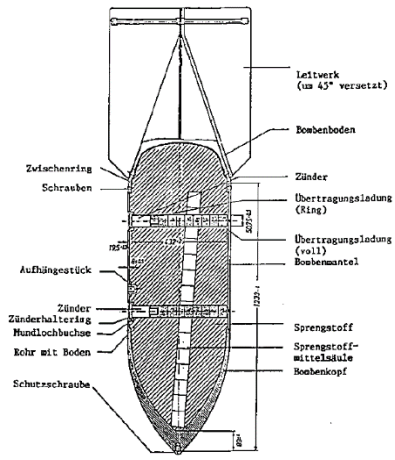
SC 250kg

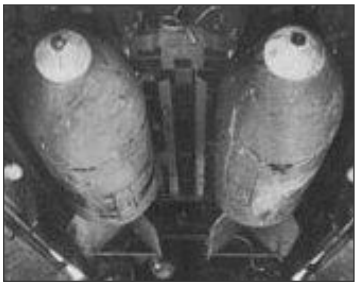
Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).



SC 500kg

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialen filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming





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Ref: **DA8179-00**

Source: Various sources

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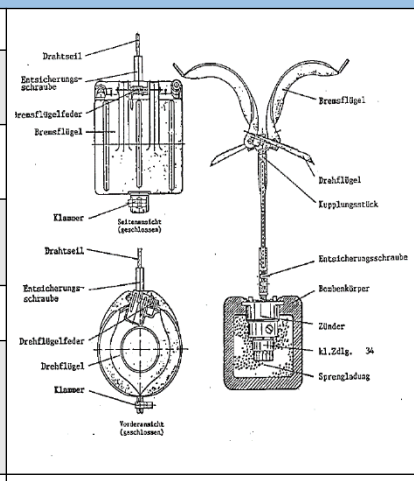
Common Types of German HE Air-Delivered Ordnance

Annex: **S2**

SD2 Butterfly Bomb

Bomb Weight	2kg (4.41lb)
Explosive Weight	7.5oz (212.6 grams) of TNT surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Bomb Dimensions	Length 240 mm Width 140 mm Height 310 mm
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	It was designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers that opened at a predetermined height, thus scattering the bombs.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

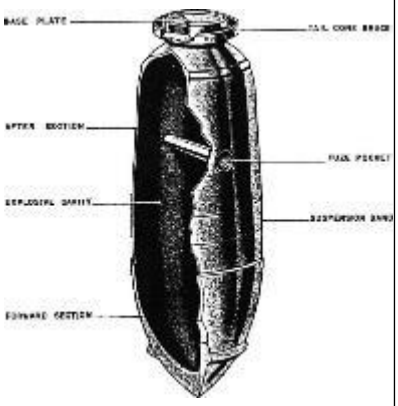


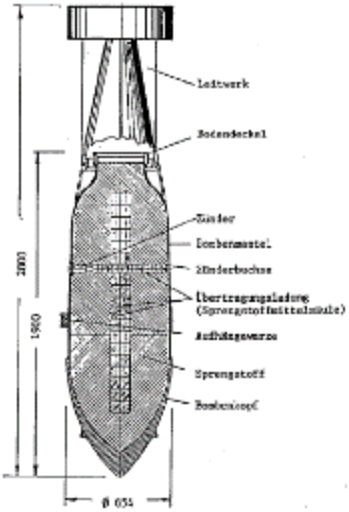
Parachute Mine (Luftmine B / LMB)

Bomb Weight	987.017kg (2176lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against civilian, military and industrial targets. Designed to detonate above ground level to maximise damage to a wider area.
Remarks	Parachute Mines were normally carried by HE 115 (Naval operations), HE 111 and JU 88 aircraft types. Deployed a parachute when dropped in order to control its descent.

SC 1000kg

Bomb Weight	996-1061kg (1,058-1,146lb)
Explosive Weight	530-620kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (77 x 25.2in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction





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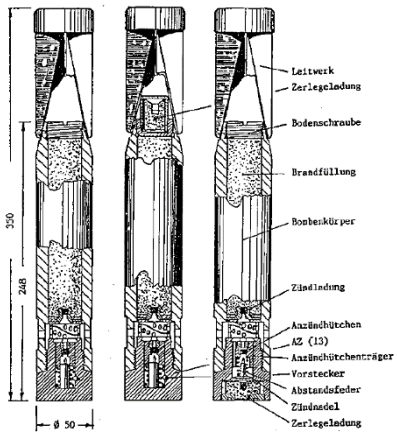
German Incendiary Bombs

Annex: **S3**

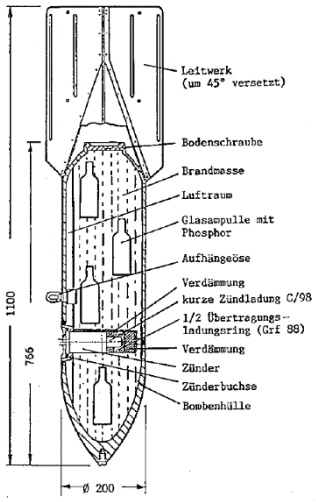
1kg Incendiary Bomb

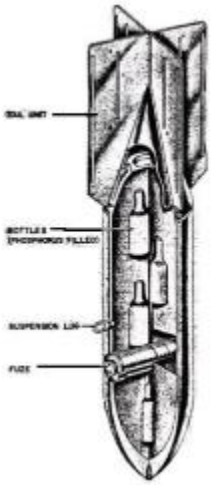
Bomb Weight	1.0 and 1.3kg (2.2 and 2.87lb)
Explosive Weight	680gm (1.3lb) Thermite
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters against towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



C50 A Incendiary Bomb

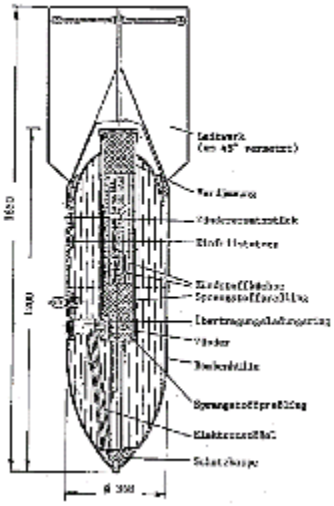
Bomb Weight	c41kg (90.4lb)
Explosive Weight	0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against all targets where an incendiary effect is to be expected
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture





Flam C-250 Oil Bomb

Bomb Weight	125kg (276lb)
Explosive Weight	1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on living targets, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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Client: **Applied Geology**

Project: **Land near Dove Valley Park, Derby**

Ref: **DA8179-00**

Source: Various sources

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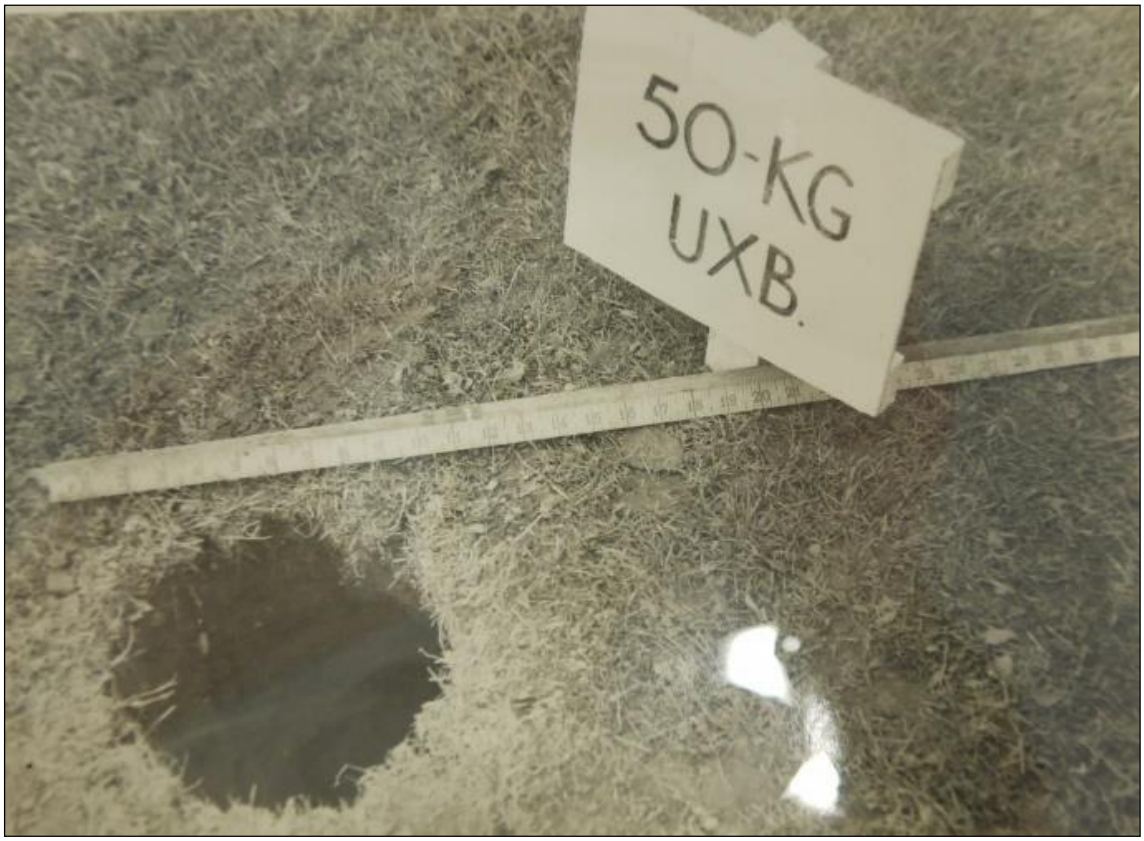
Unexploded Bomb Entry Hole Example

Annex: **T**



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Recent Unexploded Bomb Finds, UK

Annex: **U1**

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Bermondsey bomb: World War Two device safely removed

24 March 2015 | London

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The bomb measured about 5ft (1.5m) in length

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

250kg HE bomb found in Bermondsey March 2015

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England Regions London

Bethnal Green WW2 bomb: Experts remove unexploded device

11 August 2015 | London

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The MoD said the German WW2 air delivered bomb could have caused "mass destruction" if it had detonated

An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

250kg HE bomb found in Bethnal Green, Aug 2016

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England Regions Somerset

Bath WW2 bomb scare: Device defused, police say

13 May 2016 | Somerset

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The bomb was found on the site of a former school on Thursday

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

250kg HE bomb found in Bath, May 2016

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England Regions London

Wembley WW2 live bomb posed 'risk to life'

22 May 2015 | London

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A blast wall was put up around the bomb to minimise damage if it exploded

An unexploded World War Two bomb uncovered by builders near Wembley Stadium posed "a genuine risk to life", the Army has said.

50kg HE bomb found in Wembley, May 2015

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Source: BBC News

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Examples of Unexpected Detonation of WWII Bombs

Annex: **U2**

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.

BASF is expanding their its Ludwigshafen location by expanding several plants and building a TDI plant, which was the site of an explosion on Tuesday (Feb. 26). One person was injured in the blast, which BASF believes was caused when excavation work detonated a bomb.

Early reports had speculated that excavation work had detonated a bomb from World War II. While the age of the bomb has not been confirmed, BASF has said that an explosive device was detonated.

BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.

Tweet 0 Recommend 1

AP

A cutting machine lies wrecked by the side of the A3 motorway next to a small crater left by the explosion.

A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

The A3 Autobahn linking the cities of Frankfurt and Würzburg has been blocked in both directions.

More than 60 years since the end of World War II, construction workers still frequently unearth unexploded bombs and it is not uncommon for whole city districts to be cordoned off and even evacuated while bomb disposal experts defuse them.

Indeed, just last week, some 22,000 people were evacuated from their homes in Hanover when three World War II bombs were discovered.

Allied pilots rained nearly 2 million tons of explosives on Germany during the war. Landmines, hand grenades, mortar bombs and anti-tank devices from the fighting on German soil at the end of the war are also found, and authorities say it will take decades before the country is cleared of duds.

Between 400 and 600 bombs are discovered a year in the state of North Rhine-Westphalia alone, where the heavily industrialized Ruhr region was a major target for Allied bombers.

WWII bomb injures 17 at Hattingen construction site

Published: 19 Sep 08 16:53 CET

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Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

- Liberals grit teeth ahead of May state election (17 Mar 12)
- Nazi death camp guard Demjanjuk dies (17 Mar 12)
- Stupid stunt causes bomb scare chaos (16 Mar 12)

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

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2 June 2010 Last updated at 15:37

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World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

All the victims were involved in an operation to defuse the bomb

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

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Examples of Land Service Ammunition finds in the UK

Annex: **U3**

Unexploded Second World War bomb discovered under Somerset footpath

By Western Daily Press | Posted: January 21, 2014

The unexploded bomb was found in Somerset

Comments (0)

Report this article

An unexploded bomb dropped in Britain during the Second World War has finally been discovered – underneath a popular footpath in Somerset.

Unexploded WW2 bomb found at Kenfig Pool, Bridgend

23 August 2014 Last updated at 15:01

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Dean Smith believes the shell was made in Germany

Bomb experts have been called to a south Wales nature reserve after an unexploded World War Two shell was discovered by a walker in Bridgend.

Dean Smith, 38, of Pyle, was walking near Kenfig Pool on Saturday when he saw a fin sticking out of the sand.

He reached down to pick it up, but ending up falling and landed with the 2ft-long (0.6m) bomb on top of him.

The site has been cordoned off by police and the Royal Logistics Corps will carry out a controlled explosion.

Related Stories

'Panic' as dog nearly thrown grenade

WW2 bomb found at wind farm exploded

WWII bomb found in kitchen cupboard

Mortar thought to be from WWII found on Oshawa's Camp-X grounds

August 24, 2016 | 5:42 am

What is believed to be a World War II mortar has been discovered in south Oshawa. A man out in Intrepid Park, the site of the Camp-X Second World War training grounds, discovered the round with his metal detector on Tuesday evening. Durham police are held the scene overnight awaiting military officials from Trenton to come and properly detonate the mortar.

Unexploded bomb found in farmer's field

17 May 2010

A live Second World War mortar shell was blown up by Army experts after a farmer found it in his field.

The discovery was made in the field alongside the A20 between Folkestone and Dover.

The mortar shell, which was around a foot long and 3in in diameter, was around 50ft from the main road.

The farmer alerted police and PC Trevor Moody and PCSO Michelle Brady went to the field.

PC Moody contacted the Army who sent in a bomb disposal unit.

An Army officer confirmed the live shell was from the Second World War and was packed with high explosives.

They moved it a safe distance away from the A20 and carried out a controlled explosion.

PC Moody said: "Given that we live in an area that saw much action during the Second World War, it is not uncommon for us to be alerted about unexploded bombs."

The incident was on Thursday.

Click here for more news from Kent.

Royal Navy bomb disposal experts remove a World War Two shell discovered in a nature reserve

- **A World War Two bomb was discovered in a Plymouth nature reserve**
- **Amateur metal detector found the shell and partially dug it up**
- **Royal Navy experts carried the explosive away before disposing of it**

By VALERIE EDWARDS FOR MAILONLINE
PUBLISHED: 01:29, 13 January 2016 | **UPDATED:** 09:51, 13 January 2016

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A World War Two bomb was reportedly found at Efford Nature Reserve in Plymouth after a member of the public was metal detecting and partially dug it up.

The Royal Navy Bomb Disposal team was called in to remove the bomb and police have closed off Military Lane, with the possibility of Military Road also being closed.

Police were called at around 1.30pm yesterday after what appeared to be a shell was discovered and partially dug up near Military Lane, Efford.

Holiday beach cordoned off after landslip sends more than a THOUSAND Second World War bombs and rockets tumbling onto the sands

- **Bad weather led to ground movement which exposed the huge arsenal at Mappleton, East Riding**
- **A dog walker stumbled across the deadly find on Saturday and 15 controlled explosions were carried out**
- **Rockets, mortar bombs and 25-pounder bombs were recovered after they were fired into the cliffs by RAF aircraft during the war**
- **Most of the devices were dummy rounds used for bombing practice but contain enouqh explosives to cause terrible injuries**

© Jonathan Pow

Bomb Beach Alley: Rockets were found after a landslide on Mappleton beach in 2012

Army bomb disposal team called to Blacksole Bridge in Herne Bay

by Aidan Barlow abarlow@thekmgroup.co.uk 08 July 2015

It was like a scene from Dad's Army when Army bomb disposal experts found wartime explosives made by the Home Guard in makeshift bottles.

A team was called to the Blacksole Bridge in Herne Bay after the wartime bombs were found.

The team from the Royal Logistics Corps set up a 30 metre exclusion zone for pedestrians around the railway embankment after the suspected homemade phosphorous bombs were found.

The scene at Blacksole Bridge after wartime explosives were found in the railway cutting

Tweet

Published by How Oxburgh
Posted: 03/06/14
Updated: 03/06/14

Unexploded bomb found in Axminster

Update: The bomb disposal unit has made the device safe and the road has re-opened.

Six homes have been evacuated today after the discovery of an unexploded device in Axminster.

A Royal Navy bomb disposal team have been called to the scene after a 'historic German device' was discovered in a garden.

Police have set up a 20m cordon around the garden in Alexandra Road and evacuated homes in the surrounding area as a precaution.

Storms and floods unearth unexploded wartime bombs

By Claire Marshall
BBC environment correspondent

There has been a dramatic increase in the number of wartime bombs unearthed because of the winter storms and flooding.

Bomb disposal teams in the South West have dealt with double the number of unexploded ordnance than in the same period last year.

Since mid December, the Royal Navy's Southern Dive Unit has recovered or disposed of 244 items of ordnance.

During the same period last year, they dealt with just 108 items.

The storms have uncovered a lethal past

Almost 70 years after the end of WWII, one legacy of that conflict continues to turn up on beaches and harbours around Britain.

Unexploded shells, bombs and mines continue to be discovered every year, and the Royal Navy's Southern Dive Unit is tasked with making these devices safe.

Its area of responsibility stretches for some 2,250km (1,400 miles). It begins from the highwater mark in Hull and proceeds seaward to the territorial limit, and then runs clockwise around the British Isles - including the Isle of Wight, Channel Islands, and Isles of Scilly - to finish in Liverpool.

Related Stories

Ancient trees revealed by storms

Land Service Ammunition (LSA) resulting from historic military activity is commonly encountered across the UK by the public and construction industry alike. Such finds are much more common in rural areas than in urban environments, and can often be anticipated in areas such as former RAF stations or ranges. However, many such items are encountered entirely by surprise where the landowner or developer has no knowledge of any previous military use of the land.

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Ref:	**DA8179-00**
Source:	Various news sources

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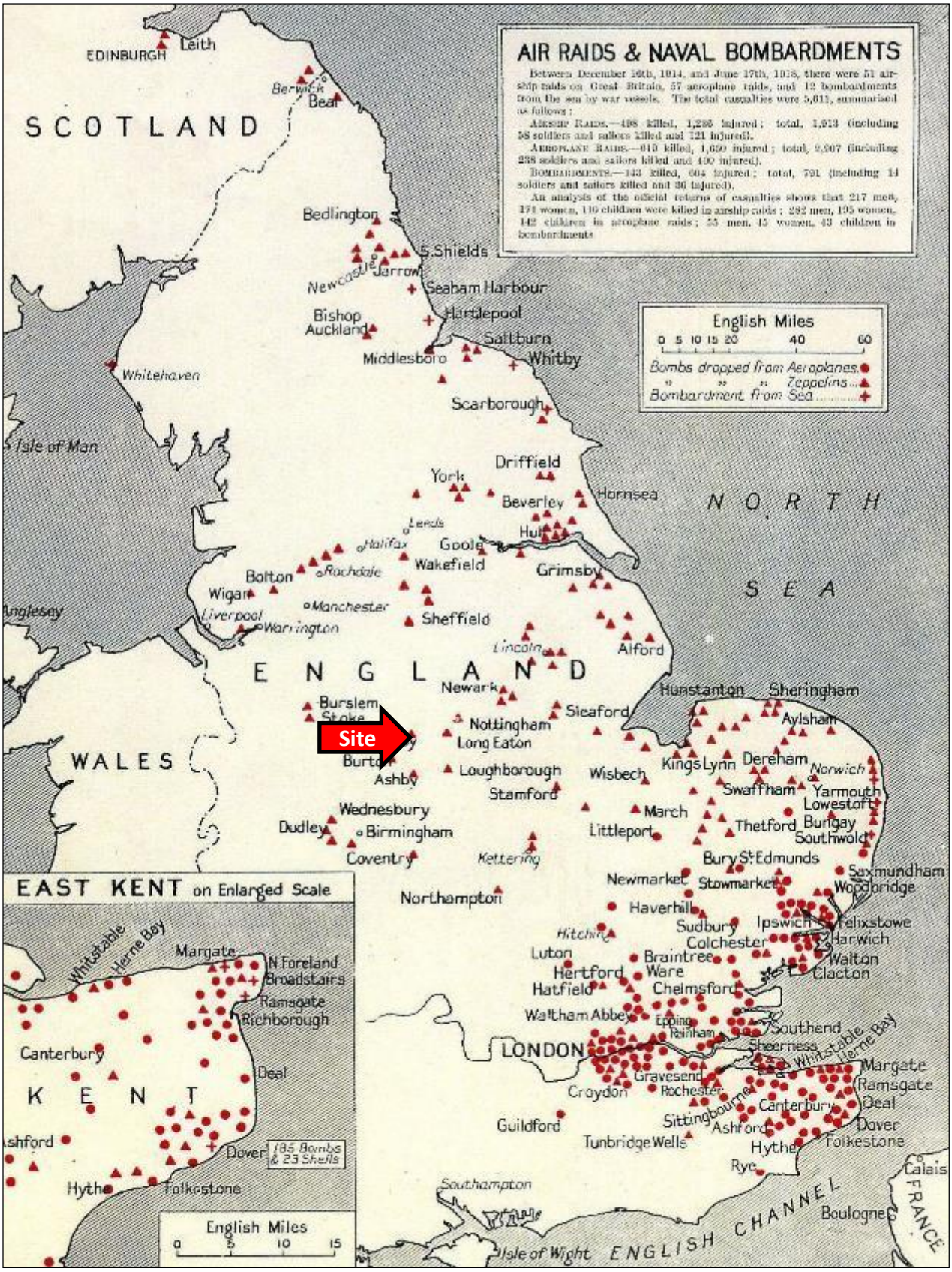
WWI Bomb Plot Map of Air Raids and Naval Bombardments

Annex: V



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Ref: **DA8179-00**

Source: J. Morris, German Air Raids on Britain, The Navel and Military Press. 1983

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APPENDIX C

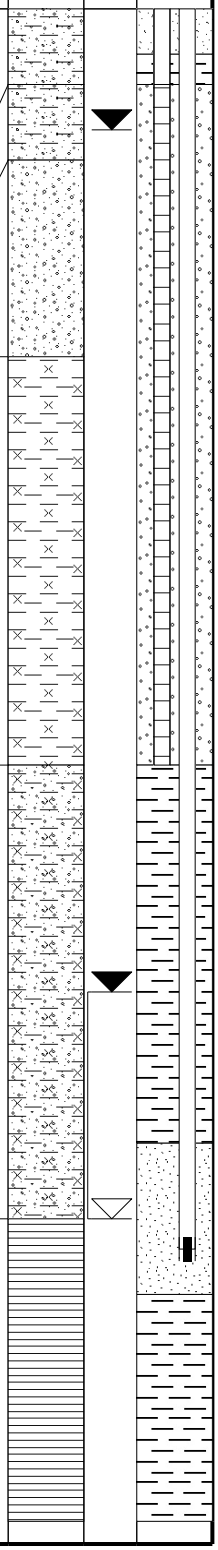
BOREHOLE LOG - ROTARY

CP01

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	1 of 3
Start	11/03/2019	**Coordinates**	E 420057.80 N 332686.24	**Scale**	1:50
End	13/03/2019	**Ground Level**	74.67m AOD	**Total Depth**	21.50m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata
			B	0.00				Grass over, soft light brown slightly gravelly slightly sandy CLAY with occasional roots and rootlets. Sand is coarse. Gravel is fine to coarse angular to subrounded quartzite and sandstone.
			ES	0.20			(0.50)	
			B	0.50		74.17	0.50	Soft to firm orangish brown slightly gravelly sandy CLAY. Sand is coarse. Gravel is fine to coarse angular to subrounded sandstone and occasional quartzite.
			ES				(0.50)	
			D	1.00		73.67	1.00	Medium dense orangish brown sandy GRAVEL. Gravel is fine to coarse angular to subrounded sandstone, quartzite and possible flint.
			B	1.20				*From 1.20m bgl: cobbles of sandstone and quartzite.*
			S (C)		N = 22		(1.30)	
			S (C)	2.00	N = 19			
			B	2.30		72.37	2.30	Firm to stiff thinly laminated light brown occasionally mottled grey silty CLAY.
			D	2.60				
			S		N = 18			
			B	3.05				
							(2.70)	
			UT	3.80				
					(34)			
			B	4.25				
			D					
			D	5.00		69.67	5.00	Firm reddish brown slightly gravelly slightly sandy silty CLAY with occasional pockets of light greenish grey silt. Sand is coarse. Gravel is fine to coarse angular siltstone.
			S		N = 24			
			D	6.00				*From 6.00m bgl: fine to coarse angular mudstone lithorelicts.*
			B	6.50			(3.00)	*From 6.50m bgl: very friable and becoming more structured.*
			UT					
					(42)			
			D	7.00				*From 7.00m bgl: becoming very silty.*
			S		N = 26			
			D	7.60				
			D	8.00		66.67	8.00	Extremely weak reddish brown occasionally mottled light grey silty MUDSTONE recovered as fine to coarse angular mudstone gravel.
			ES					
			D	8.50				
			S		N = 38			
			D	9.40			(2.84)	
			D	9.80				
			S		N >50			

Continued next sheet



Installation: 50mm diameter standpipe installed to 5.00m bgl. 19mm diameter standpipe piezometer installed to 8.30m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 10.84m bgl. Rotary open holed from 10.84m to 11.00m bgl to clean out. Rotary Cored from 11.00m to 21.00m bgl. 1 hr chiseling from 10.10m to 10.55m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
0.80	0.80			2.30
8.00	6.50		7.50	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 10.70m
121mm to 21.60m

Exploratory hole logs should be read in conjunction with key s heet

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

CP01

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	2 of 3
Start	11/03/2019	**Coordinates**	E 420057.80 N 332686.24	**Scale**	1:50
End	13/03/2019	**Ground Level**	74.67m AOD	**Total Depth**	21.50m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
			B	10.10				Extremely weak reddish brown occasionally mottled light grey silty MUDSTONE recovered as fine to coarse angular mudstone gravel.			
			D S	10.55	N >50	63.83	10.84				
11.00								No recovery.	NR NR		
	33 15 12						(1.16)				
			D	12.00		62.67	12.00	Extremely weak light greenish grey occasionally mottled orangish brown SILTSTONE. Fractures are typically 10 to 20 degrees medium spacing planar smooth and open. (Grade C) *From 12.00m to 12.17m bgl: non intact.* *From 12.17m to 12.36m bgl: weak.* *From 12.36m to 12.44m bgl: non intact.* *From 12.44m bgl: becoming weak.*			
		NI 50 180	C	12.17 - 12.36			(0.50)				
12.50			D	12.50		62.17	12.50				
		NI 100 200	S (C)		N >50		(0.50)				
			C	12.60 - 12.80		61.67	13.00				
	93 65 34	NI 40 60	C	13.00 - 13.20		61.37	(0.30) 13.30	Extremely weak to weak reddish brown silty MUDSTONE. Fractures are typically 5 to 10 degrees closely spaced planar smooth and open. (Grade C)			
			D	13.25							
		NI 100 200	C	13.50 - 13.65			(0.88)	Weak light greenish grey SILTSTONE. Fractures are 10 degrees very closely spaced stepped rough and open. (Grade C) *From 13.20m to 13.30m bgl: non intact.*			
14.00			D	14.10							
			C	14.20 - 14.30		60.49	14.18	Extremely weak to weak reddish brown occasionally mottled light grey silty friable MUDSTONE. Fractures are typically 20 degrees medium spaced irregular stepped rough and open with occasional reddish brown clay along partings. (Grade C) *At 13.90m to 13.95m bgl: non intact.* *From 14.00m to 14.18m bgl: non intact.* *At 14.05m to 14.10m bgl: band of extremely weak light greenish grey siltstone.*			
	95 63 14	NI 20 100	D	15.00			(1.60)				
15.50			S (C)	15.50	N >50			Extremely weak reddish brown silty MUDSTONE. Fractures are 5 to 15 degrees and 70 to 120 degrees medium to closely spaced stepped rough open and occasionally infilled with reddish brown clay. (Grade C to D)			
			C	15.90 - 16.00		58.89	15.78				
	95 62 39		D	16.00				Weak locally extremely weak thinly laminated reddish brown silty MUDSTONE. Fractures are typically 10 to 30 degrees medium to closely spaced stepped rough open. (Grade C to D) *From 16.00m to 16.10m bgl: non intact.*			
			C	16.00 - 16.20							
17.00		NI 100 500	D	17.00			(2.72)	*Below 17.00m bgl: extremely weak to weak. Fractures are occasionally subvertical (60 to 80 degrees) occasionally infilled with reddish brown clay.*			
	99 77 67		C	17.50 - 17.80							
			D	18.30				*From 18.30m to 18.40m bgl: non intact.*			
18.50			S (C)	18.50	N >50	56.17	18.50	No recovery.	NR NR		
	37 33 23	N/A					(0.95)				
			D	19.45		55.22	19.45	Weak locally extremely weak thinly laminated reddish brown silty MUDSTONE. Fractures are 5 to 20 degrees medium spaced planar smooth and open. (Grade C)			
		NI 70 350	C	19.50 - 19.85			(0.55)				
20.00						54.67	20.00	Continued next sheet			

Installation: 50mm diameter standpipe installed to 5.00m bgl. 19mm diameter standpipe piezometer installed to 8.30m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 10.84m bgl. Rotary open holed from 10.84m to 11.00m bgl to clean out. Rotary Cored from 11.00m to 21.00m bgl. 1 hr chiseling from 10.10m to 10.55m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
0.80	0.80			2.30
8.00	6.50		7.50	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 10.70m
121mm to 21.60m

Exploratory hole logs should be read in conjunction with key s heet

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

CP01

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	3 of 3
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End	13/03/2019	**Ground Level**	74.67m AOD	**Total Depth**	21.50m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
		N/A					(0.50)	Weak locally extremely weak thinly laminated reddish brown silty MUDSTONE. Fractures are 5 to 20 degrees medium spaced planar smooth and open. (Grade C) *From 19.45m to 19.50m bgl: non intact.*	NR NR NR NR NR NR		
	26 43 68	NI 70 150	C	20.63 - 20.80		54.17	20.50	No recovery.			
			D	21.40			(1.00)	Weak locally extremely weak thinly laminated reddish brown silty MUDSTONE. Fractures are 5 to 15 degrees closely spaced planar smooth open occasionally stepped rough open. (Grade C)			
21.50						53.17	21.50	End of Borehole at 21.50m			

Installation: 50mm diameter standpipe installed to 5.00m bgl. 19mm diameter standpipe piezometer installed to 8.30m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 10.84m bgl. Rotary open holed from 10.84m to 11.00m bgl to clean out. Rotary Cored from 11.00m to 21.00m bgl. 1 hr chiseling from 10.10m to 10.55m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
0.80	0.80			2.30
8.00	6.50		7.50	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 10.70m
121mm to 21.60m

Exploratory hole logs should be read in conjunction with key s heet

APPLiED GEOLOGY

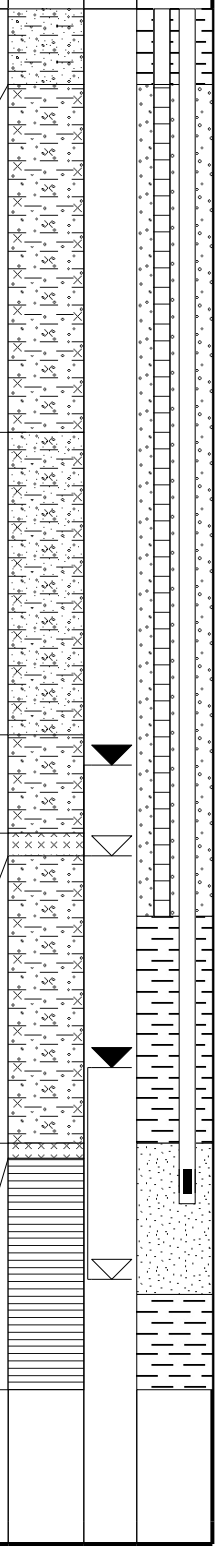
BOREHOLE LOG - CABLE PERCUSSION

CP02

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	1 of 1
Start	13/03/2019	**Coordinates**	E 420246.90 N 332624.26	**Scale**	1:50
End	13/03/2019	**Ground Level**	73.10m AOD	**Total Depth**	9.13m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata
B	0.00					Grass over, soft light brown slightly gravelly sandy CLAY with frequent roots and rootlets. Gravel is fine to coarse angular sandstone and occasional quartzite and very rare brick fragments.
ES	0.30				(0.50)	
				72.60	0.50	*From 0.30m bgl: cobbles of sandstone.*
ES	0.60					Firm locally stiff orangish brown to light greenish grey slightly gravelly silty CLAY. Gravel is fine to coarse subrounded sandstone and quartzite.
D	0.70					
ES	0.90					
UT	1.20	(28)				
B	1.65				(2.30)	*From 1.65m bgl: becoming more light greenish grey mottled orangish brown.*
D	1.65					
C	2.10	N = 23	2.00			
D	2.60					
UT	2.80	(42)		70.30	2.80	Firm reddish brown slightly silty sandy gravelly CLAY. Sand is coarse. Gravel is fine to coarse angular to subrounded sandstone, quartzite and possible flint.
B	3.25					
					(2.00)	
D	4.00					*From 4.00m bgl: becoming stiff.*
S	4.00	N = 22	3.00			
D	4.60					
D	4.80			68.30	4.80	Firm reddish brown occasionally mottled light greenish grey slightly gravelly silty CLAY. Gravel is fine to coarse angular mudstone lithorelicts.
UT	5.00	(55)			(0.65)	
D	5.45			67.65	5.45	Weak to medium strong light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravel.
D	5.60			67.50	(0.15)	
					5.60	Firm becoming stiff with depth reddish brown slightly gravelly silty CLAY. Gravel is fine to coarse angular mudstone lithorelicts.
D	6.50				(1.90)	
S	6.50	N = 21	6.50			
D	7.30					
D	7.50			65.60	7.50	Weak light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravel.
				65.50	(0.10)	
					7.60	Extremely weak to weak reddish brown friable silty MUDSTONE recovered as fine to coarse angular mudstone gravel.
D	7.90					
S	7.90	N = 50				
D	8.40				(1.53)	
D	8.60					
D	8.90					
S	8.90	N >50	8.00	63.97	9.13	End of Borehole at 9.13m

Legend | **GW** | **Install**



Chiselling

From	To	Duration (hh:mm)
5.45	5.60	00:30
8.60	8.90	01:00

Groundwater Strikes

Depth Strike	Rose to	Remarks	Cased	Sealed
5.60	5.00		5.00	7.00
8.40	7.00		8.00	

Drilled: TS

Logged: MS

Checked: AS

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 6.00m bgl. 19mm diameter standpipe piezometer installed to 7.90m bgl.

Diameter: 150mm to 9.13m

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

CP03

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	1 of 3
Start	07/03/2019	**Coordinates**	E 420157.34 N 332563.19	**Scale**	1:50
End	07/03/2019	**Ground Level**	72.98m AOD	**Total Depth**	24.80m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
			B	0.10			(0.50)	Crops over dark brown slightly gravelly sandy CLAY with occasional roots and rootlets. Gravel is fine to coarse angular to subrounded quartzite and sandstone. (TOPSOIL)			
			ES	0.40		72.48	0.50	Firm yellowish/orangish brown occasionally mottled grey slightly gravelly silty CLAY. Gravel is fine to coarse angular to subrounded quartzite and sandstone.			
			D	0.70							
			ES	1.00							
			D	1.20							
			S		N = 10						
			B	1.65							
			ES	2.00							
			UT	2.20							
					(25)						
			D	2.80				*From 2.80m bgl: no longer gravelly.*			
			D	3.00			(4.95)	*From 3.00m bgl: becoming firm to stiff.*			
			S		N = 12						
			B	3.45							
			UT	4.00							
					(36)						
			D	4.45							
			D	4.80							
			D	5.00				*From 5.00m bgl: becoming thinly laminated.*			
			S		N = 20						
						67.53	5.45	Firm reddish brown silty CLAY with occasional pockets of light greenish grey silt.			
			D	6.00							
			UT	6.50				*From 6.50m bgl: with fine to coarse angular mudstone lithorelicts.*			
					(40)						
			D	7.00			(3.05)	*From 7.00m bgl: becoming stiff to very stiff.*			
			D	8.00							
			S		N >50						
			B	8.50		64.48	8.50	Extremely weak thinly laminated reddish brown silty MUDSTONE, recovered as fine to coarse angular mudstone gravel.			
			D	9.00			(0.82)	*From 9.00m bgl: becoming weak.*			
			S		N >50						
						63.66	9.32	No recovery.	NR NR NR NR NR NR NR NR		

Continued next sheet

Installation: 50mm diameter standpipe installed to 24.80m bgl. 19mm diameter standpipe piezometer installed to 7.8m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 9.30m bgl. Rotary Cored from 9.30m to 25.00m bgl. 1 hr chiseling from 8.50m to 9.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
7.50	7.00		6.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 9.00m
121mm to 25.05m

BOREHOLE LOG - ROTARY

CP03

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	2 of 3
Start	07/03/2019	**Coordinates**	E 420157.34 N 332563.19	**Scale**	1:50
End	07/03/2019	**Ground Level**	72.98m AOD	**Total Depth**	24.80m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
							(1.78)	No recovery.	NR		
		N/A									
10.80			S (C)	10.80	N = 46						
			D	11.20		61.88	11.10	Extremely weak reddish brown silty MUDSTONE with reddish brown clay along partings. Recovered as angular mudstone gravel. Fractures are typically 5 to 25 degrees very closely spaced stepped and irregular open and locally infilled with clay. (Grade D)			
	77 29 29	NI 100 180					(0.70)				
			C	11.80 - 12.00		61.18	11.80				
		NI 100 250					(0.50)	Weak locally extremely weak thinly laminated reddish brown occasionally mottled light greenish grey silty MUDSTONE. Fractures are typically 5 to 10 degrees medium spaced planar smooth closed and infilled with reddish brown clay. (Grade C)			
			C	12.00 - 12.16							
12.30			D	12.20		60.68	12.30				
	20 5 0	N/A					(1.20)	No recovery.	NR		
		NI 10 30	D	13.60		59.48	13.50 (0.30)	Extremely weak thinly laminated reddish brown silty MUDSTONE occasionally recovered as gravel. Fractures are typically 20 to 30 degrees very closely spaced stepped rough and open. (Grade C)			
13.80			S (C)	13.80	N >50	59.18	13.80				
	0 0 0							No recovery.	NR		
15.30		N/A	S (C)	15.30	N >50		(3.00)				
	0 0 0										
16.30			S (C)	16.30	N >50						
	57 15 10	NI 50 100	D	16.90		56.18	16.80 (0.30)	Extremely weak locally weak light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravels. Fractures are typically 25 to 30 degrees very closely to closely spaced stepped and locally irregular rough open and occasionally infilled with clay. (Grade D) *From 16.80m to 17.00m bgl: siltstone is non intact.*			
		N/A	D	17.15		55.88	17.10				
17.30			C	17.25 - 17.30		55.78	(0.10)				
		NI 100 150	S (C)	17.30	N >50	55.68	17.20 (0.10)				
	100 43 27		D	17.40			17.30 (0.80)	Stiff to very stiff reddish brown slightly gravelly very silty CLAY. Gravel is fine to coarse angular mudstone lithorelicts.			
						54.88	18.10	Extremely weak light greenish grey SILTSTONE. Fractures are typically 5 to 10 degrees extremely closely spaced planar smooth and open. (Grade D)			
			D	18.70				Extremely weak thinly laminated reddish brown silty MUDSTONE. Fracture set 1 are typically 5 to 20 degrees extremely closely spaced stepped and/or irregular rough open and occasionally infilled with reddish brown clay. Fracture set 2 are 70 to 80 degrees medium spaced stepped rough and open. (Grade C) *From 17.40m to 17.50m bgl: non intact.* *From 17.80m to 17.90m bgl: non intact.*			
18.80		NI 200 700	C	18.80 - 18.95							
	88 82 53		D	19.40							
							(3.70)	Weak locally extremely weak reddish brown silty MUDSTONE.			

Continued next sheet

Installation: 50mm diameter standpipe installed to 24.80m bgl. 19mm diameter standpipe piezometer installed to 7.8m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 9.30m bgl. Rotary Cored from 9.30m to 25.00m bgl. 1 hr chiseling from 8.50m to 9.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
7.50	7.00		6.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 9.00m
121mm to 25.05m

BOREHOLE LOG - ROTARY

CP03

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	3 of 3
Start	07/03/2019	**Coordinates**	E 420157.34 N 332563.19	**Scale**	1:50
End	07/03/2019	**Ground Level**	72.98m AOD	**Total Depth**	24.80m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
			C	20.10 - 20.30				Weak locally extremely weak reddish brown silty MUDSTONE. Fractures set 1 are typically 10 to 20 degrees very closely spaced stepped rough open and occasionally infilled with clay. Fracture set 2 are 90 degrees widely spaced planar smooth and open. (Grade C)			
20.30			D	20.30				*From 18.50m to 18.60m bgl: non intact.* *From 19.40m to 19.60m bgl: non intact.* *From 20.80m to 20.87m bgl: non intact.*			
	100 89 64		D	20.80							
			D	21.70							
21.80						51.18	21.80	*At 21.75m to 21.50m bgl: thin band of light greenish grey siltstone.* No recovery.	NR NR		
	33 33 26	N/A					(1.00)				
			D	22.70		50.18	22.80	Very stiff reddish brown slightly silty gravelly friable CLAY with occasional pockets of light greenish grey silt. Gravel is fine to coarse angular mudstone lithorelicts. (Grade D) *From 23.30m to 24.30m bgl: no recovery.*			
			D	23.10							
23.30		N/A					(1.50)				
	51 39 25		D	24.20				*At 24.20m bgl: fine to coarse angular siltstone gravels.*			
		400	C	24.40 - 24.80		48.68	24.30 (0.40)	Extremely weak locally weak thinly laminated reddish brown silty MUDSTONE. Fractures are typically 10 to 25 degrees medium spaced stepped rough open and occasionally infilled with reddish brown clay. (Grade C)			
24.80		NA	D	24.70		48.28	24.70 (0.05)	Extremely weak light greenish grey SILTSTONE. Fractures are 70 degrees very closely spaced stepped rough and open. (Grade C)			
			D	24.80		48.23	24.75 (0.05)	Very stiff reddish brown slightly silty gravelly friable CLAY with occasional pockets of light greenish grey silt. Gravel is fine to coarse angular mudstone lithorelicts. (Grade D)			
						48.18	24.80	End of Borehole at 24.80m			

Installation: 50mm diameter standpipe installed to 24.80m bgl. 19mm diameter standpipe piezometer installed to 7.8m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 9.30m bgl. Rotary Cored from 9.30m to 25.00m bgl. 1 hr chiseling from 8.50m to 9.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
7.50	7.00		6.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 9.00m
121mm to 25.05m

Exploratory hole logs should be read in conjunction with key s heet

APPLiED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP04

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	1 of 2
Start	14/03/2019	**Coordinates**	E 420028.01 N 332547.12	**Scale**	1:50
End	15/03/2019	**Ground Level**	72.76m AOD	**Total Depth**	11.32m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata
B	0.00					Grass over, soft light brown slightly gravelly sandy CLAY with frequent roots and rootlets. Gravel is fine to coarse angular to subrounded quartzite and sandstone.
ES	0.20				(0.40)	
ES	0.40			72.36	0.40	
D	0.50					Soft to firm orangish brown occasionally light grey slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse angular to subrounded quartzite and sandstone.
ES	0.70					
D	1.00				(1.10)	
UT	1.20	(25)				
				71.26	1.50	Firm light orangish brown very silty CLAY.
D	1.80					
D	2.00					
S	2.00	N = 7	1.50			
D	2.90					*From 2.90m bgl: occasionally mottled light grey.*
B	3.00					
UT	3.00	(20)				
D	3.50					
S	3.50	N = 11	3.50			
B	3.95					
D	4.50					
S	4.50	N = 26	4.50			
D	5.30					
D	5.30					
S	5.50	N = 29	5.50			
					(9.20)	
D	6.50					
B	7.00					*From 7.00m bgl: stiff.*
UT	7.00	(45)				
D	7.50					
S	7.50	N = 32	6.00			
UT	8.00	(50)				
B	8.40					
C	8.50	N = 35	6.00			
D	9.50					
C	10.00	N = 41	6.00			

Continued next sheet

Chiselling

From	To	Duration (hh:mm)
10.70	11.05	01:00

Groundwater Strikes

Depth Strike	Rose to	Remarks	Cased	Sealed
3.00	2.50			4.50
9.50	8.50		6.00	

Drilled: TS

Logged: MS

Checked: AS

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 11.00m bgl.

Diameter: 150mm to 11.32m

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

CP04

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	2 of 2
Start	14/03/2019	**Coordinates**	E 420028.01 N 332547.12	**Scale**	1:50
End	15/03/2019	**Ground Level**	72.76m AOD	**Total Depth**	11.32m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
						Firm light orangish brown very silty CLAY. *From 10.00m bgl: becoming very stiff.*			
D	10.60								
D	10.70			62.06	10.70				
S	11.05	N >50	6.00		(0.62)	Extremely weak reddish brown very silty friable MUDSTONE recovered as fine to coarse angular mudstone gravel..			
				61.44	11.32				
D	11.50					End of Borehole at 11.32m			

Chiselling			Groundwater Strikes					
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
10.70	11.05	01:00	3.00	2.50			4.50	**Drilled:** TS
			9.50	8.50		6.00		**Logged:** MS
								Checked: AS

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Installation: 50mm diameter standpipe installed to 11.00m bgl.

Diameter: 150mm to 11.32m

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

CP05

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	1 of 3
Start	12/03/2019	**Coordinates**	E 420176.68 N 332472.11	**Scale**	1:50
End	15/03/2019	**Ground Level**	71.76m AOD	**Total Depth**	22.57m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
			B	0.00				Grass over, soft light brown slightly gravelly sandy CLAY with frequent roots and rootlets. Sand is coarse. Gravel is fine to coarse angular sandstone and quartzite.			
			ES	0.10			(0.40)				
			B	0.40		71.36	0.40				
			ES	0.50				Orangish brown slightly clayey sandy GRAVEL. Sand is coarse. Gravel is fine to coarse angular sandstone and quartzite.			
			ES	1.00							
			S (C)	1.20	N = 26		(1.50)	*From 1.20m bgl: medium dense, with occasional cobbles of sandstone.*			
			D	1.80							
			B	2.00		69.86	1.90	Firm locally stiff brown occasionally mottled light grey occasionally mottled orange slightly gravelly silty CLAY. Gravel is fine to coarse angular to subrounded quartzite and sandstone.			
			S (C)		N = 23						
			B	3.00			(2.10)				
			S (C)		N = 27						
			UT	4.00		67.76	4.00	Firm locally stiff reddish brown occasionally mottled light grey slightly gravelly silty CLAY. Gravel is fine to coarse angular mudstone lithorelicts and occasional siltstone.			
					(42)						
			D	4.45							
			D	4.90			(1.80)				
			S		N = 18			*From 5.00m bgl: locally stiff.*			
			D	5.80		65.96	5.80				
						65.76	(0.20)	Medium strong to strong light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravel.			
							6.00	Firm locally stiff becoming stiff with depth reddish brown slightly gravelly silty CLAY. Gravel is fine to coarse angular mudstone lithorelicts.			
			D	6.40							
			UT	6.50							
					(40)						
							(2.00)				
			D	7.20							
			D	7.60							
			D	8.00		63.76	8.00	Extremely weak thinly laminated light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravel.			
			S		N = 30						
			D	9.00							
			D	9.50			(3.11)				
			S		N = 45						

Continued next sheet

Installation: 50mm diameter standpipe installed to 12.00m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 11.11m bgl. Rotary Cored from 11.11m to 22.50m bgl. 30 mins chiseling from 5.80m to 6.00m bgl and 1 hr chiseling from 10.40m to 10.80m bgl

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
9.00	7.50		9.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 11.11m
121mm to 22.50m

BOREHOLE LOG - ROTARY

CP05

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	2 of 3
Start	12/03/2019	**Coordinates**	E 420176.68 N 332472.11	**Scale**	1:50
End	15/03/2019	**Ground Level**	71.76m AOD	**Total Depth**	22.57m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
			D	10.40				Extremely weak thinly laminated light greenish grey SILTSTONE recovered as fine to coarse angular siltstone gravel.			
			D S	10.80	N >50	60.65	11.11	No recovery.	NR		
12.00		N/A					(1.69)				
	43 27 23		D	12.80		58.96	12.80	Extremely weak to weak thinly laminated reddish brown silty MUDSTONE. Fractures are 5 degrees medium spaced stepped rough and open. (Grade C) *From 12.80m to 12.95m bgl: non intact.*			
		NI 100 150	C	13.15 - 13.30		58.41	(0.55) 13.35				
13.50			D	13.40		58.26	(0.15) 13.50	Extremely weak light greenish grey SILTSTONE. Fractures are 5 to 10 degrees very closely spaced stepped rough open and occasionally infilled with reddish brown clay. (Grade C to D)			
		N/A	S (C)	13.50	N >50	57.91	(0.35) 13.85	No recovery.	NR		
	75 56 36		D	13.90				Extremely weak to weak thinly laminated reddish brown occasionally mottled light grey silty MUDSTONE. Fractures are 5 to 20 degrees medium spaced planar relatively smooth and open. (Grade C) *From 13.85m to 13.90m bgl: non intact.* *From 14.70m to 14.77m bgl: thin band of light greenish grey siltstone recovered as gravel.* *From 15.00m bgl: becoming less extremely weak and more weak.*			
			C	14.20 - 14.40							
			D	14.70							
15.00		NI 200 700					(2.40)				
	91 77 57		C	15.40 - 15.75							
			D	15.80							
		NI				55.51	16.25				
16.50			S (C)	16.50	N >50	55.36	(0.15) 16.40	Extremely weak light greenish grey SILTSTONE. Fractures are both 5 to 10 degrees and 75 degrees very closely spaced stepped rough and open. (Grade D)			
		NI 200 300	D	16.80			(1.00)	Extremely weak reddish brown occasionally mottled light greenish grey silty MUDSTONE. Fractures are 10 degrees medium spaced stepped rough and open. (Grade C to D) *From 16.75m to 16.85m bgl: non intact.*			
	87 63 36		C	17.30 - 17.60		54.36	17.40	Extremely weak light greenish grey SILTSTONE. Fractures are 5 to 10 degrees medium spaced stepped rough and open. (Grade C)			
		NI 200 350	D	17.80			(0.50)				
18.00						53.86 53.76	17.90 (0.10)	Weak light greenish grey SILTSTONE recovered as angular to subrounded siltstone cobbles. (Grade D)			
		N/A					18.00 (0.50)	No recovery.	NR		
	63 13 0		D	18.60		53.26 52.98	18.50 (0.28) 18.78	Weak light greenish grey SILTSTONE recovered as angular to subrounded siltstone cobbles. (Grade D)			
		NI 70 70	D	19.20			(1.07)	Weak locally extremely weak thinly laminated silty friable MUDSTONE. Fractures are typically 5 to 10 degrees very closely to closely spaced stepped rough and open. (Grade C) *From 19.45m to 19.48m bgl: band of extremely weak light greenish grey siltstone recovered as gravel.* *From 19.50m to 19.85m bgl: no recovery.*			
19.50			S (C)	19.50	N >50	51.91	19.85				

Continued next sheet

Installation: 50mm diameter standpipe installed to 12.00m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 11.11m bgl. Rotary Cored from 11.11m to 22.50m bgl. 30 mins chiseling from 5.80m to 6.00m bgl and 1 hr chiseling from 10.40m to 10.80m bgl

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
9.00	7.50		9.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 11.11m
121mm to 22.50m

BOREHOLE LOG - ROTARY

CP05

Project	Dove Valley Park, Derbyshire			**Project No.**	AG2941-18
Client	PGFI III Limited			**Sheet**	3 of 3
Start	12/03/2019	**Coordinates**	E 420176.68 N 332472.11	**Scale**	1:50
End	15/03/2019	**Ground Level**	71.76m AOD	**Total Depth**	22.57m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
		NI 90 170	C	20.05 - 20.15			(0.45)	Weak thinly laminated light greenish grey SILTSTONE. Fractures are 5 degrees closely spaced stepped rough and open. (Grade B to C)			
	77 59 39		C	20.55 - 20.70		51.46	20.30	Weak thinly laminated reddish brown silty MUDSTONE. Fractures are 5 to 25 degrees closely spaced planar smooth and open. (Grade B to C)			
			D	20.90							
21.00			C	21.05 - 21.15				*From 21.00m to 21.05m bgl: non intact.*			
		NI 100 140					(2.27)				
	94 57 29		D	21.60				*At 21.46m bgl: 70 degrees fracture. Fracture is planar smooth and open.*			
			D	22.40				*From 22.40m bgl: mottled light greenish grey.*			
			S (C)	22.50	N >50	49.19	22.57	End of Borehole at 22.57m			

Installation: 50mm diameter standpipe installed to 12.00m bgl.
Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Cable percussion from 1.20m to 11.11m bgl. Rotary Cored from 11.11m to 22.50m bgl. 30 mins chiseling from 5.80m to 6.00m bgl and 1 hr chiseling from 10.40m to 10.80m bgl

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
9.00	7.50		9.00	

Drilled: TS/Dynamic Sampling UK Ltd
Logged: MS
Checked: AS

Diameter: 150mm to 11.11m
121mm to 22.50m

Exploratory hole logs should be read in conjunction with key s heet

APPLiED GEOLOGY

SPT SUMMARY SHEET

Project: Dove Valley Park, Derbyshire
Client: PGFI III Limited
Project No: AG2941-18

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive				Test Drive									Test Type	N Value
						Blows		Pen (mm)		Blows				Pen (mm)				Total Pen (mm)		
CP01	1.20	1.65	1.20	Dry	AG001	3	4	75	75	5	5	6	6	75	75	75	75	300	C	22
CP01	2.00	2.45	2.00	2.00	AG001	5	7	75	75	6	5	4	4	75	75	75	75	300	C	19
CP01	2.60	3.05	2.60	Dry	AG001	2	3	75	75	4	4	5	5	75	75	75	75	300	S	18
CP01	5.00	5.45	5.00	Dry	AG001	4	5	75	75	5	5	6	8	75	75	75	75	300	S	24
CP01	7.00	7.45	7.00	Dry	AG001	5	5	75	75	6	6	7	7	75	75	75	75	300	S	26
CP01	8.50	8.95	8.50	6.50	AG001	6	8	75	75	9	9	10	10	75	75	75	75	300	S	38
CP01	9.80	10.20	9.80	6.50	AG001	7	9	75	75	10	13	15	12	75	75	75	20	245	S	>50
CP01	10.55	10.84	9.00	6.50	AG001	11	14	75	75	18	32			75	60			135	S	>50
CP01	12.50	12.75	11.00		GC.01	6		75		19	21	29		75	75	20		170	C	>50
CP01	15.50	15.63	11.00		GC.01	25		40		38	12			75	10			85	C	>50
CP01	18.50	18.62	11.00		GC.01	25		30		42	8			75	10			85	C	>50
CP02	2.10	2.55	2.00	Dry	AG001	3	5	75	75	6	5	6	6	75	75	75	75	300	C	23
CP02	4.00	4.45	3.00	Dry	AG001	3	4	75	75	5	5	6	6	75	75	75	75	300	S	22
CP02	6.50	6.95	6.50	6.50	AG001	4	5	75	75	5	5	5	6	75	75	75	75	300	S	21
CP02	7.90	8.35	7.90	Dry	AG001	6	7	75	75	9	12	14	15	75	75	75	75	300	S	50
CP02	8.90	9.13	8.00	7.00	AG001	12	13	75	60	26	24			75	20			95	S	>50
CP03	1.20	1.65	1.20	Dry	AG001	2	2	75	75	2	2	3	3	75	75	75	75	300	S	10
CP03	3.00	3.45	3.00	Dry	AG001	2	2	75	75	2	3	3	4	75	75	75	75	300	S	12
CP03	5.00	5.45	3.00	Dry	AG001	2	3	75	75	4	5	5	6	75	75	75	75	300	S	20
CP03	8.00	8.41	8.00	7.00	AG001	5	7	75	75	9	10	15	16	75	75	75	30	255	S	>50
CP03	9.00	9.32	9.00	7.00	AG001	9	12	75	75	16	18	16		75	75	20		170	S	>50
CP03	10.80	11.25	9.30		GC.01	6	8	75	75	11	11	11	13	75	75	75	75	300	C	46
CP03	13.80	14.05	9.30		GC.01	15	10	75	40	22	28			75	60			135	C	>50
CP03	15.30	15.53	9.30		GC.01	17	8	75	10	29	21			75	70			145	C	>50
CP03	16.30	16.49	9.30		GC.01	21	4	75	10	30	20			75	25			100	C	>50
CP03	17.30	17.53	9.30		GC.01	18	7	75	10	24	26			75	70			145	C	>50
CP04	2.00	2.45	1.50	Dry	AG001	1	1	75	75	2	2	1	2	75	75	75	75	300	S	7
CP04	3.50	3.95	3.50	3.50	AG001	1	2	75	75	2	2	3	4	75	75	75	75	300	S	11
CP04	4.50	4.95	4.50	4.50	AG001	4	5	75	75	6	6	7	7	75	75	75	75	300	S	26
CP04	5.50	5.95	5.50	Dry	AG001	4	6	75	75	6	7	8	8	75	75	75	75	300	S	29
CP04	7.50	7.95	6.00	Dry	AG001	5	7	75	75	7	8	8	9	75	75	75	75	300	S	32
CP04	8.50	8.95	6.00	Dry	AG001	6	7	75	75	8	8	9	10	75	75	75	75	300	C	35
CP04	10.00	10.45	6.00	8.50	AG001	7	8	75	75	9	10	10	12	75	75	75	75	300	C	41
CP04	11.05	11.33	6.00	9.00	AG001	12	13	75	50	19	22	9		75	75	0		150	S	>50

Notes:
1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

APPLiED GEOLOGY

SPT SUMMARY SHEET

Project: Dove Valley Park, Derbyshire
Client: PGFI III Limited
Project No: AG2941-18

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive				Test Drive									Test Type	N Value
						Blows		Pen (mm)		Blows				Pen (mm)				Total Pen (mm)		
CP05	1.20	1.65	1.20	Dry	AG001	3	4	75	75	6	6	7	7	75	75	75	75	300	C	26
CP05	2.00	2.45	2.00	Dry	AG001	3	5	75	75	5	6	5	7	75	75	75	75	300	C	23
CP05	3.00	3.45	3.00	Dry	AG001	4	4	75	75	5	7	8	7	75	75	75	75	300	C	27
CP05	4.90	5.35	4.00	Dry	AG001	3	3	75	75	4	4	5	5	75	75	75	75	300	S	18
CP05	8.00	8.45	8.00	Dry	AG001	6	6	75	75	7	7	8	8	75	75	75	75	300	S	30
CP05	9.50	9.95	9.00	7.50	AG001	7	8	75	75	10	10	12	13	75	75	75	75	300	S	45
CP05	10.80	11.11	9.00	7.50	AG001	9	13	75	75	19	22	9		75	75	10		160	S	>50
CP05	13.50	13.59	12.00		GC.01	25		30		50				60				60	C	>50
CP05	16.50	16.73	12.00		GC.01	12	13	75	60	32	18			75	20			95	C	>50
CP05	19.50	19.57	12.00		GC.01	25		10		50				60				60	C	>50
CP05	22.50	22.57	12.00		GC.01	25		30		50				40				40	C	>50

Notes:
1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

APPLiED GEOLOGY

Cable Percussion

Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
5-8 victory parkway
victory road
Derby
DE24 8ZF

Hammer Ref:	AG001
Test Date:	15/03/2019
Report Date:	15/03/2019
File Name:	AG001.spt
Test Operator:	TS

Instrumented Rod Data

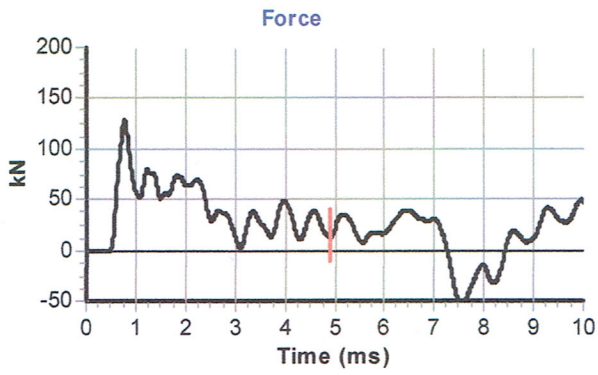
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	9603
Accelerometer No.2:	6457

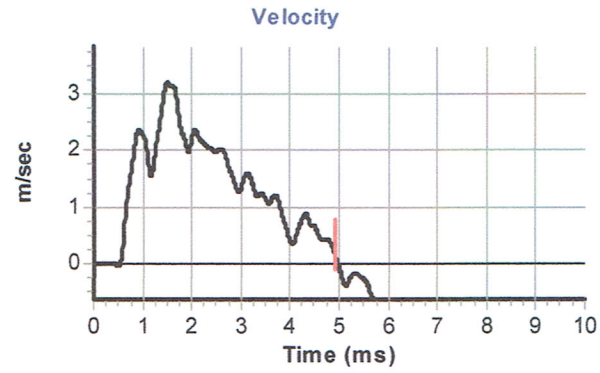
Hammer Information

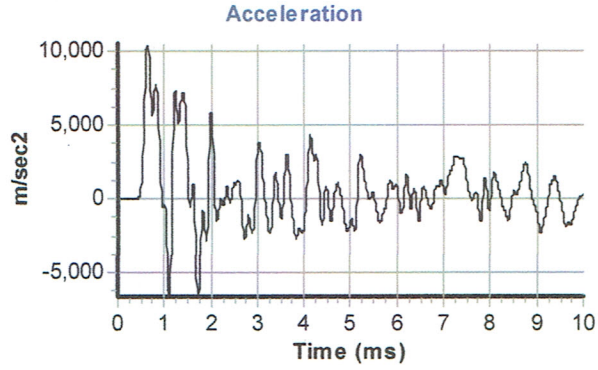
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	15.0

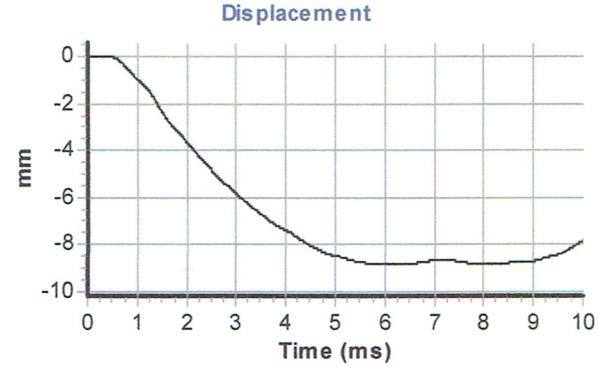
Comments / Location

Applied geology hammer tested at Dynamic samplings yard.









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	363

Energy Ratio E_r (%): **77**

Signed: A.parker.

Title: Associate Director.

The recommended calibration interval is 12 months

SPTMAN ver.Hammer Energy ver. 1.93 All rights reserved, Testconsult ©2010

Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
5-8 victory parkway
victory road
Derby
DE24 8ZF

Hammer Ref:	GC.01
Test Date:	18/05/2018
Report Date:	22/05/2018
File Name:	GC.01.spt
Test Operator:	A.PARKER.

Instrumented Rod Data

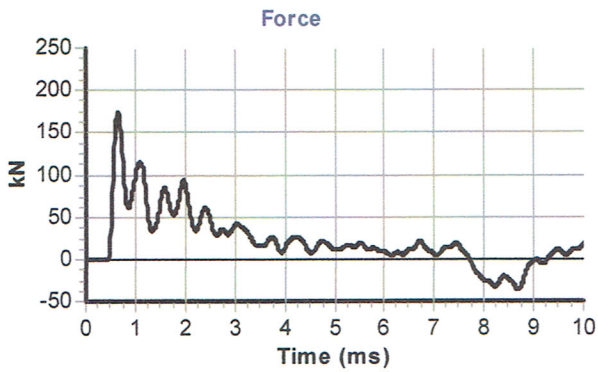
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.9
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	
Accelerometer No.2:	

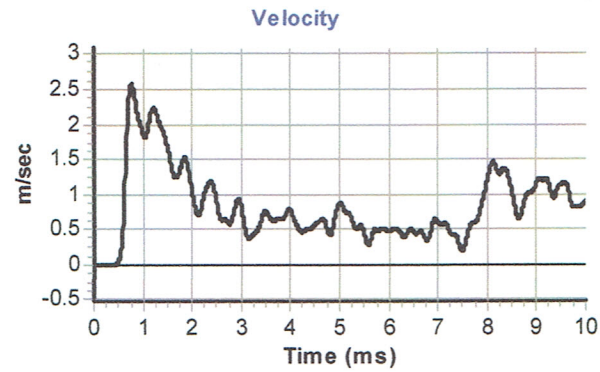
Hammer Information

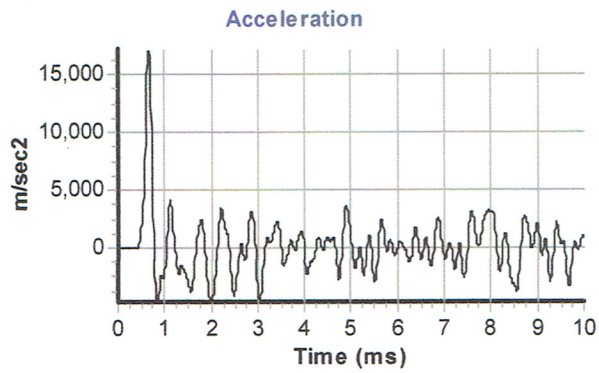
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	15.0

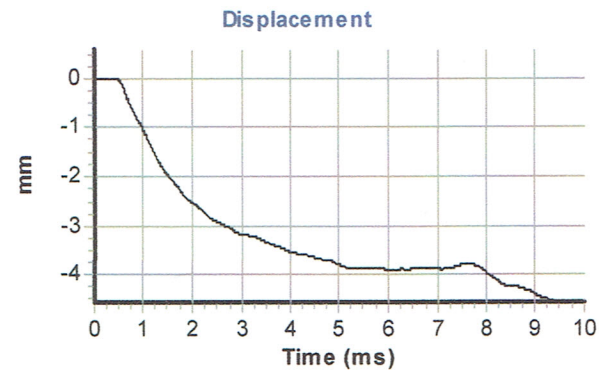
Comments / Location

Rotory hammer tested at Dynamic samplings yard.









Calculations

Area of Rod A (mm2):	1021
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	274

Energy Ratio E_r (%): **58**

Signed: A.parker.

Title: Associate Director.

The recommended calibration interval is 12 months

SPTMAN ver.Hammer Energy ver. 1.93 All rights reserved, Testconsult ©2010

TRIAL PIT LOG

TP01

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	75.24m AOD **Coordinates** E 420122.56 N 332743.93	**Total Depth**	4.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.10					Grass over firm dark brown slightly gravelly very sandy CLAY with occasional fine rootlets. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. (TOPSOIL)		
D	0.10			(0.35)				
ES	0.10							
			74.89	0.35	E			
B	0.40					Light brown slightly silty gravelly SAND with occasional pockets of orange and brown firm gravelly very sandy clay. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded quartzite.		
WAC	0.40							
				(0.65)	E			
			74.24	1.00				
HV	1.10	Cu = 161				Stiff red-brown mottled light grey slightly sandy slightly gravelly CLAY with frequent cobbles. Gravel is fine to coarse subrounded to rounded quartzite. Cobbles are rounded quartzite.		
B	1.20							
D	1.20							
				(1.10)	E			
HV	2.00	Cu = 160						
			73.14	2.10				
D	2.20					Stiff brown mottled blue-grey slightly sandy slightly gravelly CLAY with rare relict roots. Gravel is fine to coarse angular mudstone lithorelicts.		
B	2.30							
HV	2.50	Cu = 147						
HV	3.00	Cu = 131						
D	3.20			(2.20)	E			
						From 3.50m bgl: very stiff, unable to hand vane.		
						From 4.00m bgl: very friable.		
D	4.20							
			70.94	4.30		End of Trial Pit at 4.30m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.00m
Width:	0.65m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP02

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	11/03/2019	**Scale**	1:25
Ground Level	74.71m AOD **Coordinates** E 420116.23 N 332701.89	**Total Depth**	4.35m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B D ES	0.15 0.15 0.15		74.36	(0.35) 0.35	E	Grass over soft to firm dark brown slightly gravelly sandy silty CLAY with rare fine rootlets. Gravel is fine to coarse angular to rounded quartzite, flint, sandstone and very rare brick fragments. (MADE GROUND)		
HV B D ES	0.50 0.60 0.60 0.60	Cu = 92				Firm orangish brown mottled light grey gravelly sandy to very sandy SILT with occasional cobbles. Gravel is fine to coarse angular to rounded quartzite, flint and sandstone. Cobbles are rounded quartzite.		
HV	1.00	Cu = 132		(1.25)	E			
HV B D	1.50 1.60 1.60	Cu = 137	73.11	1.60		Orangish brown silty very sandy GRAVEL with frequent cobbles. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are subrounded to rounded quartzite. *Below 2.00m bgl: red-brown in colour.*		
				(1.00)	E			
B D HV	2.50 2.50 2.70	Cu = 125	72.11	2.60		Stiff brown mottled dark grey slightly gravelly slightly sandy silty CLAY. Gravel is fine to medium angular to rounded mudstone and quartzite.		
B D HV	2.90 2.90 3.20	Cu = 159						
				(1.70)	E			
HV D	3.70 3.80	Cu = 205				*Below 3.60m bgl: becoming friable.*		
D HV	4.30 4.30	Cu = 64	70.41 70.36	4.30 (0.05) 4.35	M	Firm red-brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium angular mudstone lithorelicts. End of Trial Pit at 4.35m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: CBR plate load testing at 0.35m bgl. Trial pit backfilled with arisings on completion.

Length:	2.10m
Width:	0.75m
Logged:	FD
Checked:	AS

TRIAL PIT LOG

TP03

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	73.94m AOD **Coordinates** E 420226.48 N 332683.40	**Total Depth**	4.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
WAC	0.20			(0.40)		Grass over firm brown slightly gravelly very sandy silty CLAY. Gravel is fine to coarse subrounded to rounded quartzite and brick. Rare cobbles of subrounded to rounded quartzite and rare fine rootlets.		
B	0.30				E			
D	0.30		73.54	0.40				
HV	0.50	Cu = 95				Firm friable orangish brown slightly gravelly sandy silty CLAY with rare cobbles and occasional pockets of firm light grey silt. Gravel is fine to coarse subangular to rounded quartzite, flint and sandstone. Cobbles are subrounded to rounded quartzite.		
WAC	0.70							
B	0.80			(0.80)				
					E			
D	1.00					*Below 1.00m bgl: becoming very silty.*		
HV	1.00	Cu = 101						
D	1.10		72.74	1.20				
D	1.40					Light brown slightly silty sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subrounded to rounded quartzite, flint and sandstone. Cobbles are subrounded to rounded quartzite.		
B	1.50							
D	2.00							
				(2.60)	E			
B	3.00							
D	3.00							
			70.14	3.80				
B	4.00					Soft to firmfriable red-brown slightly sandy slightly gravelly clayey SILT with occasional lenses of grey silt. Gravel is fine to medium angular to subrounded mudstone lithorelicts.		
D	4.00			(0.50)				
HV	4.20	Cu = 56			M	*Below 4.20m bgl: frequent pockets of grey silt.*		
D	4.30		69.64	4.30				
						End of Trial Pit at 4.30m		

Method: Backhoe excavator

Groundwater: Seepage at 1.20m bgl.

Stability: Collapse below 1.20m bgl.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.00m
Width:	0.80m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP04

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	73.60m AOD **Coordinates** E 420318.61 N 332653.64	**Total Depth**	4.40m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.30			(0.60)		Grass over dark brown slightly gravelly very clayey SAND with rare fine rootlets and rare cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded quartzite, flint and sandstone. Cobbles are subrounded to rounded quartzite.		
D	0.30							
WAC	0.30				E			
			73.00	0.60		Orangish brown slightly silty sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subangular to rounded quartzite, flint and sandstone. Cobbles are subrounded to rounded quartzite.		▼
B	0.70							
D	0.70							
WAC	0.70							
				(1.40)	E			
D	1.70							
			71.60	2.00		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY with rare relict rootlets. Gravel is fine to coarse angular to rounded mudstone, quartzite and flint.		
B	2.10							
D	2.10							
HV	2.20	Cu = 116						
				(0.70)	E			
HV	2.60	Cu = 121						
			70.90	2.70		Stiff dark brown mottled dark grey slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse angular to rounded quartzite and mudstone.		
HV	2.80	Cu = 184						
B	2.90							
D	2.90					*Below 3.20m bgl: becoming friable.*		
				(1.70)	M			
D	3.90							
			69.20	4.40		End of Trial Pit at 4.40m		

Method: Backhoe excavator

Groundwater: Seepage at 0.70m bgl.

Stability: Stable.

Remarks: Soils too friable/stiff to hand vane below 3.30m bgl. Trial pit backfilled with arisings on completion.

Length:	3.10m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP05

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	75.57m AOD **Coordinates** E 420035.03 N 332683.40	**Total Depth**	2.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(2.00)	E	Grass over dark brown slightly gravelly silty SAND with rare rootlets and occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse angular to rounded quartzite, flint, brick fragments, ceramic and glass fragments. Cobbles are subrounded to rounded quartzite.		
B D WAC	1.10 1.10 1.10							
			73.57	2.00		End of Trial Pit at 2.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: Trial pit undertaken in bund. Trial pit backfilled with arisings on completion.

Length:	1.90m
Width:	0.60m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP06

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	73.39m AOD **Coordinates** E 420159.93 N 332627.78	**Total Depth**	3.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B D ES	0.20 0.20 0.20		72.94	(0.45) 0.45	E	Grass over soft dark brown slightly gravelly very sandy silty CLAY with occasional fine rootlets. Gravel is fine to coarse angular to rounded quartzite, flint, sandstone, brick, ceramic and igneous stone. (MADE GROUND)		
B D ES HV	0.60 0.60 0.60 0.70	Cu = 127	72.39	(0.55) 1.00	E	Firm to stiff orange-brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded quartzite, sandstone and flint.		
ES B D	1.10 1.20 1.20		71.99	(0.40) 1.40	E	Light brown slightly silty gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded quartzite, sandstone and flint.		▼
B D B D	1.70 1.70 2.70 2.70		70.39	(1.60) 3.00	E	Brown silty sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subangular to rounded quartzite and flint. Cobbles are subrounded to rounded quartzite.		
HV D	3.10 3.20	Cu = 111	70.19	(0.20) 3.20	M	Stiff indistinctly thickly laminated brown rarely mottled orange-brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse angular to subangular mudstone lithorelicts.		

End of Trial Pit at 3.20m

Method: Backhoe excavator

Groundwater: Seepage at 1.20m bgl.

Stability: Unstable below 1.00m bgl, large collapse.

Remarks: Water at surface. Heavy ballooning of pit. Trial pit backfilled with arisings on completion.

Length:	2.90m
Width:	0.90m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP07

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	11/03/2019	**Scale**	1:25
Ground Level	73.39m AOD **Coordinates** E 420159.93 N 332627.78	**Total Depth**	4.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.25)	E	Grass over soft to firm dark brown gravelly sandy silty CLAY with occasional cobbles and occasional fine rootlets. Gravel is fine to coarse angular to rounded quartzite, flint, brick fragments, ceramic fragments and sandstone. Cobbles are rounded quartzite. (MADE GROUND)		
B	0.20							
D	0.20		73.14	0.25				
WAC	0.20							
HV	0.50	Cu = 138				Stiff orangish brown mottled light grey slightly gravelly sandy silty CLAY with frequent cobbles, occasional fine rootlets and rare pockets of red sandy silt. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are rounded quartzite.		
B	0.60							
D	0.60							
WAC	0.60							
HV	1.00	Cu = 153				*Below 1.00m bgl: gravelly.*		
D	1.10							
				(2.25)	E			
HV	1.50	Cu = 183				*Below 1.50m bgl: becoming stiffer with depth.*		
D	2.00					*Below 2.00m bgl: pockets of red-brown sand and rare relict rootlets.*		
HV	2.00	Cu = 185						
B	2.50		70.89	2.50		Very stiff brown mottled dark grey slightly sandy slightly gravelly silty CLAY with occasional relict rootlets. Gravel is fine to medium angular mudstone lithorelicts.		
D	2.50							
HV	2.50	Cu = 236				*Between 2.80m and 3.20m bgl: predominantly dark grey in colour.*		
HV	3.00	Cu = 226				*Below 3.20m bgl: indistinctly thickly laminated.*		
				(1.70)	M			
D	3.50							
HV	3.50	Cu = 220				*Below 3.70m bgl: becoming friable.*		
D	4.00							
			69.19	4.20		End of Trial Pit at 4.20m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: CBR plate load testing at 0.25m bgl. Soils too friable/stiff to hand vane below 3.70m bgl. Trial pit backfilled with arisings on completion.

Length:	2.40m
Width:	0.75m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP08

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	72.94m AOD **Coordinates** E 420144.06 N 332557.93	**Total Depth**	3.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D	0.20			(0.30)	E	Grass over firm dark brown slightly gravelly very sandy CLAY with frequent fine rootlets. Gravel is fine to coarse angular to rounded quartzite, sandstone, brick fragments and ceramic. (MADE GROUND)		
ES	0.20		72.64	0.30				
B	0.35		72.54	(0.10)		Red-brown slightly silty sandy GRAVEL. Gravel is fine to coarse angular to subrounded predominantly brick fragments angular sandstone, quartzite, concrete and possiblesiltstone. (MADE GROUND)		
D	0.35			0.40				
ES	0.35							
B	0.50				E			
D	0.50					(West of pit) Stiff brown mottled grey slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse angular to rounded quartzite. *In east of pit from 0.40m to 1.40m bgl: Orange-brown mottled light brown slightly silty sandy GRAVEL. Gravel is fine to coarse subangular to rounded quartzite, flint and sandstone.*		
ES	0.50							
B	0.60							
D	0.60							
ES	0.60			(1.20)				
HV	0.60	Cu = 112			E			
B	1.60		71.34	1.60		Very stiff thickly laminated brown mottled dark blue-grey slightly sandy slightly gravelly silty CLAY with occasional relict rootlets. Gravel is fine to medium angular to rounded mudstone lithorelicts.		
D	1.60							
HV	1.60	Cu = 184						
HV	2.10	Cu = 124				*Below 2.30m bgl: becoming friable.*		
D	2.60			(2.20)	M			
D	3.60							
D	3.80		69.14	3.80		End of Trial Pit at 3.80m		

Method: Backhoe excavator

Groundwater: Seepage at 0.30m bgl.

Stability: Stable.

Remarks: Land drain (clay pipe) at 0.50m bgl. Soils too friable/stiff to hand vane below 2.30m bgl. Trial pit backfilled with arisings on completion.

Length:	2.30m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP09

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	11/03/2019	**Scale**	1:25
Ground Level	72.56m AOD **Coordinates** E 420233.15 N 332544.10	**Total Depth**	4.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B D ES	0.20 0.20 0.20			(0.50)	E	Grass over stiff dark brown gravelly very sandy CLAY. Gravel is fine to coarse angular to rounded quartzite, sandstone and brick fragments. (MADE GROUND)		
			72.06	0.50				
B D ES	0.70 0.70 0.70			(0.70)	E	Orangish brown gravelly very clayey SAND with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are subrounded to rounded quartzite.		
HV B D	1.20 1.30 1.30	Cu = 122	71.36	1.20		In east of pit: Firm brown mottled grey slightly gravelly sandy CLAY with rare cobbles and rare relict rootlets. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are rounded quartzite. *In west of pit from 1.20m to 2.50m bgl: Orangish brown slightly silty sandy GRAVEL with frequent cobbles and rare boulders. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are subrounded to rounded quartzite. Boulders are quartzite.*		
B D HV	1.80 1.80 1.80	Cu = 193		(1.30)	E			
			70.06	2.50				
D	2.60					Very stiff dark grey mottled brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to rounded quartzite and mudstone lithorelicts.		
				(1.70)	M			
D	3.60							
			68.36	4.20		End of Trial Pit at 4.20m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: CBR plate test undertaken at 0.55m bgl. Soils too stiff to hand vane below 2.60m bgl. Trial pit backfilled with arisings on completion.

Length:	2.10m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

TRIAL PIT LOG

TP10

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	72.59m AOD **Coordinates** E 420077.38 N 332505.94	**Total Depth**	4.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.15			(0.25)	E	Grass over dark brown slightly gravelly silty SAND with frequent fine rootlets and occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse angular to rounded quartzite and sandstone. Cobbles are subangular sandstone.		
D	0.15		72.34	0.25				
WAC	0.15					Firm orangish brown mottled light grey slightly gravelly sandy clayey SILT with frequent cobbles. Gravel is fine to coarse subangular to rounded quartzite and flint. Cobbles are subrounded to rounded quartzite.		
HV	0.15	Cu = 129						
B	0.50							
D	0.50							
WAC	0.50					*Below 0.60m bgl: becoming friable.*		
				(1.35)	E			
B	1.60		70.99	1.60		Stiff reddish brown slightly gravelly slightly sandy silty CLAY with rare cobbles. Gravel is fine to coarse subrounded to rounded quartzite and siltstone/ mudstone. Cobbles are subrounded to rounded quartzite.		
D	1.60							
HV	1.70	Cu = 119						
HV	2.20	Cu = 179				*Below 2.20m bgl : mottled grey.*		▼
D	2.60			(2.10)	E			
						Below 3.00m bgl: no quartzite gravel.		
						Below 3.20m bgl: occasional relict rootlets.		
D	3.60							
			68.89	3.70		Very stiff brown rarely mottled dark grey slightly gravelly slightly sandy CLAY. Gravel is fine to medium angular to subangular mudstone.		
B	4.00			(0.50)	M			
D	4.00							
			68.39	4.20		End of Trial Pit at 4.20m		

Method: Backhoe excavator

Groundwater: Seepage at 2.20m bgl.

Stability: Stable.

Remarks: Soils too friable to hand vane below 0.60m bgl. Soils too stiff to hand vane below 2.70m bgl. Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.45m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP11

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	73.92m AOD **Coordinates** E 420145.78 N 332513.72	**Total Depth**	1.40m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(1.40)	E	Grass over dark brown slightly gravelly clayey SAND with occasional fine rootlets and occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse angular to rounded quartzite, flint, sandstone and brick fragments. Cobbles are subrounded to rounded quartzite. (MADE GROUND)		
B D WAC	1.00 1.00 1.00							
			72.52	1.40		End of Trial Pit at 1.40m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: Trial pit undertaken in bund. Trial pit terminated at 1.40m bgl, animal burrow approximately 100mm diameter encountered. Trial pit backfilled with arisings on completion.

Length:	2.10m
Width:	0.60m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP12

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	72.66m AOD **Coordinates** E 420308.84 N 332468.01	**Total Depth**	2.10m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
					E	Grass over firm to stiff brown mottled orange-brown slightly gravelly sandy silty CLAY with occasional pockets of clayey gravelly SAND and occasional cobbles, occasional fine rootlets and rare boulders. Gravel is fine to coarse angular to rounded quartzite, sandstone, brick fragments and plastic fragments, glass fragments and ceramic fragments. Cobbles and boulders are subrounded to rounded quartzite. (MADE GROUND)		
B D WAC	1.00 1.00 1.00			(1.90)				
			70.76	1.90				
B D WAC	2.00 2.00 2.00		70.56	(0.20) 2.10	E	Orangish brown silty sandy GRAVEL with frequent cobbles and rare boulders. Gravel is fine to coarse angular to rounded quartzite and sandstone. Boulders are subrounded to rounded quartzite. Cobbles are subrounded to rounded quartzite. End of Trial Pit at 2.10m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: Trial pit undertaken in bund. Trial pit backfilled with arisings on completion.

Length:	2.00m
Width:	0.60m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP13

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	75.26m AOD **Coordinates** E 420004.16 N 332469.39	**Total Depth**	2.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
						Grass over firm orangish brown mottled dark brown and brown slightly sandy to very sandy slightly gravelly to gravelly silty CLAY with occasional rootlets <5mm and occasional pockets of dark brown slightly gravelly clayey sand, rare pockets of stiff red-brown mottled grey slightly sandy slightly gravelly clay and occasional cobbles. Gravel is fine to coarse angular to rounded quartzite, brick fragments, ceramic, flint and sandstone. Cobbles are subangular to rounded quartzite and flint. (MADE GROUND)		
B D WAC	1.00 1.00 1.00			(2.70)	E			
B D WAC	2.75 2.75 2.75		72.56 72.46	2.70 (0.10) 2.80	E	Soft friable dark grey-brown slightly gravelly sandy SILT with frequent fine rootlets, occasional <5mm roots, rare wood fragments and rare cobbles. Gravel is fine to coarse angular to rounded quartzite and flint. Cobbles are subrounded to rounded quartzite. End of Trial Pit at 2.80m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: Trial pit undertaken in bund. Top of trial pit in bund 2.7m above ground level. Trial pit backfilled with arisings on completion.

Length:	3.00m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP14

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	11/03/2019	**Scale**	1:25
Ground Level	71.87m AOD **Coordinates** E 420067.86 N 332456.90	**Total Depth**	4.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.30			(0.50)	E	Grass dark brown slightly gravelly silty SAND with occasional fine rootlets and occasional cobbles. Gravel is fine to coarse angular to rounded quartzite, flint, concrete and brick fragments. Cobbles are angular to subrounded concrete. (MADE GROUND)		
D	0.30							
ES	0.30		71.37	0.50				
B	0.60			(0.25)		Light brown slightly gravelly silty SAND with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse angular to rounded quartzite and sandstone. Cobbles are angular sandstone.		
D	0.60							
ES	0.60		71.12	0.75		Stiff orange-brown mottled light grey slightly gravelly sandy silty CLAY. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint.		
B	0.80				E			
D	0.80							
ES	0.80							
HV	0.80	Cu = 208						
HV	1.30	Cu = 199						
				(1.75)	E			
D	1.80							
HV	1.80	Cu = 196						
HV	2.30	Cu = 185						
			69.37	2.50				
B	2.60					Firm red-brown slightly gravelly sandy to very sandy CLAY with rare pockets of yellow-brown silty sand. Gravel is fine to coarse angular to rounded quartzite, sandstone and mudstone.		
HV	2.70	Cu = 128						
				(0.70)	E			
D	3.00					*Below 3.00m bgl: soft and wet with occasional lenses of grey silt.*		
HV	3.20	Cu = 55	68.67	3.20		Firm indistinctly thickly laminated friable red-brown mottled light grey slightly gravelly sandy silty slightly micaceous CLAY. Gravel is fine to coarse angular to subangular mudstone lithorelicts.		
B	3.40							
D	3.40							
				(1.00)	M			
D	4.00							
			67.67	4.20		End of Trial Pit at 4.20m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: CBR plate load test undertaken at 0.53m bgl. Trial pit backfilled with arisings on completion.

Length:	2.10m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP15

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	07/03/2019	**Scale**	1:25
Ground Level	71.04m AOD **Coordinates** E 420153.27 N 332431.80	**Total Depth**	4.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.10					Grass over dark brown slightly gravelly clayey SAND with occasional cobbles and occasional fine rootlets. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded quartzite, flint and sandstone.		
D	0.10			(0.35)				
WAC	0.10							
			70.69	0.35	E			
B	0.40					Stiff to very stiff orange-brown mottled light grey slightly gravelly sandy silty CLAY. Gravel is fine to coarse angular to subrounded quartzite and sandstone.		
D	0.40							
WAC	0.40							
HV	0.70	Cu = 94						
				(0.95)	E			
D	1.00							
			69.74	1.30				
B	1.40					Orangish brown slightly clayey gravelly SAND with occasional cobbles of angular to subrounded sandstone. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded quartzite and sandstone.		
D	1.40							
				(1.20)	E			
HV	2.50	Cu = 81	68.54	2.50				
B	2.60					Firm reddish brown slightly gravelly sandy silty CLAY with frequent pockets of grey silty sand and fine to coarse sand. Gravel is fine to coarse angular to subrounded siltstone.		
D	2.60							
D	3.00							
HV	3.00	Cu = 47				*Below 3.10m bgl: less friable and becoming firm and more silty.*		
				(1.70)	E			
HV	3.50	Cu = 59						
D	4.00							
HV	4.00	Cu = 87						
			66.84	4.20		End of Trial Pit at 4.20m		

Method: Backhoe excavator

Groundwater: Seepage at 3.50m bgl.

Stability: Stable.

Remarks: Soils too sandy for hand vane below 2.50m bgl. Trial pit backfilled with arisings on completion.

Length:	1.90m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

TRIAL PIT LOG

TP16

Project	Dove Valley Park, Derbyshire	**Project No.**	AG2941-18
Client	PGFI III Limited	**Sheet**	1 of 1
Date	08/03/2019	**Scale**	1:25
Ground Level	70.96m AOD **Coordinates** E 420249.03 N 332402.07	**Total Depth**	0.88m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
B	0.20			(0.40)		Grass over soft dark brown slightly gravelly sandy clayey SILT with frequent fine rootlets, occasional <5mm roots and rare cobbles. Gravel is fine to coarse angular to rounded quartzite, sandstone and flint. Cobbles are subrounded quartzite.		
D	0.20							
ES	0.20		70.56	0.40	E	Firm orange-brown mottled light grey slightly gravelly sandy silty CLAY with occasional cobbles. Gravel is fine to coarse subangular to rounded quartzite and sandstone. Cobbles are angular to subrounded sandstone.		
B	0.50							
D	0.50							
ES	0.50			(0.48)				
HV	0.60	Cu = 79						
			70.08	0.88	E	End of Trial Pit at 0.88m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered

Stability: Stable.

Remarks: Trial pit undertaken in bund. Trial pit backfilled with arisings on completion.

Length:	1.81m
Width:	0.70m
Logged:	FD
Checked:	AS

Exploratory hole logs should be read in conjunction with key sheets

APPLiED GEOLOGY

Exploratory Hole Log Key Sheet

Sample Notation

D	Small Disturbed sample
B	Bulk Disturbed sample
ES	Environmental sample
U	Undisturbed U100 sample
UT	Undisturbed UT100 sample
C	Core sample
W	Water sample

In Situ Test Notation

S	Standard Penetration Test
S (C)	Standard Penetration Test (cone)
HV	Hand Shear Vane Test
PID	Photoionization Detector Test
MEXE	Mexecone Cone Penetrometer Test
PP	Pocket Penetrometer Test
K	Permeability Test

Results Notation

Cu	Shear Strength	kN/m^2
N	SPT N Value	-
PID	VOC Concentration	ppm
( )	U/UT Blow Count	-

Rotary Core Notation

TCR	Total Core Recovery
SCR	Solid Core Recovery
RQD	Rock Quality Designation
FI	Fracture Index
If	Fracture Spacing
NI	Non Intact
NR	No Recovery
NA	Not Applicable

Ease of Dig

VE	Very Easy
E	Easy
M	Moderate
H	Hard
VH	Very Hard

Backfill Symbols

- Sand
- Gravel
- Concrete
- Bentonite
- Arisings
- Grout

Installation Symbols

- Plain Standpipe
- Slotted Standpipe
- Piezometer
- Vibrating Wire Piezometer
- Inclinometer
- Extensometer (with magnet locations)

Groundwater (GW)

- Rise
- Groundwater Strike - with Recorded Rise
- Strike
- Groundwater Strike - No Recorded Rise

Legend Symbols

- Topsoil
- Made Ground
- Concrete
- Clay
- Silt
- Sand
- Gravel
- Peat
- Cobbles
- Boulders
- Mudstone
- Siltstone
- Sandstone
- Limestone
- Chalk
- Coal
- Breccia
- Conglomerate
- Shale
- Igenous Rock
- Metamorphic Rock
- No Recovery

Note: Most soils comprise a mixture of particle sizes. The soil type is graphically represented on the log and may be a combination of these symbols.

General Notes

1. Details of the standpipe/piezometer are given on the log. The 'Install' column shows a graphical representation of the installed including depth of instruments including slotted section or piezometer depth, and backfill details.

2. Standard Penetration Test is defined in BS EN ISO 17892. Total N value is shown on the logs, full details of the test increments, equipment references, water and casing levels shown on the SPT Summary Sheet.

APPLiED GEOLOGY

APPENDIX D

Ground Gas Monitoring and Flow Results

Project Number AG2941-18

Project/Site Name Dove Valley Park, Derbyshire

Date and Time of Monitoring 19th March 2019 from 10.55 to 12.45

Phase of Monitoring 1 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Ground Level (m AOD)	Water Level (m AOD)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady					
CP01	21.3	3.0	3.0	77	0.5	0.5	1.2	1.2	18.5	18.5	5.00	50	1.00	74.667	73.67
CP01	0.1	0.1	0.1	<1	0.5	0.5	0.7	0.7	19.5	19.5	8.30	19	3.89	74.667	70.78
CP02	0.1	0.1	0.1	<1	0.4	0.4	1.5	1.5	16.2	16.2	6.00	50	2.53	73.102	70.57
CP02	<0.1	<0.1	<0.1	<1	0.4	0.4	0.1	0.1	20.0	20.0	7.60	19	2.53	73.102	70.57
CP03	<0.1	<0.1	<0.1	<1	0.4	0.4	0.7	0.7	19.3	19.3	15.00	50	3.64	72.977	69.34
CP03	<0.1	<0.1	<0.1	<1	0.4	0.4	0.2	0.2	19.9	19.9	8.00	19	4.05	72.977	68.93
CP04	<0.1	<0.1	<0.1	<1	0.4	0.4	0.3	0.3	20.1	20.1	11.00	50	2.87	72.762	69.89
CP05	<0.1	<0.1	<0.1	<1	0.4	0.4	1.1	1.1	19.3	19.3	12.00	50	3.14	71.758	68.62

Meterological Data

Atmospheric Pressure (mb)	Start:	1019
Atmospheric Pressure (mb)	Finish:	1019
Pressure Rising or Falling	Falling	
Weather Conditions	Overcast	
Atmospheric Oxygen (% vol)	19.9	
Wind Speed & Direction	Light Breeze	
Ambient Air Temperature (°C)	10.0	

Site Data

Monitoring Personnel	Kevin Harper
GPS Instrument	
Gasmeter Serial Number	G503948
PID Serial Number	-
Ground Conditions (vegetation stress, visual contamination)	

General Notes

Instrument specification data and calibration information is provided on a separate data sheet

APPLiED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number AG2941-18

Project/Site Name Dove Valley Park, Derbyshire

Date and Time of Monitoring 29th March 2019 from 12.55 to 14.00

Phase of Monitoring 2 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Ground Level (m AOD)	Water Level (m AOD)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady					
CP01	4.5	<0.1	<0.1	10	<0.1	<0.1	1.0	1.0	19.2	19.2	5.00	50	0.76	74.667	73.91
CP01	2.9	<0.1	<0.1	6	<0.1	<0.1	0.4	0.4	20.3	20.3	8.30	19	5.38	74.667	69.29
CP02	0.5	0.1	0.1	1	<0.1	<0.1	2.1	2.1	9.8	9.8	6.00	50	2.22	73.102	70.88
CP02	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.1	0.1	20.7	20.9	7.60	19	2.20	73.102	70.90
CP03	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.7	0.7	19.9	19.9	15.00	50	3.62	72.977	69.36
CP03	<0.1	<0.1	<0.1	6	<0.1	<0.1	0.1	0.1	20.5	20.5	8.00	19	3.54	72.977	69.44
CP04	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.5	0.5	18.6	18.6	11.00	50	2.60	72.762	70.16
CP05	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.6	0.4	18.9	19.6	12.00	50	3.45	71.758	68.31

Meterological Data

Atmospheric Pressure (mb)	Start:	1020
Atmospheric Pressure (mb)	Finish:	1020
Pressure Rising or Falling	Falling	
Weather Conditions	Sunny	
Atmospheric Oxygen (% vol)	20.9	
Wind Speed & Direction	Moderate Breeze	
Ambient Air Temperature (°C)	13.0	

Site Data

Monitoring Personnel	Kevin Harper
GPS Instrument	
Gasmeter Serial Number	G505737
PID Serial Number	-
Ground Conditions (vegetation stress, visual contamination)	

General Notes

Instrument specification data and calibration information is provided on a separate data sheet

APPLiED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number AG2941-18

Project/Site Name Dove Valley Park, Derbyshire

Date and Time of Monitoring 5th April 2019

Phase of Monitoring 3 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Ground Level (m AOD)	Water Level (m AOD)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady					
CP01	0.3	-0.1	-0.1	2	<0.1	<0.1	0.9	0.9	20.5	20.5	5.00	50	0.91	74.667	73.76
CP01	0.7	-0.1	-0.1	18	<0.1	<0.1	0.6	0.6	20.6	20.6	8.30	19	5.28	74.667	69.39
CP02	<0.1	<0.1	<0.1	<1	<0.1	<0.1	2.2	2.2	10.3	10.3	6.00	50	2.47	73.102	70.63
CP02	*	*	*	*	*	*	*	*	*	*	7.60	19	2.49	73.102	70.61
CP03	<0.1	<0.1	0.1	<1	<0.1	<0.1	0.8	0.8	19.9	19.9	15.00	50	4.00	72.977	68.98
CP03	<0.1	-0.5	<0.1	-4	<0.1	<0.1	0.8	0.4	20.0	20.5	8.00	19	4.04	72.977	68.94
CP04	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.6	0.6	17.7	17.7	11.00	50	2.85	72.762	69.91
CP05	<0.1	<0.1	0.1	<1	<0.1	<0.1	0.5	0.3	19.6	20.2	12.00	50	3.94	71.758	67.82

Meterological Data

Atmospheric Pressure (mb)	Start: 994
Atmospheric Pressure (mb)	Finish: 994
Pressure Rising or Falling	Rising
Weather Conditions	Cloudy, breezy
Atmospheric Oxygen (% vol)	20.8
Wind Speed & Direction	Strong Breeze- SW
Ambient Air Temperature (°C)	12.0

Site Data

Monitoring Personnel	Malcolm McGlone
GPS Instrument	
Gasmeter Serial Number	G505737
PID Serial Number	-
Ground Conditions (vegetation stress, visual contamination)	

General Notes

Instrument specification data and calibration information is provided on a separate data sheet.

* CP02 pipe was damaged. Technician will attempt to fix for the fourth and final visit.

APPLiED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number AG2941-18

Project/Site Name Dove Valley Park, Derbyshire

Date and Time of Monitoring 12th April 2019 from 10.20 to 11.45

Phase of Monitoring 4 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (pa)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Installed Depth (m bgl)	Diameter of installation (mm)	Water level (m bgl)	Ground Level (m AOD)	Water Level (m AOD)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady					
CP01	-0.1	-0.1	-0.1	-3	<0.1	<0.1	1.1	1.1	20.7	20.7	5.00	50	0.94	74.667	73.73
CP01	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.7	0.7	20.9	20.9	8.30	19	4.97	74.667	69.70
CP02	0.2	-0.6	-0.1	-3	<0.1	<0.1	2.6	2.6	8.2	8.2	6.00	50	2.73	73.102	70.37
CP02	*	*	*	*	*	*	*	*	*	*	7.60	19	2.72	73.102	70.38
CP03	<0.1	<0.1	<0.1	<1	<0.1	<0.1	1.0	1.0	19.5	19.5	15.00	50	4.50	72.977	68.48
CP03	0.1	-1.0	0.1	-3	<0.1	<0.1	0.5	0.5	19.8	19.8	8.00	19	4.47	72.977	68.51
CP04	<0.1	<0.1	<0.1	<1	<0.1	<0.1	0.6	0.6	17.7	17.7	11.00	50	3.05	72.762	69.71
CP05	<0.1	<0.1	<0.1	<1	<0.1	<0.1	1.7	1.7	17.7	17.7	12.00	50	4.32	71.758	67.44

Meterological Data

Atmospheric Pressure (mb)	Start:	1021
Atmospheric Pressure (mb)	Finish:	1021
Pressure Rising or Falling	Rising	
Weather Conditions	Sunny	
Atmospheric Oxygen (% vol)	21.0	
Wind Speed & Direction	Light Breeze- E	
Ambient Air Temperature (°C)	8.0	

Site Data

Monitoring Personnel	Malcolm McGlone
GPS Instrument	
Gasmeter Serial Number	G505737
PID Serial Number	-
Ground Conditions (vegetation stress, visual contamination)	

General Notes

Instrument specification data and calibration information is provided on a separate data sheet.

* CP02 pipe was damaged. Technician attempted to fix install, however was unsuccessful. Only groundwater level obtainable.

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

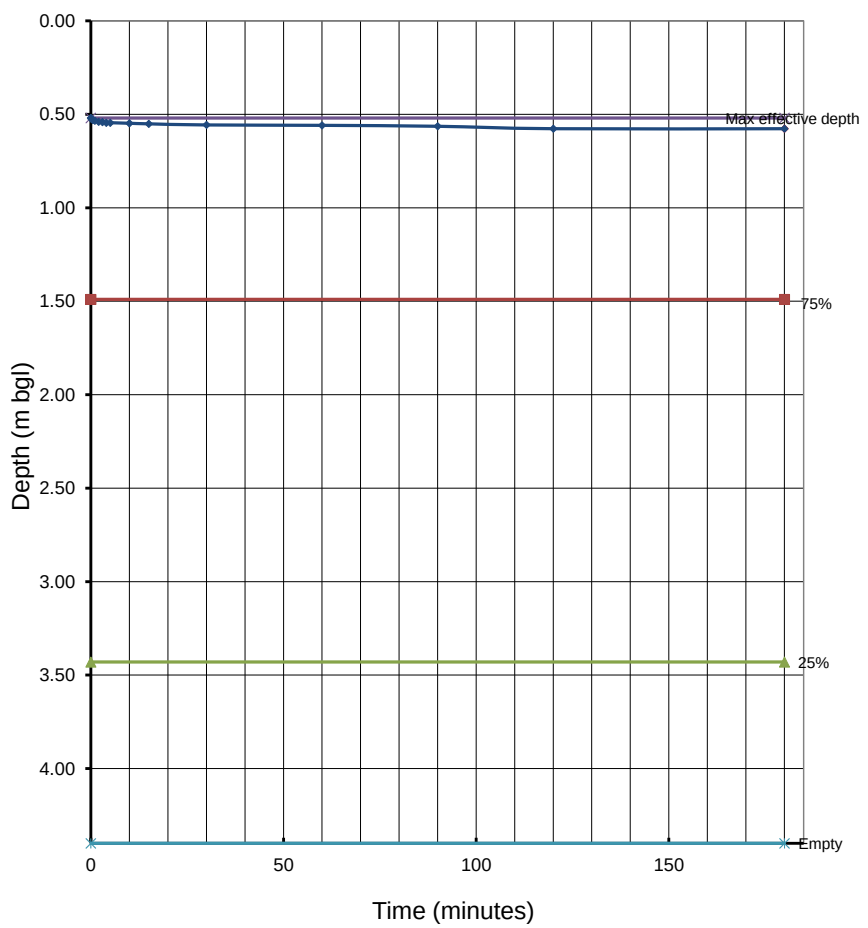
Trial Pit No.	TP04

Filling	1 of 1

Date	08/03/2019
Operator	MS
Test Strata	Topsoil & Gravel & Clay
Stability of pit	Stable
Backfill used	None

Trial Pit Length (m)	3.10
Trial Pit Width (m)	0.70
Trial Pit Depth (m)	4.40
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

Time (Minutes)	Water level (m.bgl)
0	0.52
0.16	0.53
0.5	0.53
1	0.53
2	0.54
3	0.54
4	0.55
5	0.55
10	0.55
15	0.55
30	0.56
60	0.56
90	0.56
120	0.58
180	0.58



Initial Water Level (m)	0.52	Total internal surface area of pit (m^2)	35.61
Final Water Level (m)	0.58	Internal surface area of trial pit within effective depth range (m^2)	16.91
Change in Water Level (m)	0.06	Volume outflowing between 75% and 25% effective depth (m^3)	4.21
Effective Depth at 25% (tp25) (m)	3.43	Time at 25% (tp25) (minutes)	
Effective Depth at 75% (tp75) (m)	1.49	Time at 75% (tp75) (minutes)	

Soil Infiltration Rate (m/s)	*

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Water level did not drop sufficiently for the calculation to be made

Client:	PGFI III Limited
Project:	Dove Valley Park, Derbyshire
Project No.	AG2941-18

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

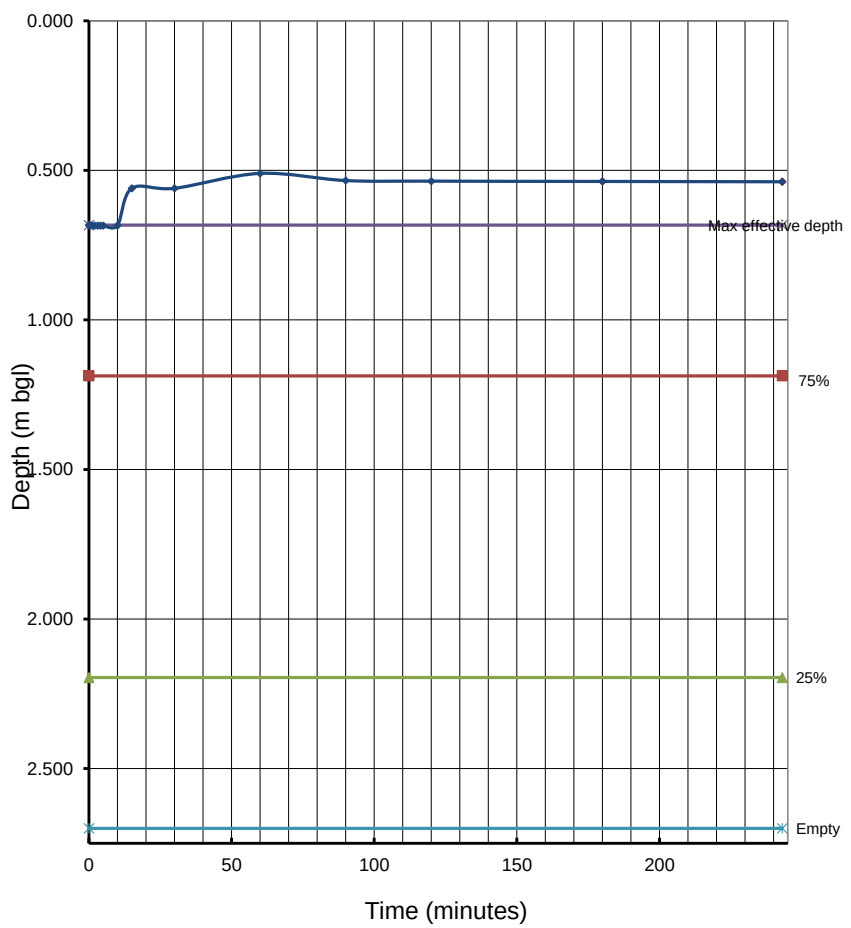
Trial Pit No.	TP06

Filling	1 of 1

Date	08/03/2019
Operator	MS
Test Strata	Topsoil & Sand and Gravel
Stability of pit	Very unstable
Backfill used	None

Trial Pit Length (m)	2.90
Trial Pit Width (m)	0.90
Trial Pit Depth (m)	2.70
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

Time (Minutes)	Water level (m.bgl)
0	0.683
0.16	0.684
0.5	0.684
1	0.684
2	0.685
3	0.685
4	0.685
5	0.685
10	0.684
15	0.560
30	0.560
60	0.510
90	0.534
120	0.536
180	0.537
243	0.538



Initial Water Level (m)	0.68	Total internal surface area of pit (m^2)	23.13
Final Water Level (m)	0.69	Internal surface area of trial pit within effective depth range (m^2)	10.27
Change in Water Level (m)	0.00	Volume outflowing between 75% and 25% effective depth (m^3)	2.63
Effective Depth at 25% (tp25) (m)	2.20	Time at 25% (tp25) (minutes)	
Effective Depth at 75% (tp75) (m)	1.19	Time at 75% (tp75) (minutes)	

Soil Infiltration Rate (m/s)	*

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Water level did not drop sufficiently for the calculation to be made

Client:	PGFI III Limited
Project:	Dove Valley Park, Derbyshire
Project No.	AG2941-18

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

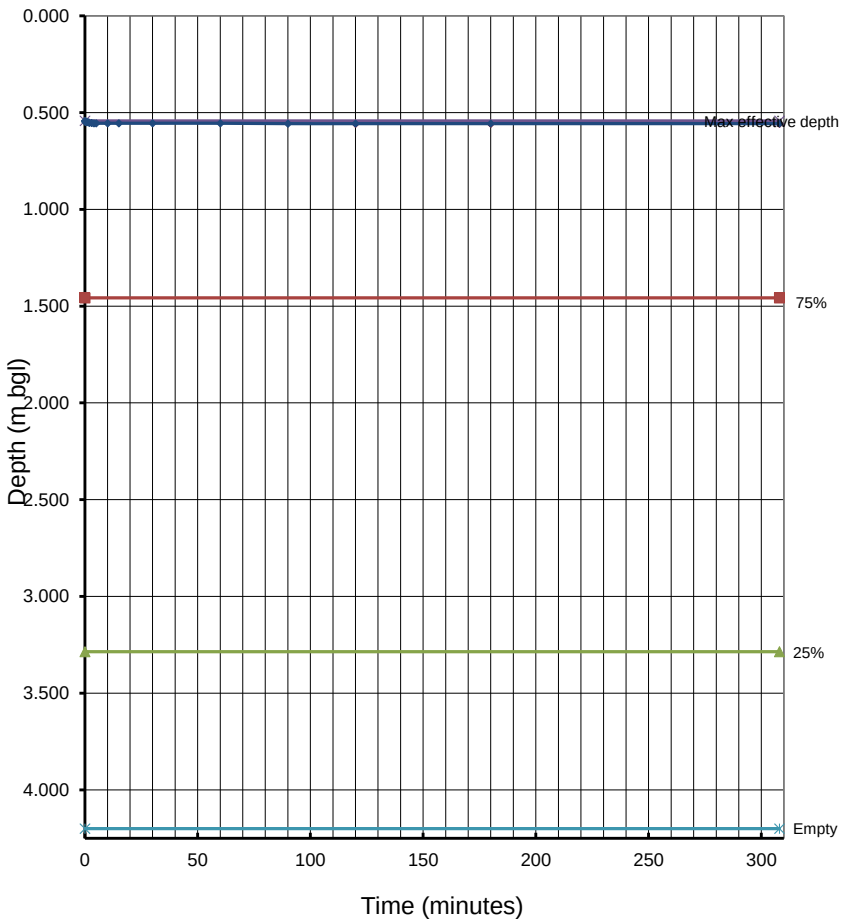
Trial Pit No.	TP10

Filling	1 of 1

Date	08/03/2019
Operator	MS
Test Strata	Topsoil & Clay
Stability of pit	Stable
Backfill used	None

Trial Pit Length (m)	2.50
Trial Pit Width (m)	0.45
Trial Pit Depth (m)	4.20
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

Time (Minutes)	Water level (m.bgl)
0	0.543
0.16	0.548
0.5	0.549
1	0.549
1.5	0.550
2	0.553
3	0.554
4	0.555
5	0.555
10	0.555
15	0.555
30	0.555
60	0.555
90	0.557
120	0.557
180	0.557
308	0.557



Initial Water Level (m)	0.54	Total internal surface area of pit (m^2)	25.91
Final Water Level (m)	0.56	Internal surface area of trial pit within effective depth range (m^2)	11.91
Change in Water Level (m)	0.01	Volume outflowing between 75% and 25% effective depth (m^3)	2.06
Effective Depth at 25% (tp25) (m)	3.29	Time at 25% (tp25) (minutes)	
Effective Depth at 75% (tp75) (m)	1.46	Time at 75% (tp75) (minutes)	

Soil Infiltration Rate (m/s)	*

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Water level did not drop sufficiently for the calculation to be made

Client:	PGFI III Limited
Project:	Dove Valley Park, Derbyshire
Project No.	AG2941-18

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

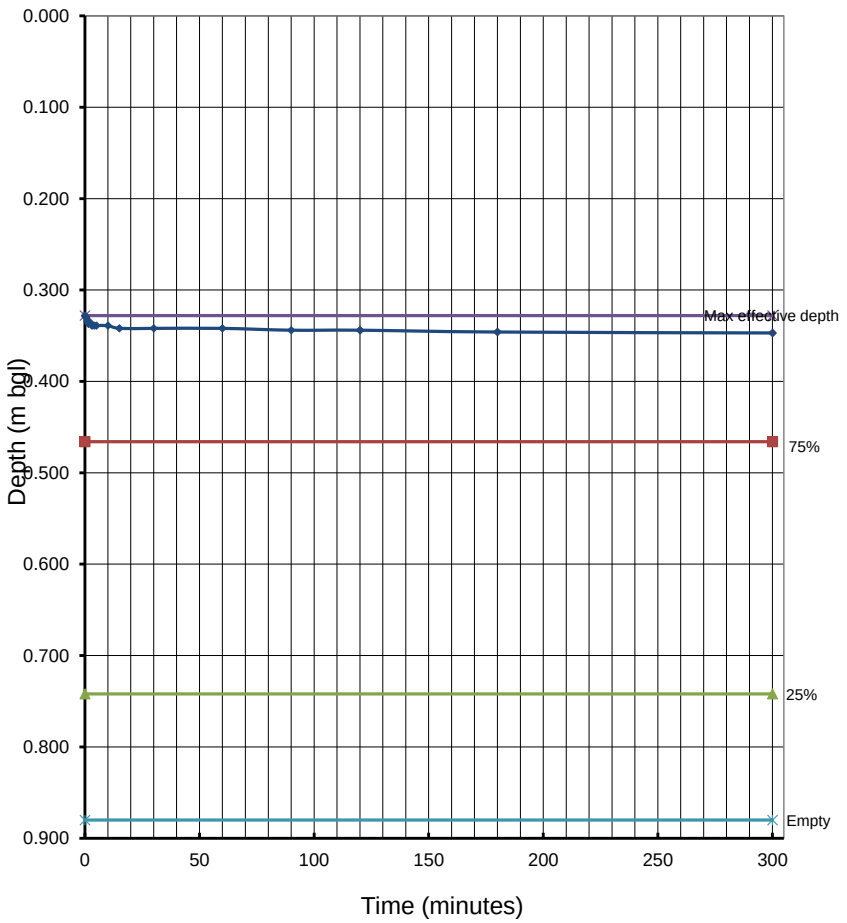
Trial Pit No.	TP16

Filling	1 of 1

Date	08/03/2019
Operator	MS
Test Strata	Topsoil & Clay
Stability of pit	Stable
Backfill used	None

Trial Pit Length (m)	1.81
Trial Pit Width (m)	0.70
Trial Pit Depth (m)	0.88
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

Time (Minutes)	Water level (m.bgl)
0	0.328
0.16	0.329
0.5	0.330
1	0.334
1.5	0.337
2	0.335
3	0.339
4	0.339
5	0.339
10	0.339
15	0.342
30	0.342
60	0.342
90	0.344
120	0.344
180	0.346
300	0.347



Initial Water Level (m)	0.33	Total internal surface area of pit (m^2)	5.68
Final Water Level (m)	0.35	Internal surface area of trial pit within effective depth range (m^2)	2.65
Change in Water Level (m)	0.02	Volume outflowing between 75% and 25% effective depth (m^3)	0.35
Effective Depth at 25% (tp25) (m)	0.74	Time at 25% (tp25) (minutes)	
Effective Depth at 75% (tp75) (m)	0.47	Time at 75% (tp75) (minutes)	

Soil Infiltration Rate (m/s)	*

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Water level did not drop sufficiently for the calculation to be made

Client:	PGFI III Limited
Project:	Dove Valley Park, Derbyshire
Project No.	AG2941-18

APPLiED GEOLOGY

4161

Construction Testing Solutions Ltd

Quarry Farm View Bowbridge Lane
Newark Nottinghamshire NG24 3BZ
t: 01636 705100 f: 01636 640640

TEST CERTIFICATE

Determination of Approximate Equivalent CBR Value derived from Plate Bearing Test

Tested in accordance with BS 1377-9: 1990 & Design Manual Roads & Bridges IAN 73/06

Client: Applied Geology Ltd
Client Address: Unit 23, Abbey Park
Stareton
Kenilworth
CV8 2LY

Certificate Number: NL5439-1/1/714-4

Client Reference: N/A
Lab Job Number: NL5439-1

Contact: Melissa Southworth

Site Name: Derby
Site Address: Dove Valley Park

Date Received: 11.03.2019
Date Tested: 11.03.2019

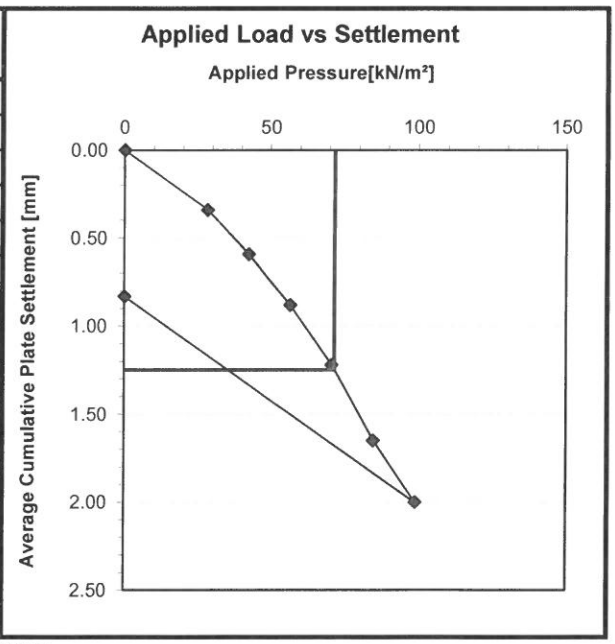
Test Results: **Laboratory Reference:** NL5439-1/1
Sample Reference: PBT 1

Description: Light Brown Gravelly Clay

Test Location: TP02 **Depth:** Formation

Kentiledge Type: JS160 **Plate Diameter [m]:** 0.30

Applied Load [kN]	Applied Pressure [kN/m²]	Average Plate Settlement [mm]
0	0	0.00
2	28	0.34
3	42	0.59
4	57	0.88
5	71	1.22
6	85	1.65
7	99	2.00
0	0	0.83
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	



Initial Pressure Applied to Induce 1.5mm Settlement **71 kN/m²**

Pressure at 1.25mm Settlement **72 kN/m²**

Modulus of Subgrade Reaction **25 MN/m²/m**

Equivalent CBR Value **2.6%**

Test results valid at time of test

Comments:

Approved Signatory: C. Major - Deputy Laboratory Manager

Signed:

for and on behalf of Construction Testing Solutions Ltd

Date Reported: 18.03.2019
Form Number: EN/C/714-4 Version 13

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Castle Donington, DE74 2UD

4161

Construction Testing Solutions Ltd

Quarry Farm View Bowbridge Lane
Newark Nottinghamshire NG24 3BZ
t: 01636 705100 f: 01636 640640

TEST CERTIFICATE

Determination of Approximate Equivalent CBR Value derived from Plate Bearing Test

Tested in accordance with BS 1377-9: 1990 & Design Manual Roads & Bridges IAN 73/06

Client: Applied Geology Ltd
Client Address: Unit 23, Abbey Park
Stareton
Kenilworth
CV8 2LY

Certificate Number: NL5439-1/2/714-4

Client Reference: N/A
Lab Job Number: NL5439-1

Contact: Melissa Southworth

Site Name: Derby
Site Address: Dove Valley Park

Date Received: 11.03.2019
Date Tested: 11.03.2019

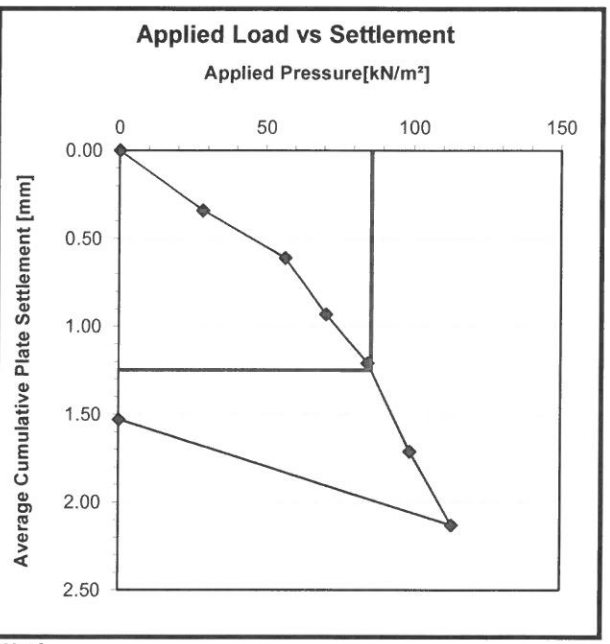
Test Results: **Laboratory Reference:** NL5439-1/2
Sample Reference: PBT 2

Description: Light Brown Gravelly Clay

Test Location: TP07 **Depth:** Formation

Kentiledge Type: JS160 **Plate Diameter [m]:** 0.30

Applied Load [kN]	Applied Pressure [kN/m²]	Average Plate Settlement [mm]
0	0	0.00
2	28	0.34
4	57	0.61
5	71	0.93
6	85	1.21
7	99	1.71
8	113	2.13
0	0	1.53
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	



Initial Pressure Applied to Induce 1.5mm Settlement	**71 kN/m²**
Pressure at 1.25mm Settlement	**86 kN/m²**
Modulus of Subgrade Reaction	**30 MN/m²/m**
Equivalent CBR Value	**3.6%**

Test results valid at time of test

Comments:

Approved Signatory: C. Major - Deputy Laboratory Manager

Signed:

for and on behalf of Construction Testing Solutions Ltd

Date Reported: 18.03.2019
Form Number: EN/C/714-4 Version 13

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Newark Nottinghamshire NG24 3BZ
t: 01636 705100 f: 01636 640640

TEST CERTIFICATE

Determination of Approximate Equivalent CBR Value derived from Plate Bearing Test

Tested in accordance with BS 1377-9: 1990 & Design Manual Roads & Bridges IAN 73/06

Client: Applied Geology Ltd
Client Address: Unit 23, Abbey Park
Stareton
Kenilworth
CV8 2LY

Contact: Melissa Southworth

Site Name: Derby
Site Address: Dove Valley Park

Certificate Number: NL5439-1/3/714-4

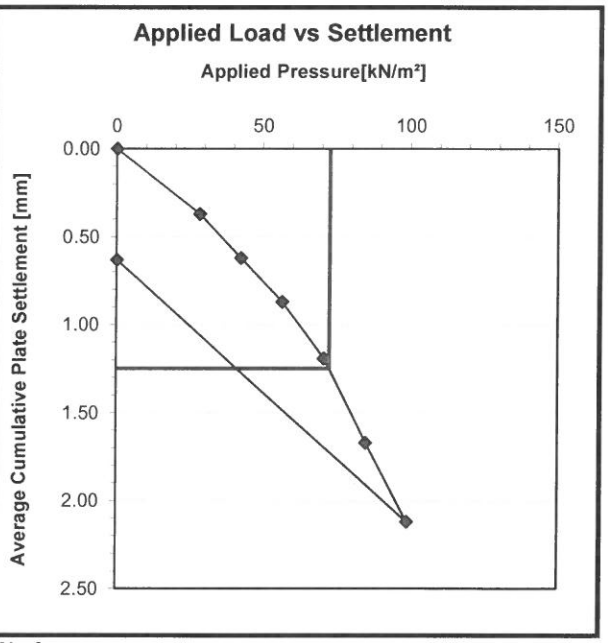
Client Reference: N/A
Lab Job Number: NL5439-1

Date Received: 11.03.2019
Date Tested: 11.03.2019

Test Results:

Laboratory Reference: NL5439-1/3
Sample Reference: PBT 3
Description: Light Brown Gravelly Clay
Test Location: TP09
Depth: Formation
Kentiledge Type: JS160
Plate Diameter [m]: 0.30

Applied Load [kN]	Applied Pressure [kN/m²]	Average Plate Settlement [mm]
0	0	0.00
2	28	0.37
3	42	0.62
4	57	0.87
5	71	1.19
6	85	1.67
7	99	2.12
0	0	0.63
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	



Initial Pressure Applied to Induce 1.5mm Settlement **71 kN/m²**
Pressure at 1.25mm Settlement **73 kN/m²**
Modulus of Subgrade Reaction **26 MN/m²/m**
Equivalent CBR Value **2.7%**

Test results valid at time of test

Comments:

Approved Signatory: C. Major - Deputy Laboratory Manager

Signed:

for and on behalf of Construction Testing Solutions Ltd

Date Reported: 18.03.2019
Form Number: EN/C/714-4 Version 13

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation
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Registered in England & Wales
Registration Number 05998333
Reg Office; 3 Boundary Court
Willow Farm Business Park
Castle Donington, DE74 2UD

4161

Construction Testing Solutions Ltd

Quarry Farm View Bowbridge Lane
Newark Nottinghamshire NG24 3BZ
t: 01636 705100 f: 01636 640640

TEST CERTIFICATE

Determination of Approximate Equivalent CBR Value derived from Plate Bearing Test

Tested in accordance with BS 1377-9: 1990 & Design Manual Roads & Bridges IAN 73/06

Client: Applied Geology Ltd
Client Address: Unit 23, Abbey Park
Stareton
Kenilworth
CV8 2LY

Certificate Number: NL5439-1/4/714-4

Client Reference: N/A
Lab Job Number: NL5439-1

Contact: Melissa Southworth

Site Name: Derby
Site Address: Dove Valley Park

Date Received: 11.03.2019
Date Tested: 11.03.2019

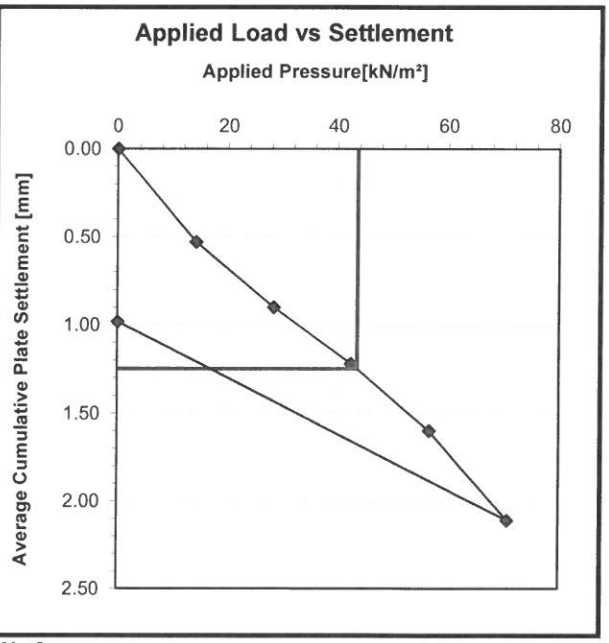
Test Results: **Laboratory Reference:** NL5439-1/4
Sample Reference: PBT 4

Description: Light Brown Gravelly Clay

Test Location: TP14 **Depth:** Formation

Kentiledge Type: JS160 **Plate Diameter [m]:** 0.30

Applied Load [kN]	Applied Pressure [kN/m²]	Average Plate Settlement [mm]
0	0	0.00
1	14	0.53
2	28	0.90
3	42	1.22
4	57	1.60
5	71	2.11
0	0	0.98
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	



Initial Pressure Applied to Induce 1.5mm Settlement **71 kN/m²**

Pressure at 1.25mm Settlement **44 kN/m²**

Modulus of Subgrade Reaction **15 MN/m²/m**

Equivalent CBR Value **1.1%**

Test results valid at time of test

Comments:

Approved Signatory: C. Major - Deputy Laboratory Manager

Signed:

for and on behalf of Construction Testing Solutions Ltd

Date Reported: 18.03.2019

Form Number: EN/C/714-4 Version 13

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Willow Farm Business Park
Castle Donington, DE74 2UD

APPENDIX E

GEOLABS Limited
Unit D3 HRS Business Park
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Birmingham
B33 0SJ

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email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Applied Geology
Unit 23
Abbey Park
Stareton
Kenilworth
Warwickshire
CV8 2LY

29 April 2019
Report No : GEO/29046/01

For the attention of Ms M Southworth / Mr A Smith

Dear Sirs

Date samples received	29/03/2019
Date written instructions received	29/03/2019
Date testing commenced	30/03/2019
Date of sample disposal	**27/05/2019**

Our ref **GEO / 29046**
Your Ref **AG2941-18**

Project **DOVE VALLEY PARK, DERBYSHIRE**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	~	Geotechnical Test Summary
~	23	Water Content
2	~	Geochemical Test Summary
~	5	BRE SD1 Suite B - Natural ground + pyrite
3	19	Liquid & Plastic Limits
4	16	Particle Size Distribution
5	9	Moisture Content / Dry Density Relationship
6	3	One Dimensional Consolidation
7	4	Unconsolidated Undrained Triaxial Compression

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

J A Reynolds
Laboratory Manager

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Registered Office: Bucknalls Lane Garston Watford Hertfordshire WD25 9XX Registered in England and Wales No: 3177641

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	Other tests and comments
CP01	0.50-1.20		B	Brown and yellowish brown mottled sandy CLAY with much fine to coarse gravel.															Compaction
CP01	5.00-5.45		D	Brown slightly sandy CLAY with some fine to medium gravel.	14.1	37	16	21	95										
CP01	7.60		D	Reddish brown sandy CLAY with rare fine gravel.	18.3	27	14	13	99										
CP01	10.10-10.55		B													8.8	0.016		
CP02	0.70-0.80		D	Light grey mottled orangish brown sandy CLAY with rare fine to medium gravel.	19.0	45	14	31	99										
CP02	1.65-2.10		B	Yellowish brown sandy slightly clayey fine to coarse GRAVEL.															Particle Size Distribution
CP02	2.80-3.25		UT	Very stiff dark brown mottled brown and grey CLAY.															One Dimensional Consolidation
CP02	3.25-4.00		B													8.6	<0.010		
CP02	4.80		D	Brown mottled grey sandy CLAY with rare fine gravel.	23.2	31	17	14	99										
CP02	5.00-5.45		UT	Firm reddish brown mottled grey silty CLAY.	33.0					1.99	1.50		100 200 400	134 137 102	62				

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	Other tests and comments
CP03	1.20-1.65		D	Brown mottled cream CLAY with rare fine gravel.	12.2	50	17	33	99										
CP03	1.65-2.00		B	Brown silty CLAY with rare fine gravel.															Particle Size Distribution
CP03	3.45-4.00		B	Dark brown silty CLAY.															Particle Size Distribution
CP03	4.00-4.45		UT	Stiff fissured dark brown silty CLAY	22.2					2.04	1.67		80 160 320	346 382 411	190				
CP03	5.00-5.45		D	Dark brown slightly sandy silty CLAY.	17.3	35	16	19	100										
CP03	6.00		D													7.7	<0.010		
CP03	6.50-6.95		UT	Firm reddish brown mottled grey silty CLAY.	30.8					2.05	1.57		130 260 520	191 180 150	87				
CP03	8.00-8.42		D	Reddish brown slightly sandy silty CLAY.	21.1	30	18	12	100										
CP03	8.50-9.00		B													8.6	<0.010		
CP04	1.20-1.65		UT	Firm brown mottled grey and dark brown CLAY.															One Dimensional Consolidation

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	Other tests and comments
CP04	3.95-4.50		B	Brown very sandy clayey SILT.															Particle Size Distribution
CP05	0.40-0.80		B	Orangish brown sandy slightly clayey fine to coarse GRAVEL with some cobbles.															Particle Size Distribution
CP05	2.00-3.00		B	Brown sandy CLAY with much fine to coarse gravel and rare cobbles.	15.7	47	19	28	55										
CP05	3.00-4.00		B	Orangish brown slightly sandy silty CLAY with some fine to coarse gravel.															Particle Size Distribution
CP05	4.00-4.45		UT	Stiff fissured dark brown mottled grey silty CLAY	24.8					1.98	1.59		80 160 320	152 217 207	96				
CP05	6.40		D	Brown sandy CLAY with some fine to coarse gravel.	17.8	29	17	12	96										
CP05	6.50-6.95		UT	Firm darkish brown rare mottled grey sandy CLAY with rare fine to medium gravel.															One Dimensional Consolidation
CP05	7.20		D													8.6	0.041		
TP01	1.20		B	Reddish brown CLAY with some fine to coarse gravel.	17.2	43	16	27	95										
TP01	2.30		B	Brown CLAY with rare fine to coarse gravel.	23.7	57	21	36	99										

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	Other tests and comments
TP02	2.50		B	Orangish brown mottled grey sandy silty CLAY with much fine to coarse gravel.															Particle Size Distribution
TP03	3.00		B	Orangish brown sandy fine to coarse GRAVEL.															Particle Size Distribution
TP04	0.30		B	Dark brown sandy CLAY with much fine to coarse gravel.															Compaction
TP04	2.10		B	Brown CLAY with some fine to coarse gravel.	22.6	48	17	31	95										
TP05	1.10		B	Dark brown very sandy CLAY with much fine to coarse GRAVEL.															Particle Size Distribution Compaction
TP06	0.60		B	Grey mottled yellowish brown slightly sandy CLAY with some fine to coarse gravel.	16.5	41	15	26	98										
TP07	0.60		B	Yellowish brown mottled grey silty CLAY with some fine to medium gravel.															Particle Size Distribution
TP07	2.00		D	Brown mottled grey very sandy CLAY with much fine to coarse gravel.	19.6	53	21	32	63										
TP07	2.50		D	Dark brown silty CLAY.															Particle Size Distribution
TP08	0.50		B	Dark brown sandy CLAY with much fine to coarse gravel.															Compaction

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	Other tests and comments
TP08	1.60		B	Dark brown silty CLAY with some fine to medium gravel.															Particle Size Distribution
TP09	0.70		B	Brown sandy CLAY with much fine to coarse gravel.															Compaction
TP09	1.30		B	Brown mottled grey slightly sandy CLAY with some fine to coarse gravel.	23.2	52	17	35	95										
TP09	2.60		D	Dark brown mottled dark grey CLAY.	23.7	57	22	35	100										
TP10	0.50		D	Brown mottled light grey sandy CLAY with rare fine to medium gravel.	14.4	34	15	19	99										
TP10	1.60		B	Brown mottled light grey CLAY.															Compaction
TP10	1.60		D	Brown mottled grey slightly sandy CLAY with rare fine to coarse gravel.	19.3	38	16	22	99										
TP11	1.00		B	Dark brown sandy CLAY with much fine to coarse gravel.															Particle Size Distribution Compaction
TP13	2.75		B	Dark brown slightly sandy organic CLAY with some fine to medium gravel.															Particle Size Distribution Compaction
TP14	0.60		B	Orangish brown very sandy silty clayey fine to coarse GRAVEL.															Particle Size Distribution

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Borehole / Trial Pit	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	W/S Mg mg/L	
TP15	1.40		B	Orangish brown sandy fine to coarse GRAVEL.															Particle Size Distribution Compaction
TP16	0.50		D	Light brown and brown mottled sandy CLAY with rare fine to medium gravel.	22.7	46	19	27	99										

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS®

1131 - BS1377 Chemical Suite - 29046.XLSM

SUMMARY OF CHEMICAL TESTS ON SOIL

Borehole / Trial Pit	Depth m	Sample Ref	Sample Type	pH Value	Total Acid Soluble Sulphate as SO4 %	Water Soluble Sulphate as SO4 2:1 Water:Soil Extract g/l	Total Sulphur %	Water Soluble Chloride g/l	Water Soluble Nitrate g/l	Magnesium g/l	Organic Content %	Mass Loss on Ignition %	Carbonate Content %
CP01	10.10-10.55		B	8.8	0.071	0.016	0.044	-	-	-	-	-	-
CP02	3.25-4.00		B	8.6	0.033	<0.010	0.030	-	-	-	-	-	-
CP03	6.00		D	7.7	0.047	<0.010	<0.010	-	-	-	-	-	-
CP03	8.50-9.00		B	8.6	0.087	<0.010	0.027	-	-	-	-	-	-
CP05	7.20		D	8.6	0.054	0.041	0.041	-	-	-	-	-	-

Tested by Chemtest Ltd : UKAS No 2183

Checked and Approved by:

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

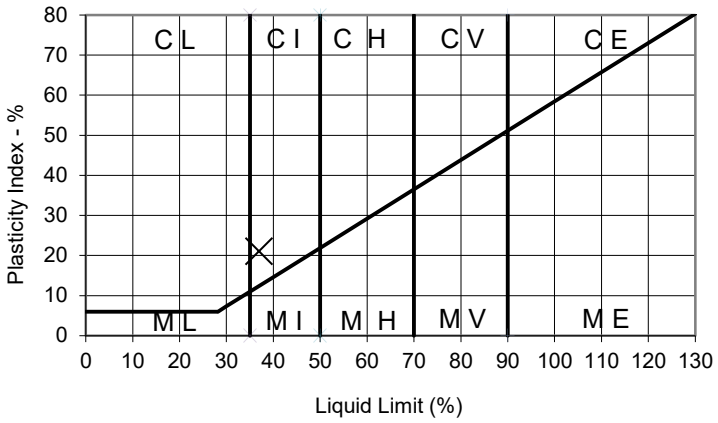
BH / TP	CP01
Depth (m)	5.00
Sample Type	D

Description:

Brown slightly sandy CLAY with some fine to medium gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	14.1	%
Percentage passing 425µm sieve :	95	%
Liquid Limit :	37	%
Plastic Limit :	16	%
Plasticity Index :	21	%
Equivalent Water Content of material passing 425µm sieve :	14.8	%
Liquidity Index :	-0.06	



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Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

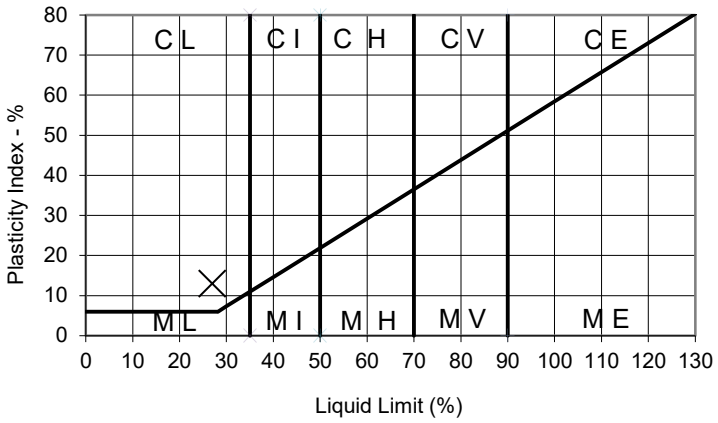
BH / TP	CP01
Depth (m)	7.60
Sample Type	D

Description:

Reddish brown sandy CLAY with rare fine gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	18.3	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	27	%
Plastic Limit :	14	%
Plasticity Index :	13	%
Equivalent Water Content of material passing 425µm sieve :	18.5	%
Liquidity Index :	0.35	



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J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

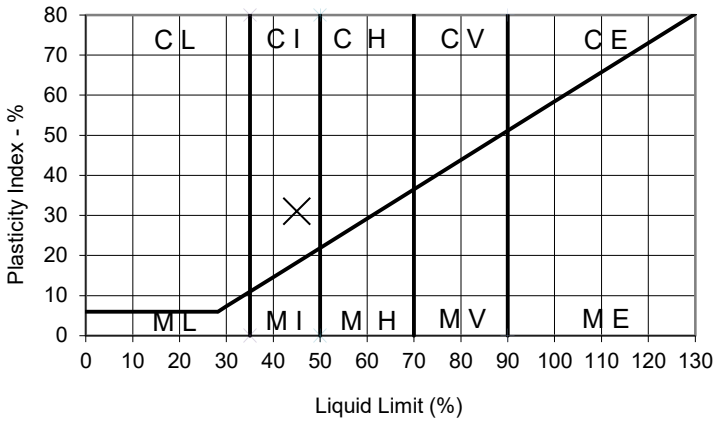
BH / TP	CP02
Depth (m)	0.70
Sample Type	D

Description:

Light grey mottled orangish brown sandy CLAY with rare fine to medium gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	19.0	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	45	%
Plastic Limit :	14	%
Plasticity Index :	31	%
Equivalent Water Content of material passing 425µm sieve :	19.2	%
Liquidity Index :	0.17	



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Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

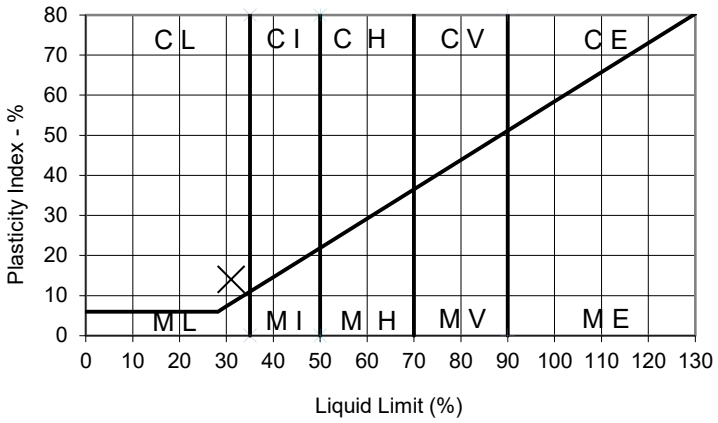
BH / TP	CP02
Depth (m)	4.80
Sample Type	D

Description:

Brown mottled grey sandy CLAY with rare fine gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	23.2	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	31	%
Plastic Limit :	17	%
Plasticity Index :	14	%
Equivalent Water Content of material passing 425µm sieve :	23.5	%
Liquidity Index :	0.46	



Processed by PK
Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

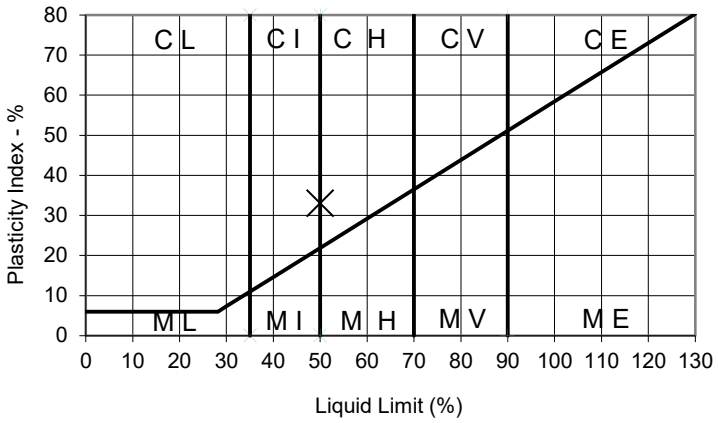
BH / TP	CP03
Depth (m)	1.20
Sample Type	D

Description:

Brown mottled cream CLAY with rare fine gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	12.2	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	50	%
Plastic Limit :	17	%
Plasticity Index :	33	%
Equivalent Water Content of material passing 425µm sieve :	12.3	%
Liquidity Index :	-0.14	



Processed by PK/BB
Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

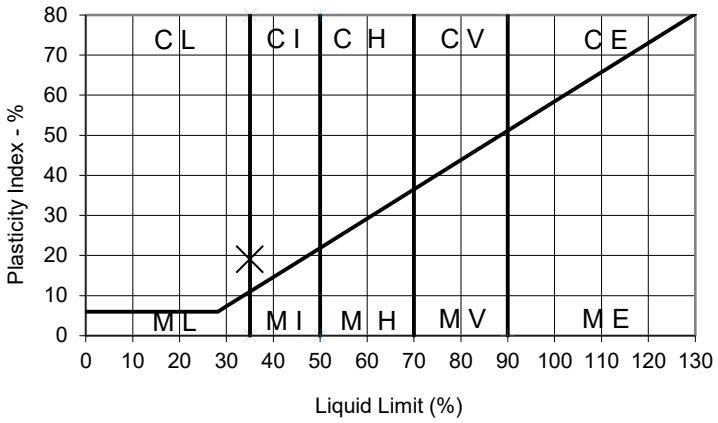
BH / TP	CP03
Depth (m)	5.00
Sample Type	D

Description:

Dark brown slightly sandy silty CLAY.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	17.3	%
Percentage passing 425µm sieve :	100	%
Liquid Limit :	35	%
Plastic Limit :	16	%
Plasticity Index :	19	%
Equivalent Water Content of material passing 425µm sieve :	17.3	%
Liquidity Index :	0.07	



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Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

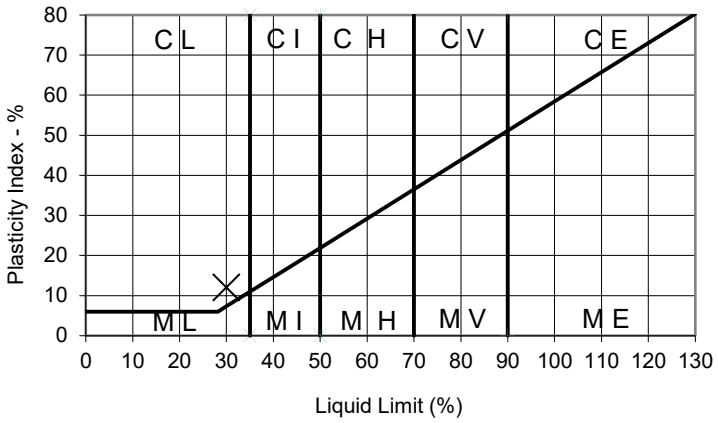
BH / TP	CP03
Depth (m)	8.00
Sample Type	D

Description:

Reddish brown slightly sandy silty CLAY.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	21.1	%
Percentage passing 425µm sieve :	100	%
Liquid Limit :	30	%
Plastic Limit :	18	%
Plasticity Index :	12	%
Equivalent Water Content of material passing 425µm sieve :	21.1	%
Liquidity Index :	0.26	



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Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

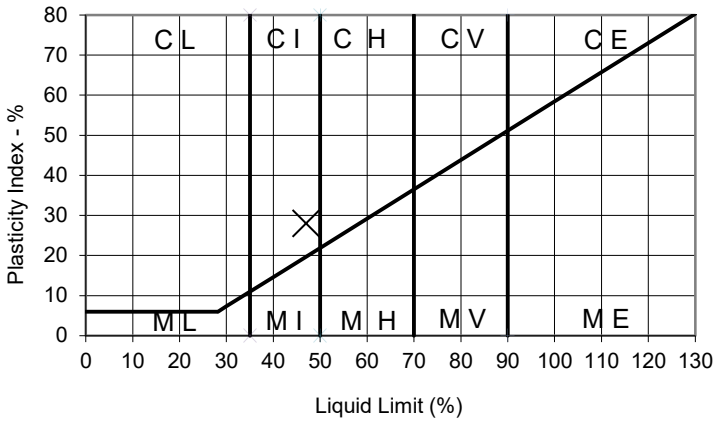
BH / TP	CP05
Depth (m)	2.00
Sample Type	B

Description:

Brown sandy CLAY with much fine to coarse gravel and rare cobbles.

Preparation : Sample washed and air dried

Water Content : (BS EN ISO 17892-1:2014)	15.7	%
Percentage passing 425µm sieve :	55	%
Liquid Limit :	47	%
Plastic Limit :	19	%
Plasticity Index :	28	%
Equivalent Water Content of material passing 425µm sieve :	28.3	%
Liquidity Index :	0.33	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

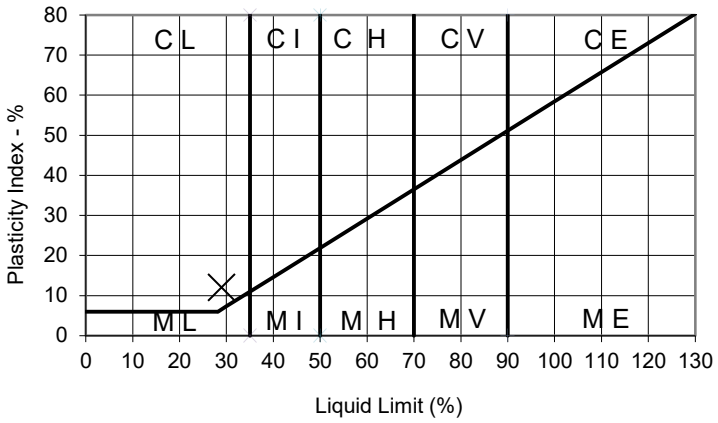
BH / TP	CP05
Depth (m)	6.40
Sample Type	D

Description:

Brown sandy CLAY with some fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	17.8	%
Percentage passing 425µm sieve :	96	%
Liquid Limit :	29	%
Plastic Limit :	17	%
Plasticity Index :	12	%
Equivalent Water Content of material passing 425µm sieve :	18.5	%
Liquidity Index :	0.13	



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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

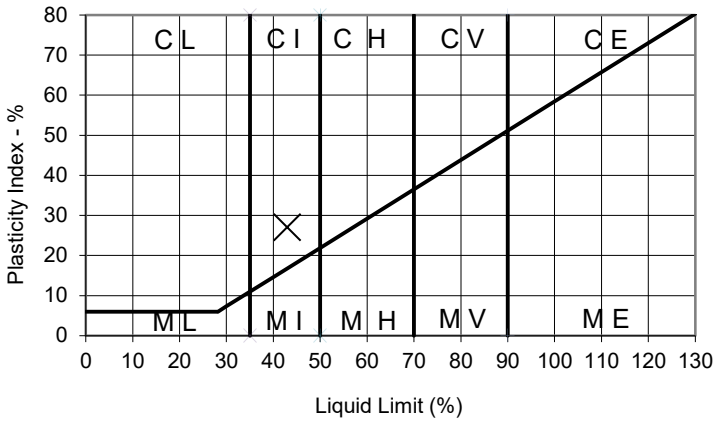
BH / TP	TP01
Depth (m)	1.20
Sample Type	B

Description:

Reddish brown CLAY with some fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	17.2	%
Percentage passing 425µm sieve :	95	%
Liquid Limit :	43	%
Plastic Limit :	16	%
Plasticity Index :	27	%
Equivalent Water Content of material passing 425µm sieve :	18.0	%
Liquidity Index :	0.07	



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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

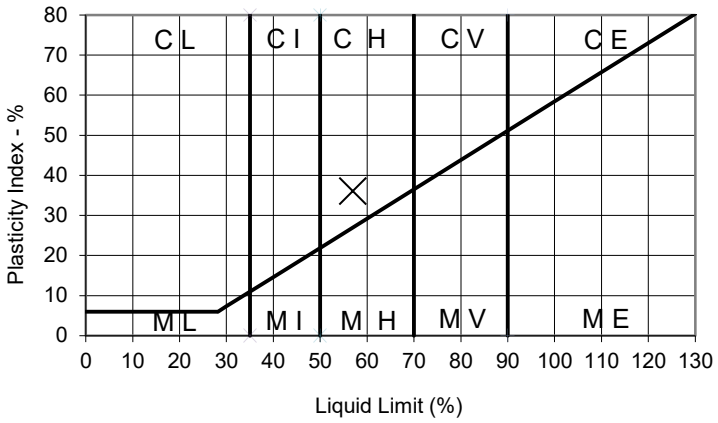
BH / TP	TP01
Depth (m)	2.30
Sample Type	B

Description:

Brown CLAY with rare fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	23.7	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	57	%
Plastic Limit :	21	%
Plasticity Index :	36	%
Equivalent Water Content of material passing 425µm sieve :	24.0	%
Liquidity Index :	0.08	



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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

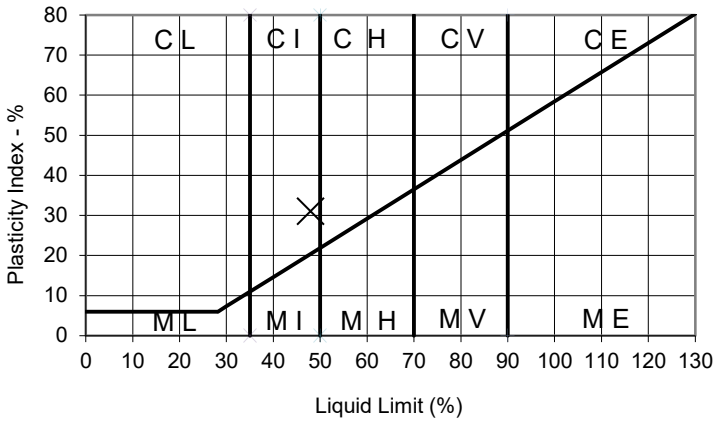
BH / TP	TP04
Depth (m)	2.10
Sample Type	B

Description:

Brown CLAY with some fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	22.6	%
Percentage passing 425µm sieve :	95	%
Liquid Limit :	48	%
Plastic Limit :	17	%
Plasticity Index :	31	%
Equivalent Water Content of material passing 425µm sieve :	23.8	%
Liquidity Index :	0.22	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

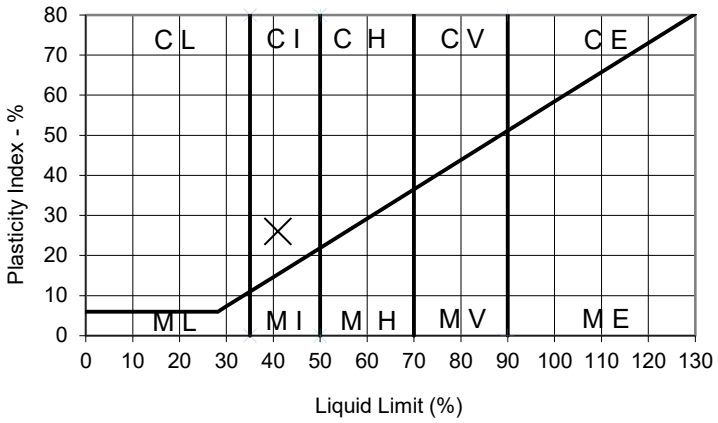
BH / TP	TP06
Depth (m)	0.60
Sample Type	B

Description:

Grey mottled yellowish brown slightly sandy CLAY with some fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	16.5	%
Percentage passing 425µm sieve :	98	%
Liquid Limit :	41	%
Plastic Limit :	15	%
Plasticity Index :	26	%
Equivalent Water Content of material passing 425µm sieve :	16.9	%
Liquidity Index :	0.07	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

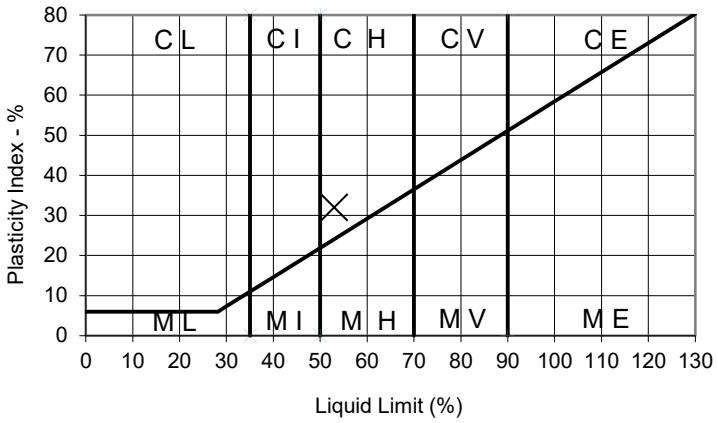
BH / TP	TP07
Depth (m)	2.00
Sample Type	D

Description:

Brown mottled grey very sandy CLAY with much fine to coarse gravel.

Preparation : Sample washed and air dried

Water Content : (BS EN ISO 17892-1:2014)	19.6	%
Percentage passing 425µm sieve :	63	%
Liquid Limit :	53	%
Plastic Limit :	21	%
Plasticity Index :	32	%
Equivalent Water Content of material passing 425µm sieve :	31.0	%
Liquidity Index :	0.31	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

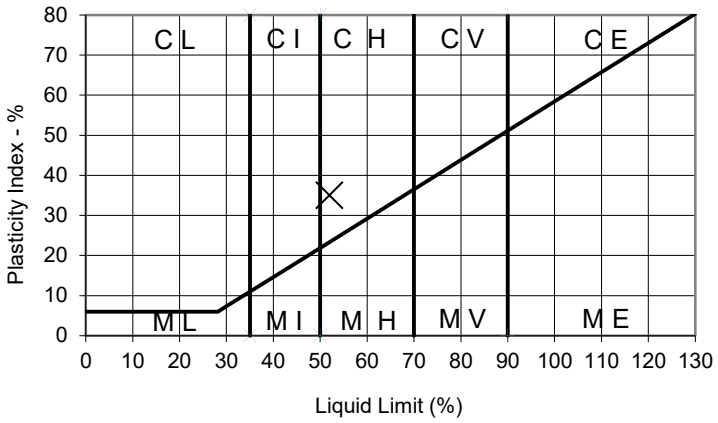
BH / TP	TP09
Depth (m)	1.30
Sample Type	B

Description:

Brown mottled grey slightly sandy CLAY with some fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	23.2	%
Percentage passing 425µm sieve :	95	%
Liquid Limit :	52	%
Plastic Limit :	17	%
Plasticity Index :	35	%
Equivalent Water Content of material passing 425µm sieve :	24.4	%
Liquidity Index :	0.21	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

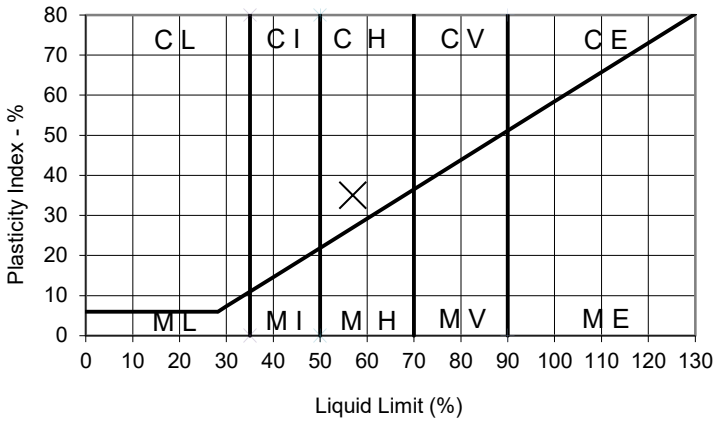
BH / TP	TP09
Depth (m)	2.60
Sample Type	D

Description:

Dark brown mottled dark grey CLAY.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	23.7	%
Percentage passing 425µm sieve :	100	%
Liquid Limit :	57	%
Plastic Limit :	22	%
Plasticity Index :	35	%
Equivalent Water Content of material passing 425µm sieve :	23.7	%
Liquidity Index :	0.05	



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AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

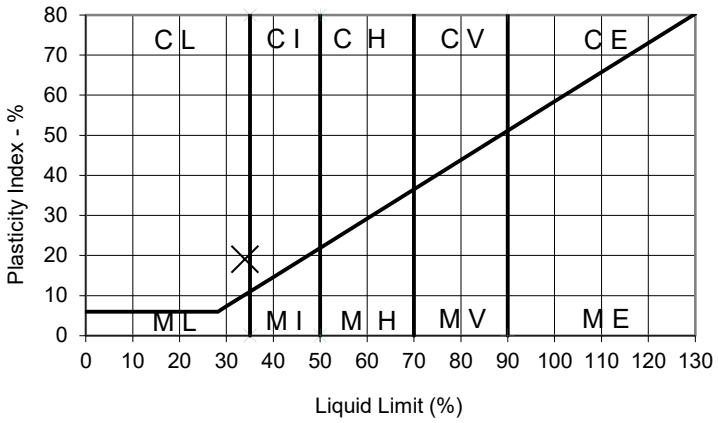
BH / TP	TP10
Depth (m)	0.50
Sample Type	D

Description:

Brown mottled light grey sandy CLAY with rare fine to medium gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	14.4	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	34	%
Plastic Limit :	15	%
Plasticity Index :	19	%
Equivalent Water Content of material passing 425µm sieve :	14.6	%
Liquidity Index :	-0.02	



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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

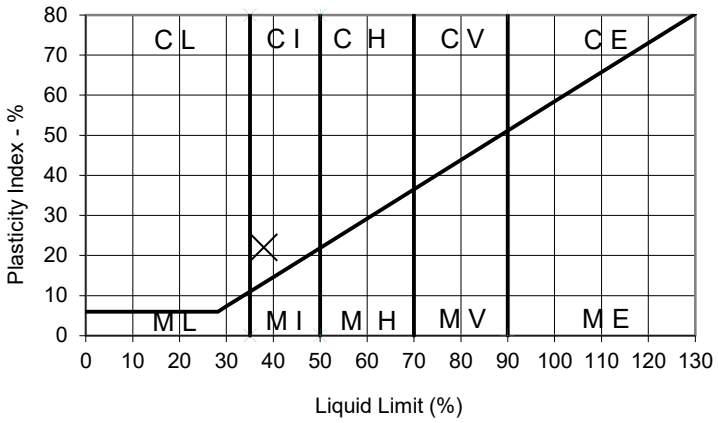
BH / TP	TP10
Depth (m)	1.60
Sample Type	D

Description:

Brown mottled grey slightly sandy CLAY with rare fine to coarse gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	19.3	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	38	%
Plastic Limit :	16	%
Plasticity Index :	22	%
Equivalent Water Content of material passing 425µm sieve :	19.5	%
Liquidity Index :	0.16	



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AG2941-18

BS1377 : Part 2 : 1990 Clauses 4.4 & 5

LIQUID AND PLASTIC LIMITS

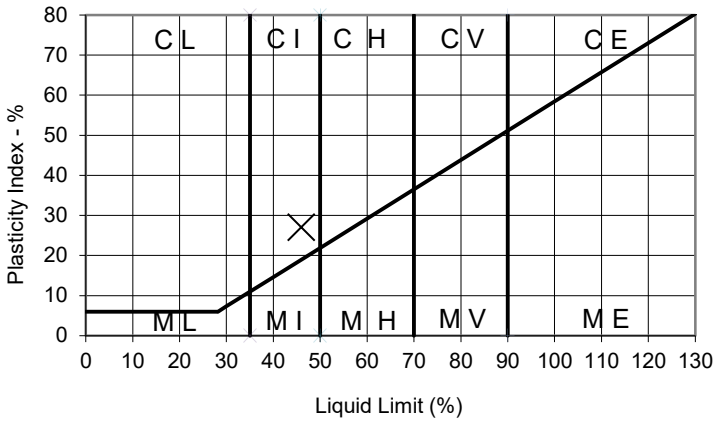
BH / TP	TP16
Depth (m)	0.50
Sample Type	D

Description:

Light brown and brown mottled sandy CLAY with rare fine to medium gravel.

Preparation : Sample as received

Water Content : (BS EN ISO 17892-1:2014)	22.7	%
Percentage passing 425µm sieve :	99	%
Liquid Limit :	46	%
Plastic Limit :	19	%
Plasticity Index :	27	%
Equivalent Water Content of material passing 425µm sieve :	23.0	%
Liquidity Index :	0.15	



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Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

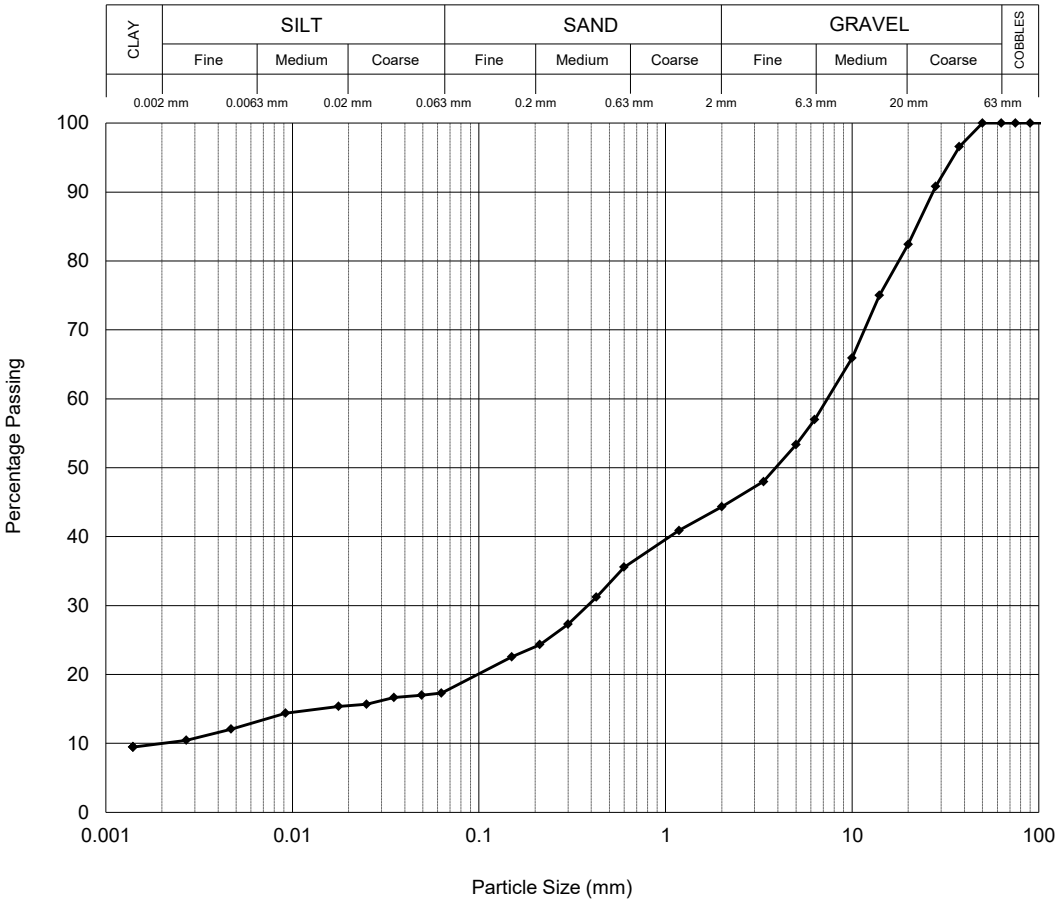
BH / TP No.	CP02
Depth (m)	1.65-2.10
Sample Type	B

Description

Yellowish brown sandy slightly clayey fine to coarse GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	97
28.0 mm	91
20.0 mm	82
14.0 mm	75
10.0 mm	66
6.30 mm	57
5.00 mm	53
3.35 mm	48
2.00 mm	44
1.18 mm	41
600 µm	36
425 µm	31
300 µm	27
212 µm	24
150 µm	23
63 µm	17



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
49 µm	17
35 µm	17
25 µm	16
18 µm	15
9.2 µm	14
4.7 µm	12
2.7 µm	10
1.4 µm	9
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	56
Sand	27
Silt	7
Clay	10

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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS
UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

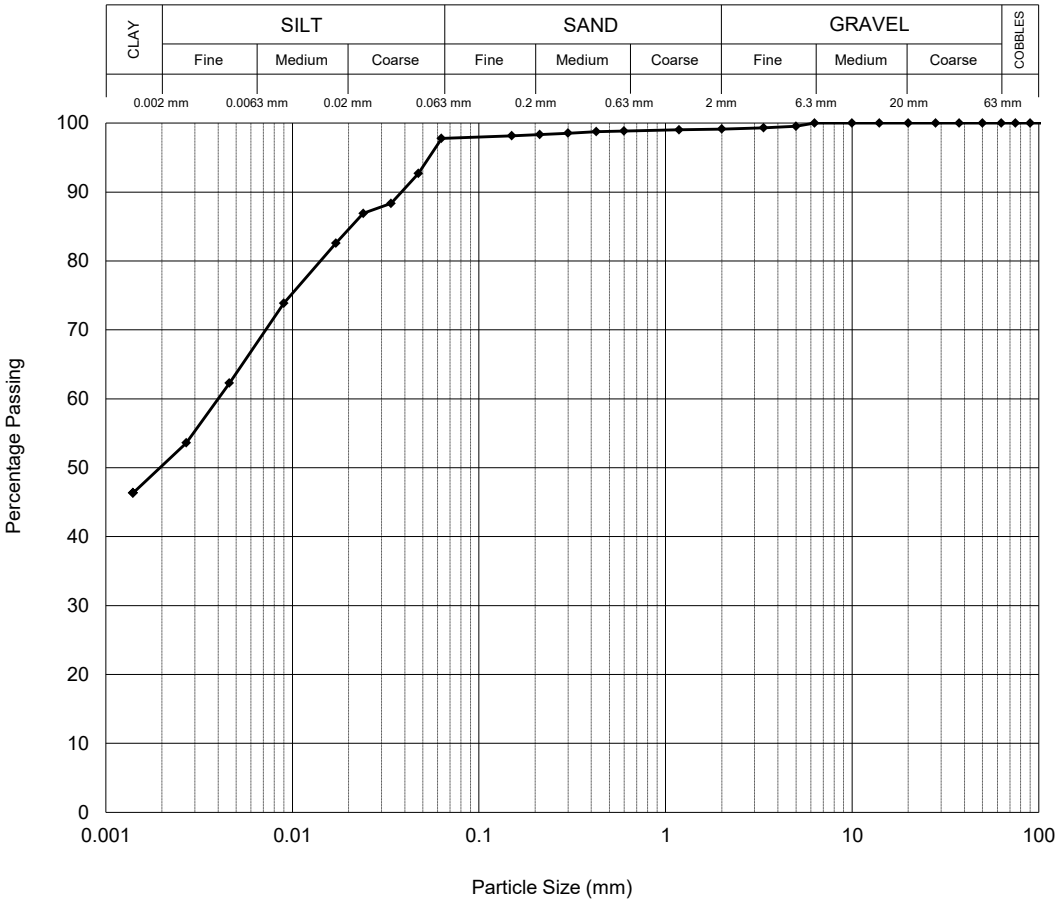
BH / TP No.	CP03
Depth (m)	1.65-2.00
Sample Type	B

Description

Brown silty CLAY with rare fine gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	99
2.00 mm	99
1.18 mm	99
600 µm	99
425 µm	99
300 µm	99
212 µm	98
150 µm	98
63 µm	98



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
47 µm	93
34 µm	88
24 µm	87
17 µm	83
9.0 µm	74
4.6 µm	62
2.7 µm	54
1.4 µm	46
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	1
Sand	1
Silt	48
Clay	50

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AG2941-18

GEOLABS

UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

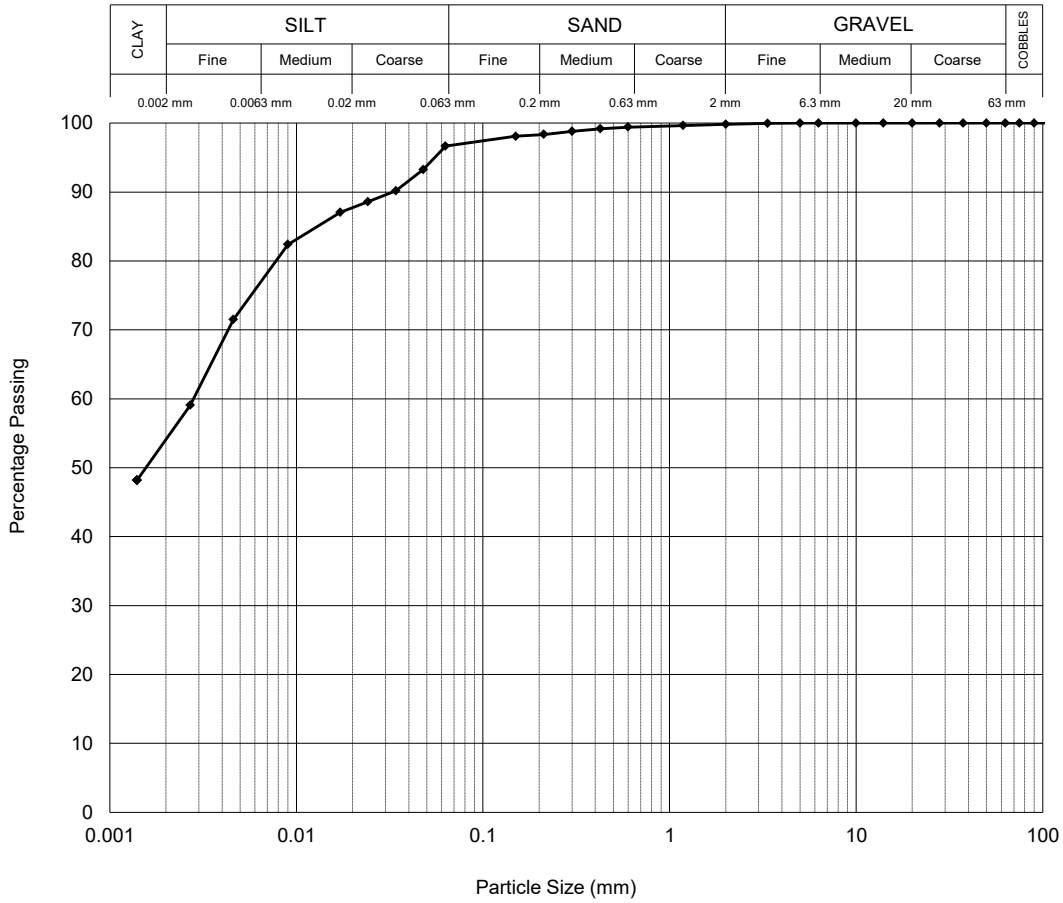
BH / TP No.	CP03
Depth (m)	3.45-4.00
Sample Type	B

Description

Dark brown silty CLAY.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	100
600 µm	99
425 µm	99
300 µm	99
212 µm	98
150 µm	98
63 µm	97



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
48 µm	93
34 µm	90
24 µm	89
17 µm	87
9.0 µm	82
4.6 µm	72
2.7 µm	59
1.4 µm	48
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	0
Sand	3
Silt	43
Clay	54

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AG2941-18

GEOLABS

UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

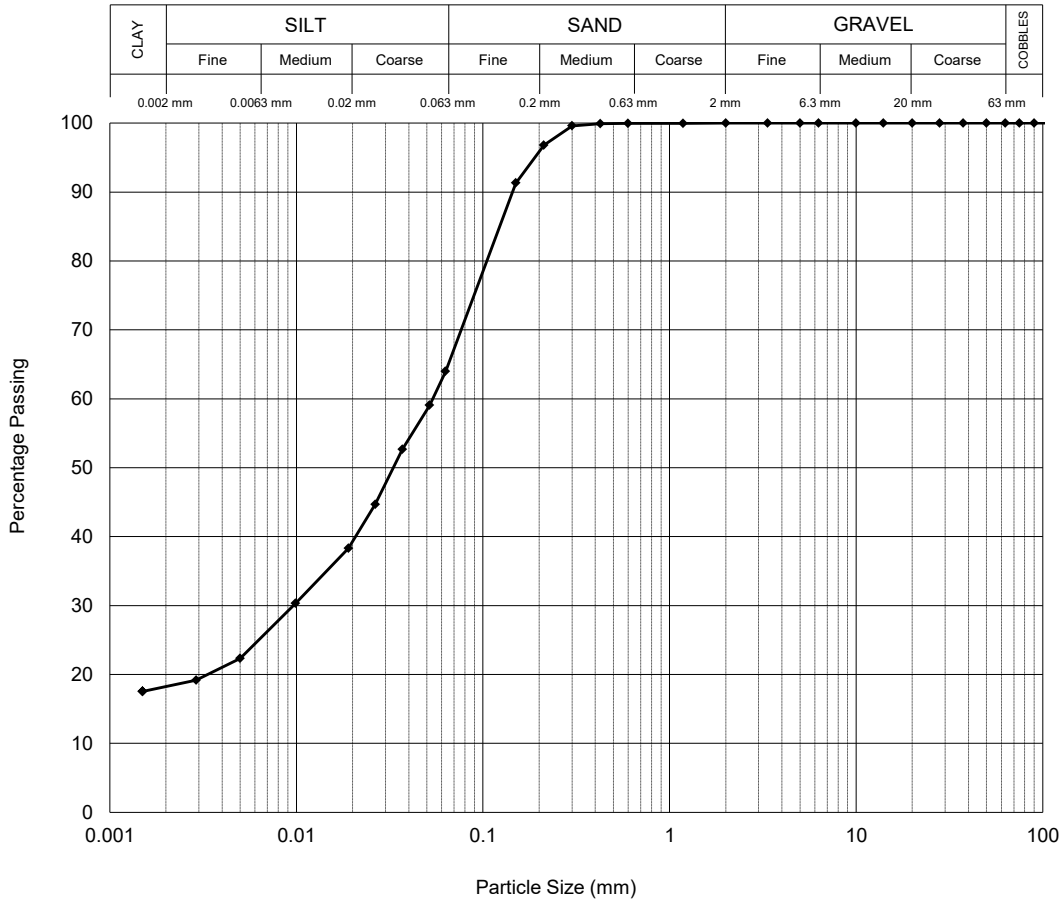
BH / TP No.	CP04
Depth (m)	3.95-4.50
Sample Type	B

Description

Brown very sandy clayey SILT.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	100
600 µm	100
425 µm	100
300 µm	100
212 µm	97
150 µm	91
63 µm	64



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
52 µm	59
37 µm	53
27 µm	45
19 µm	38
9.9 µm	30
5.0 µm	22
2.9 µm	19
1.5 µm	18
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	0
Sand	36
Silt	46
Clay	18

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Project Number:

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Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

BH / TP No.	CP05
Depth (m)	0.40-0.80
Sample Type	B

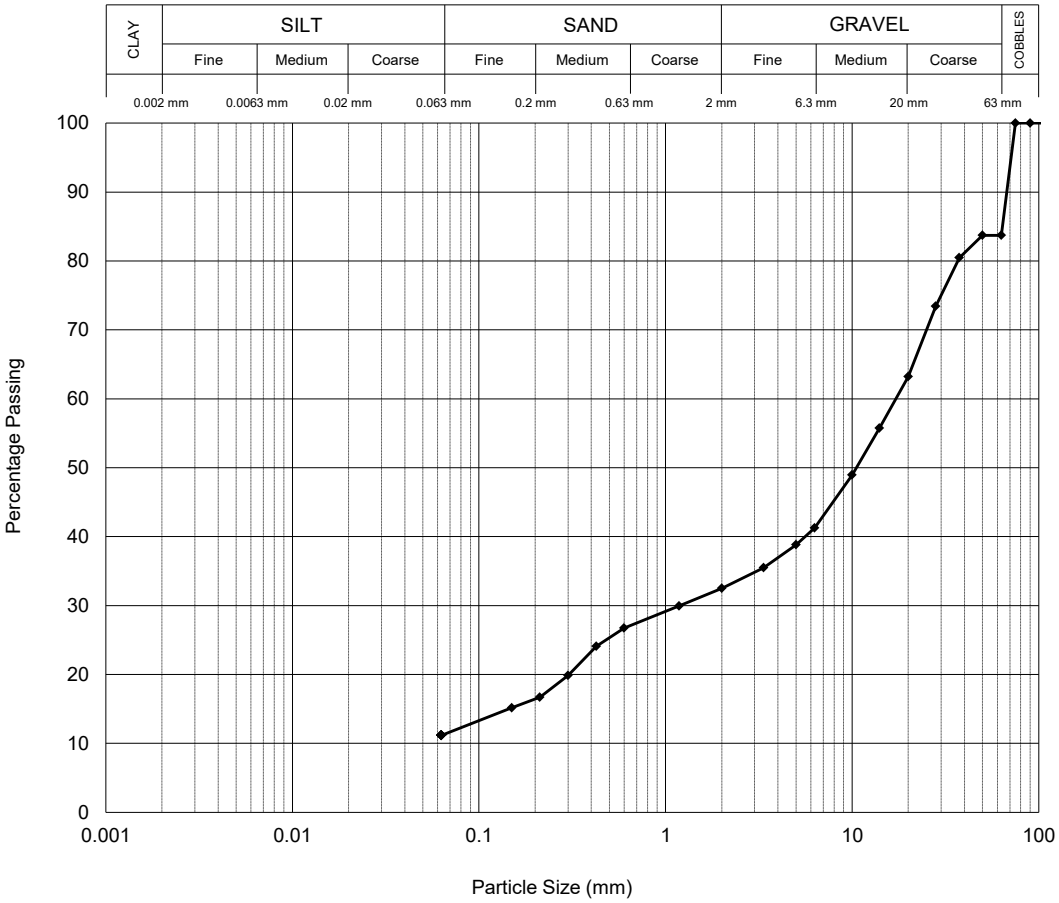
Description

Orangish brown sandy slightly clayey fine to coarse GRAVEL with some cobbles.

Remarks: Insuffcient sample supplied to comply with BS EN ISO 17892-4 : 2016 minimum mass requirements

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	84
50.0 mm	84
37.5 mm	80
28.0 mm	73
20.0 mm	63
14.0 mm	56
10.0 mm	49
6.30 mm	41
5.00 mm	39
3.35 mm	35
2.00 mm	32
1.18 mm	30
600 µm	27
425 µm	24
300 µm	20
212 µm	17
150 µm	15
63 µm	11



Particle Proportions	
Cobbles	16
Gravel	51
Sand	21
Silt & Clay	12

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Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

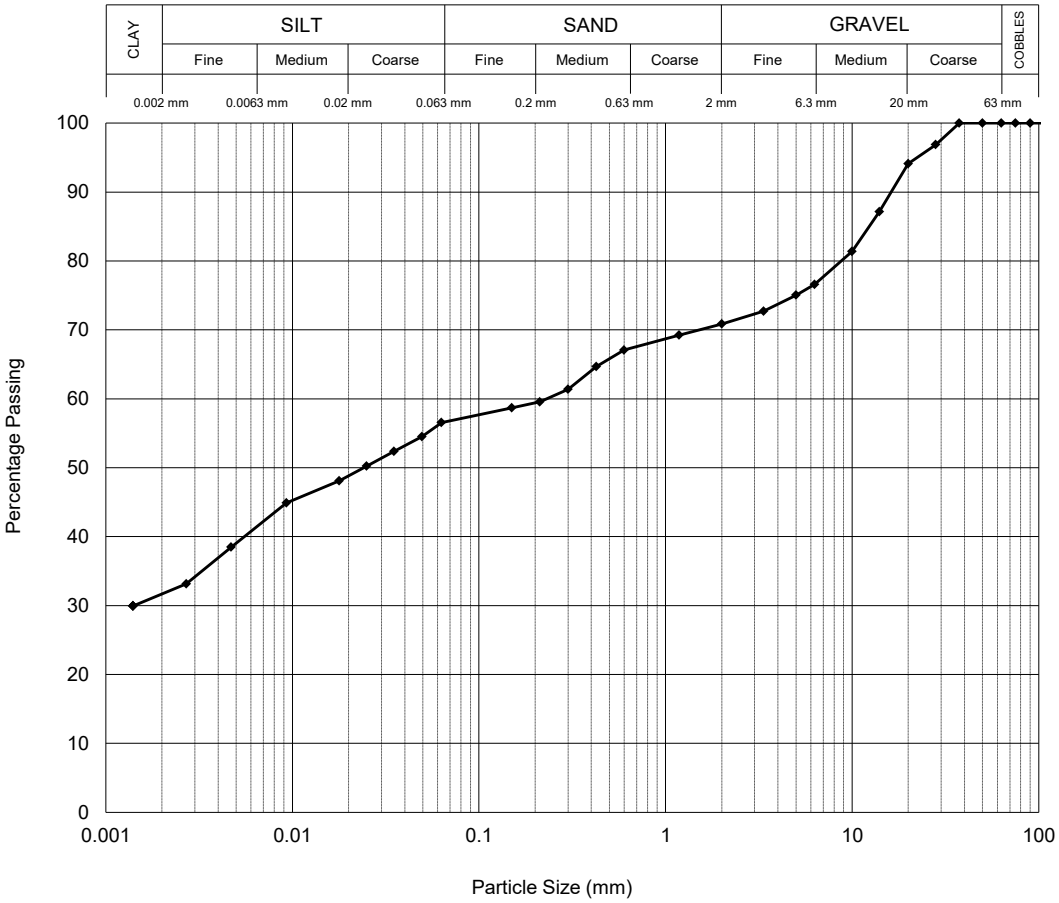
BH / TP No.	CP05
Depth (m)	3.00-4.00
Sample Type	B

Description

Orangish brown slightly sandy silty CLAY with some fine to coarse gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	97
20.0 mm	94
14.0 mm	87
10.0 mm	81
6.30 mm	77
5.00 mm	75
3.35 mm	73
2.00 mm	71
1.18 mm	69
600 µm	67
425 µm	65
300 µm	61
212 µm	60
150 µm	59
63 µm	57



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
49 µm	55
35 µm	52
25 µm	50
18 µm	48
9.3 µm	45
4.7 µm	38
2.7 µm	33
1.4 µm	30
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	29
Sand	14
Silt	25
Clay	32

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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

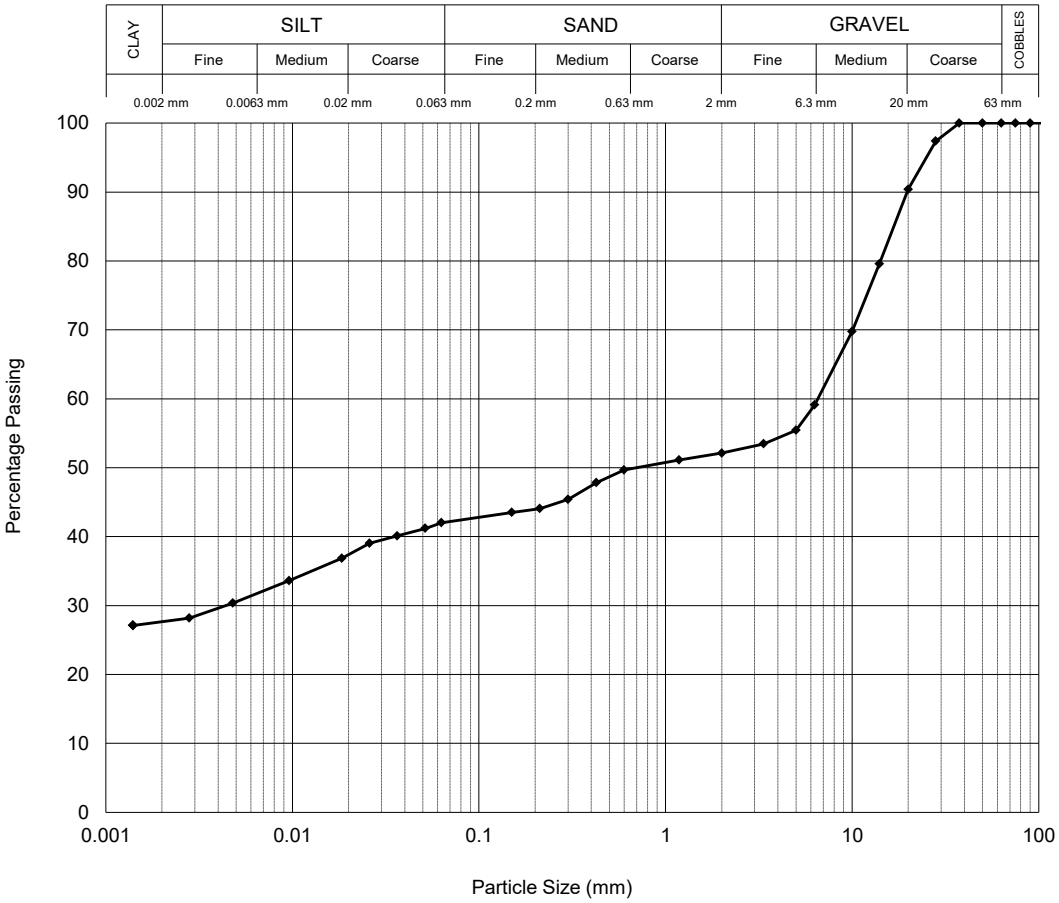
BH / TP No.	TP02
Depth (m)	2.50
Sample Type	B

Description

Orangish brown mottled grey sandy silty CLAY with much fine to coarse gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	97
20.0 mm	90
14.0 mm	80
10.0 mm	70
6.30 mm	59
5.00 mm	55
3.35 mm	53
2.00 mm	52
1.18 mm	51
600 µm	50
425 µm	48
300 µm	45
212 µm	44
150 µm	44
63 µm	42



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
52 µm	41
37 µm	40
26 µm	39
18 µm	37
9.6 µm	34
4.8 µm	30
2.8 µm	28
1.4 µm	27
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	48
Sand	10
Silt	14
Clay	28

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

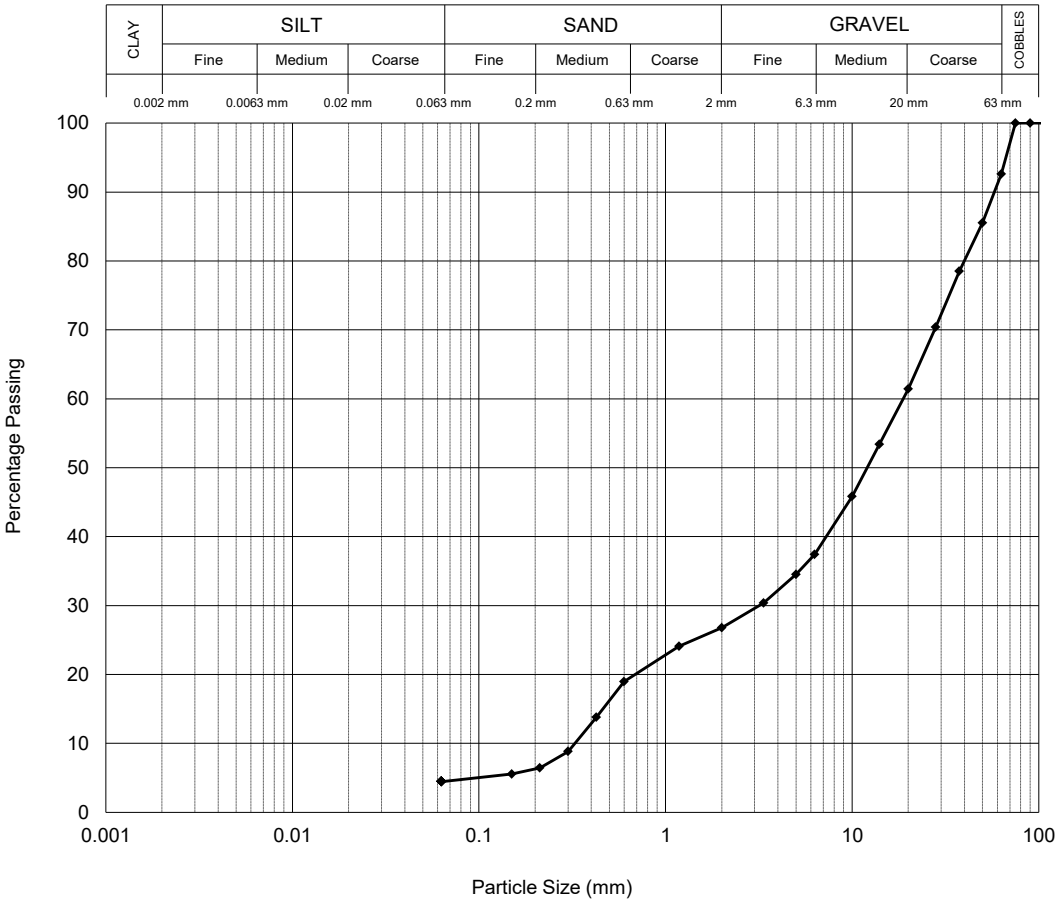
BH / TP No.	TP03
Depth (m)	3.00
Sample Type	B

Description

Orangish brown sandy fine to coarse GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	93
50.0 mm	86
37.5 mm	79
28.0 mm	70
20.0 mm	61
14.0 mm	53
10.0 mm	46
6.30 mm	37
5.00 mm	35
3.35 mm	30
2.00 mm	27
1.18 mm	24
600 µm	19
425 µm	14
300 µm	9
212 µm	6
150 µm	6
63 µm	4



Particle Proportions	
Cobbles	7
Gravel	66
Sand	22
Silt & Clay	5

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

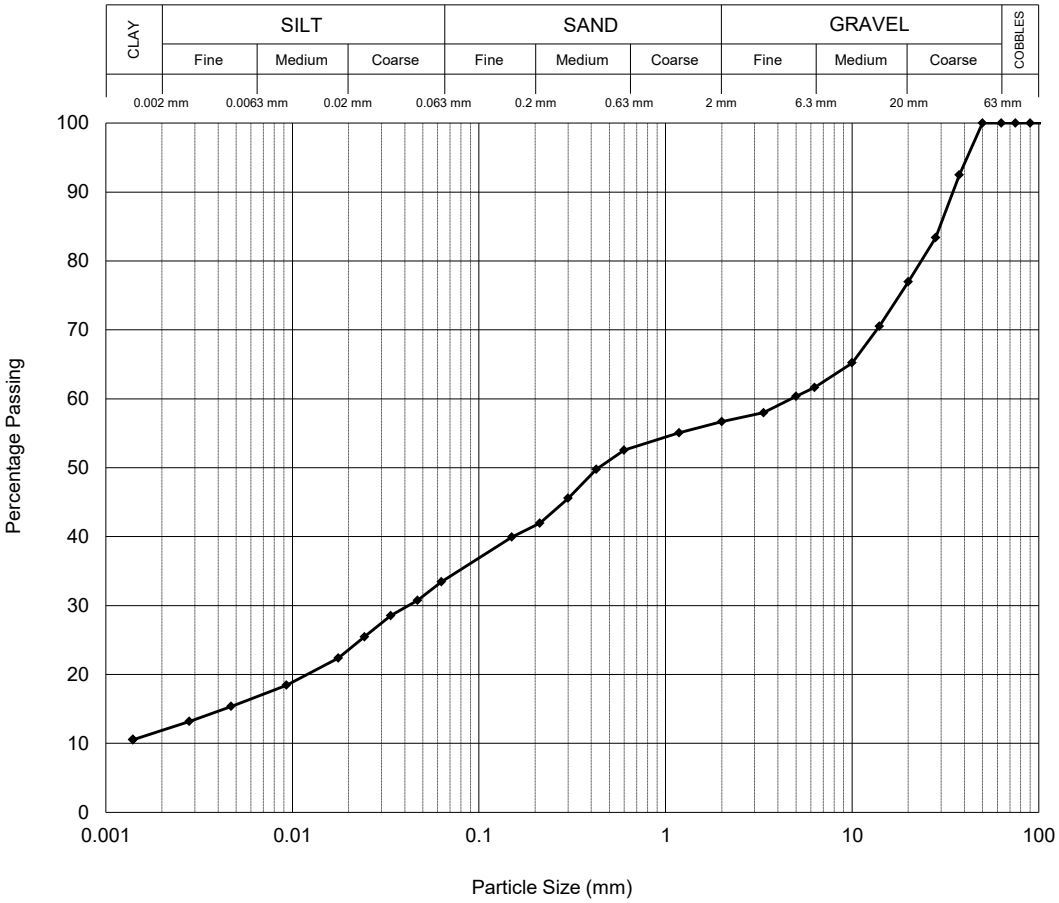
BH / TP No.	TP05
Depth (m)	1.10
Sample Type	B

Description

Dark brown sandy clayey TOPSOIL with some fine to coarse gravel and some roots.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	92
28.0 mm	83
20.0 mm	77
14.0 mm	71
10.0 mm	65
6.30 mm	62
5.00 mm	60
3.35 mm	58
2.00 mm	57
1.18 mm	55
600 µm	53
425 µm	50
300 µm	46
212 µm	42
150 µm	40
63 µm	33



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
47 µm	31
34 µm	29
24 µm	25
18 µm	22
9.3 µm	18
4.7 µm	15
2.8 µm	13
1.4 µm	11
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	43
Sand	23
Silt	22
Clay	12

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Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

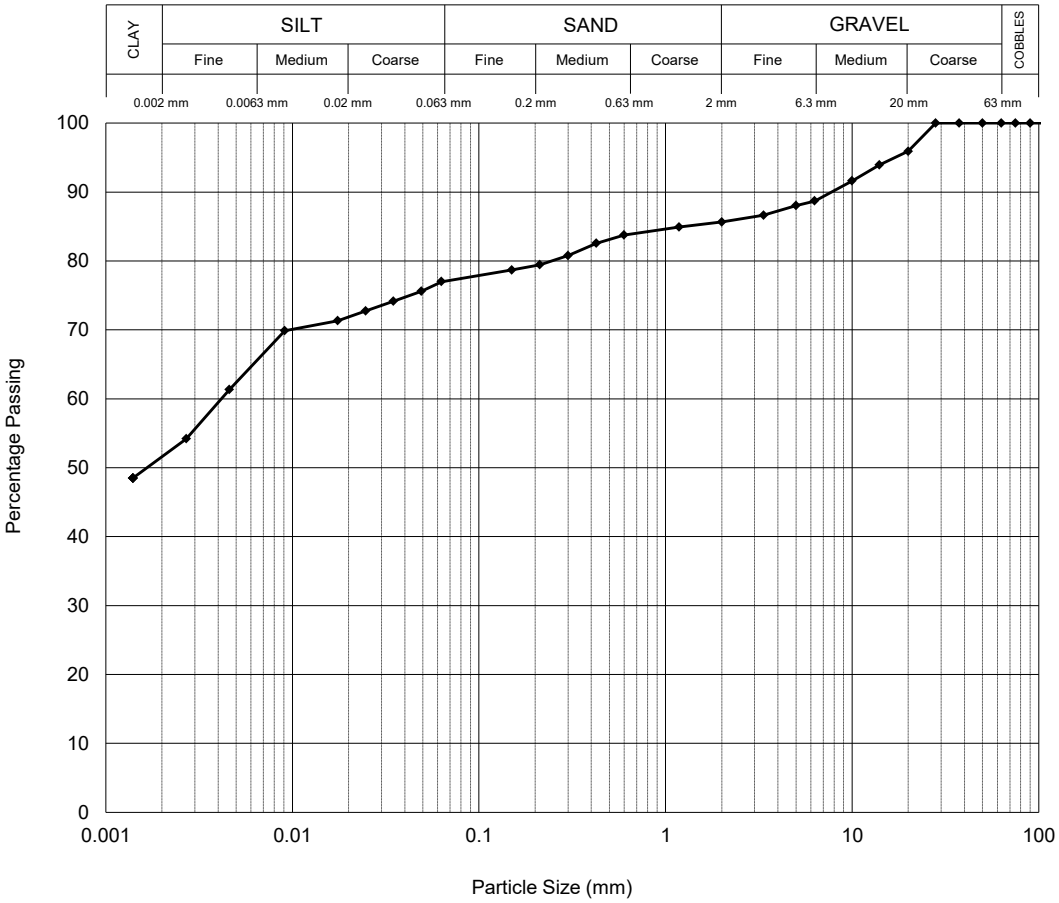
BH / TP No.	TP07
Depth (m)	0.60
Sample Type	B

Description

Yellowish brown mottled grey silty CLAY with some fine to medium gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	96
14.0 mm	94
10.0 mm	92
6.30 mm	89
5.00 mm	88
3.35 mm	87
2.00 mm	86
1.18 mm	85
600 µm	84
425 µm	83
300 µm	81
212 µm	79
150 µm	79
63 µm	77



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
49 µm	76
35 µm	74
25 µm	73
18 µm	71
9.1 µm	70
4.6 µm	61
2.7 µm	54
1.4 µm	48
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	14
Sand	9
Silt	26
Clay	51

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Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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UKAS TESTING 1982

BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

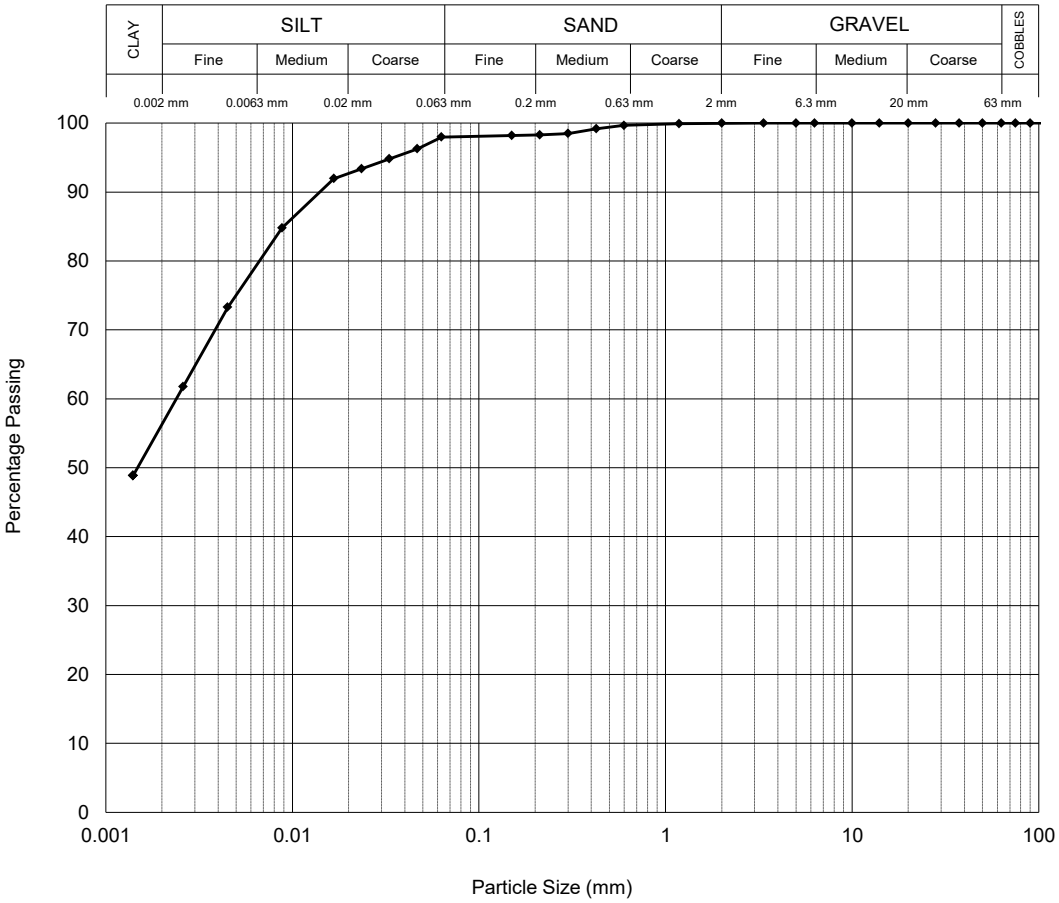
BH / TP No.	TP07
Depth (m)	2.50
Sample Type	D

Description

Dark brown silty CLAY.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	100
600 µm	100
425 µm	99
300 µm	98
212 µm	98
150 µm	98
63 µm	98



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
47 µm	96
33 µm	95
24 µm	93
17 µm	92
8.8 µm	85
4.5 µm	73
2.6 µm	62
1.4 µm	49
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	0
Sand	2
Silt	43
Clay	55

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AG2941-18

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

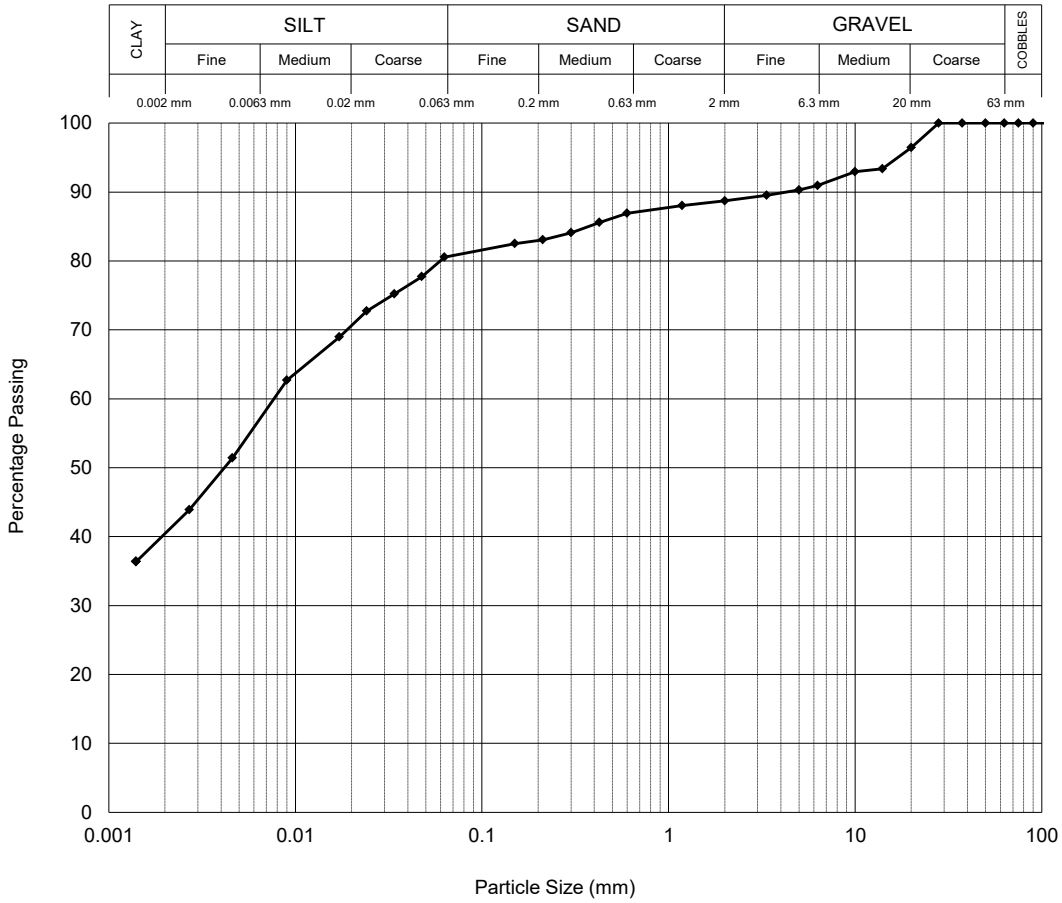
BH / TP No.	TP08
Depth (m)	1.60
Sample Type	B

Description

Dark brown silty CLAY with some fine to medium gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	96
14.0 mm	93
10.0 mm	93
6.30 mm	91
5.00 mm	90
3.35 mm	90
2.00 mm	89
1.18 mm	88
600 µm	87
425 µm	86
300 µm	84
212 µm	83
150 µm	83
63 µm	81



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
48 µm	78
34 µm	75
24 µm	73
17 µm	69
9.0 µm	63
4.6 µm	51
2.7 µm	44
1.4 µm	36
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	11
Sand	8
Silt	41
Clay	40

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AG2941-18

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

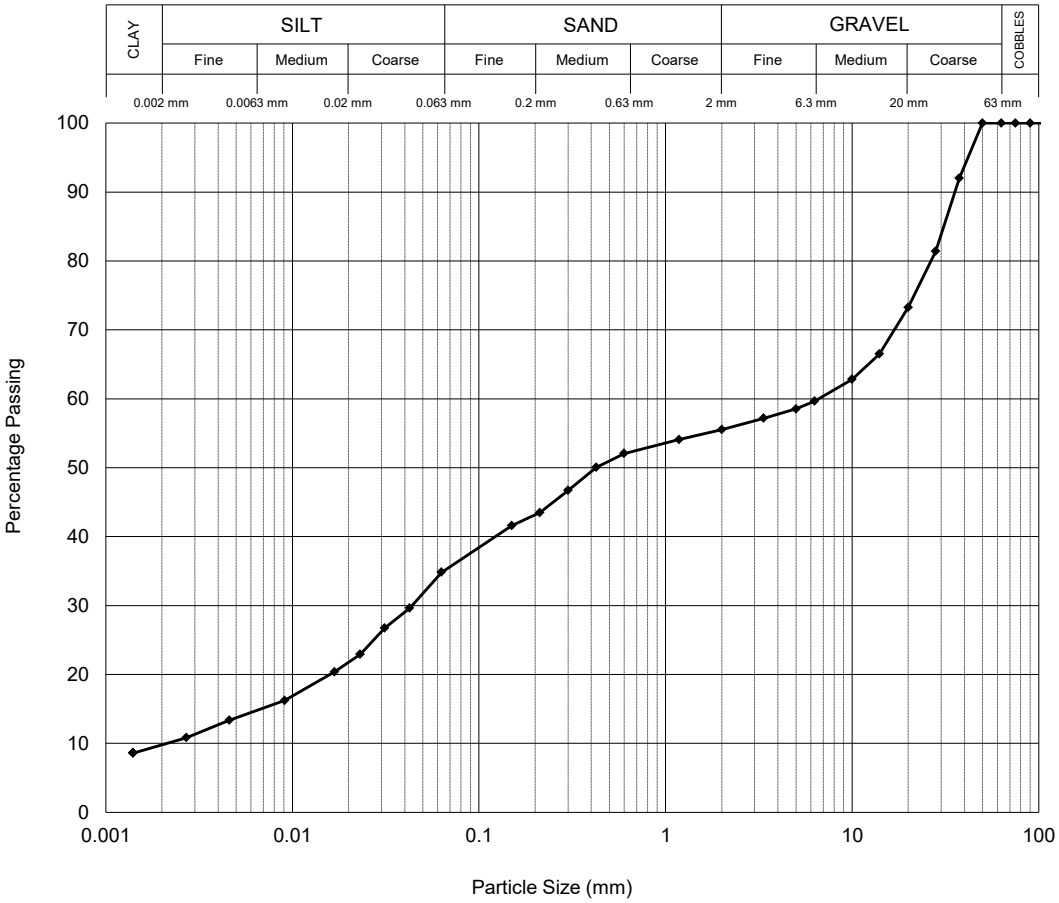
BH / TP No.	TP11
Depth (m)	1.00
Sample Type	B

Description

Dark brown sandy clayey TOPSOIL with much fine to coarse gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	92
28.0 mm	81
20.0 mm	73
14.0 mm	67
10.0 mm	63
6.30 mm	60
5.00 mm	59
3.35 mm	57
2.00 mm	56
1.18 mm	54
600 µm	52
425 µm	50
300 µm	47
212 µm	43
150 µm	42
63 µm	35



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
43 µm	30
31 µm	27
23 µm	23
17 µm	20
9.1 µm	16
4.6 µm	13
2.7 µm	11
1.4 µm	9
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	44
Sand	21
Silt	25
Clay	10

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

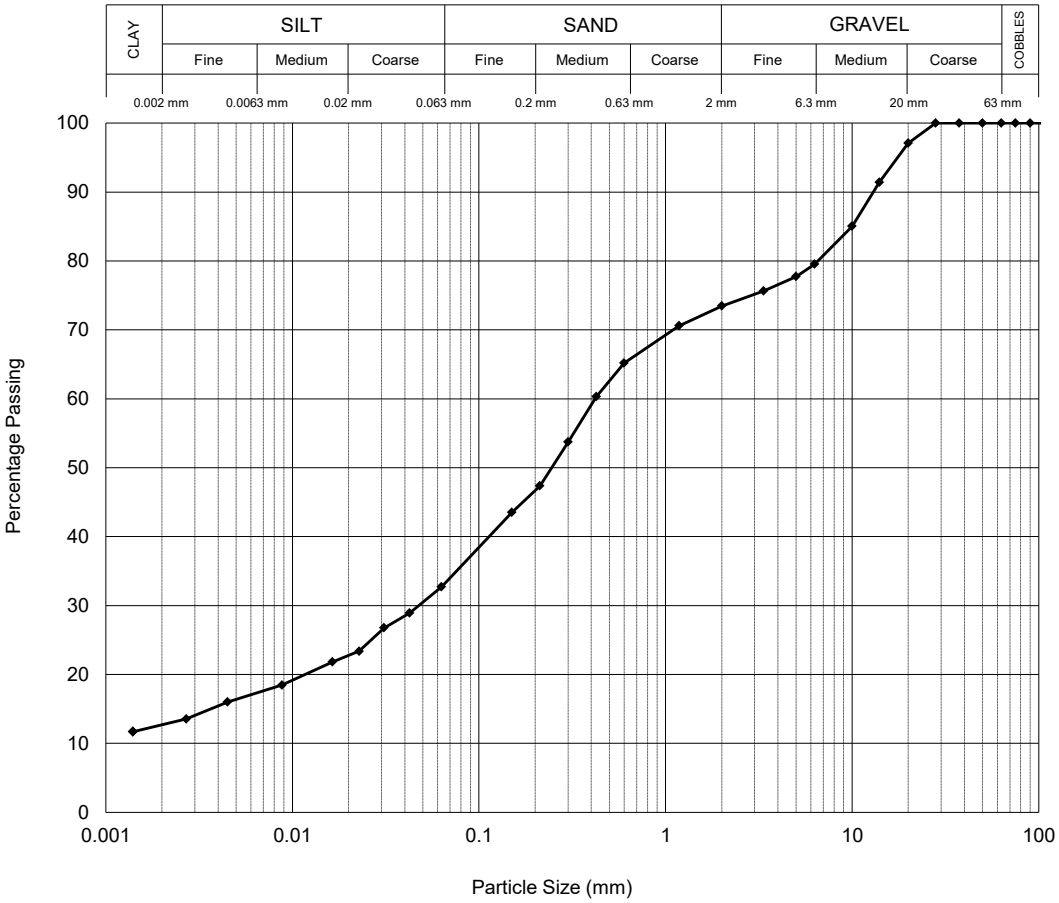
BH / TP No.	TP13
Depth (m)	2.75
Sample Type	B

Description

Dark brown sandy clayey TOPSOIL with some fine to medium gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	97
14.0 mm	91
10.0 mm	85
6.30 mm	80
5.00 mm	78
3.35 mm	76
2.00 mm	73
1.18 mm	71
600 µm	65
425 µm	60
300 µm	54
212 µm	47
150 µm	44
63 µm	33



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
43 µm	29
31 µm	27
23 µm	23
16 µm	22
8.8 µm	18
4.5 µm	16
2.7 µm	14
1.4 µm	12
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	27
Sand	41
Silt	20
Clay	12

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

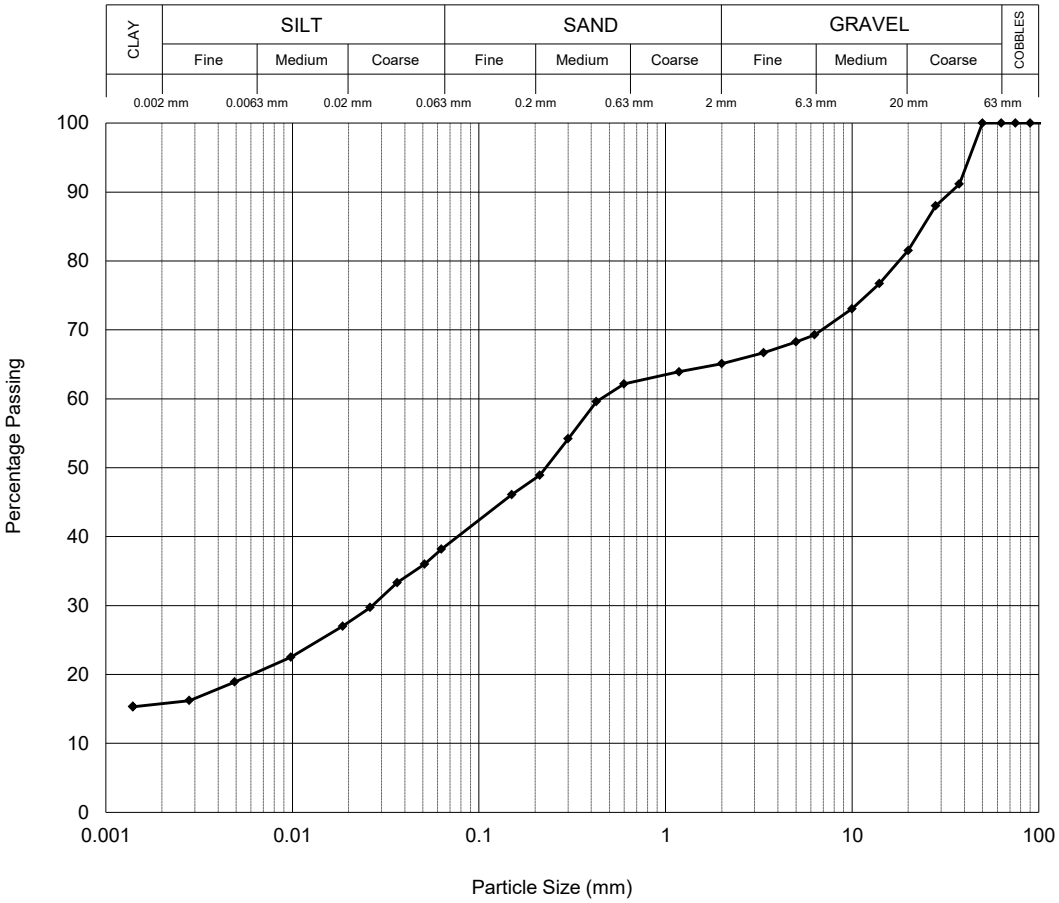
BH / TP No.	TP14
Depth (m)	0.60
Sample Type	B

Description

Orangish brown very sandy silty clayey fine to coarse GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.3 - Sedimentation by Hydrometer

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	91
28.0 mm	88
20.0 mm	82
14.0 mm	77
10.0 mm	73
6.30 mm	69
5.00 mm	68
3.35 mm	67
2.00 mm	65
1.18 mm	64
600 µm	62
425 µm	60
300 µm	54
212 µm	49
150 µm	46
63 µm	38



Sedimentation	
No Pre-treatment used	
Temp (°C)	25
Size	% Pass
51 µm	36
37 µm	33
26 µm	30
19 µm	27
9.8 µm	23
4.9 µm	19
2.8 µm	16
1.4 µm	15
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0
Gravel	35
Sand	27
Silt	23
Clay	15

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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

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BS EN ISO 17892-4 : 2016

PARTICLE SIZE DISTRIBUTION

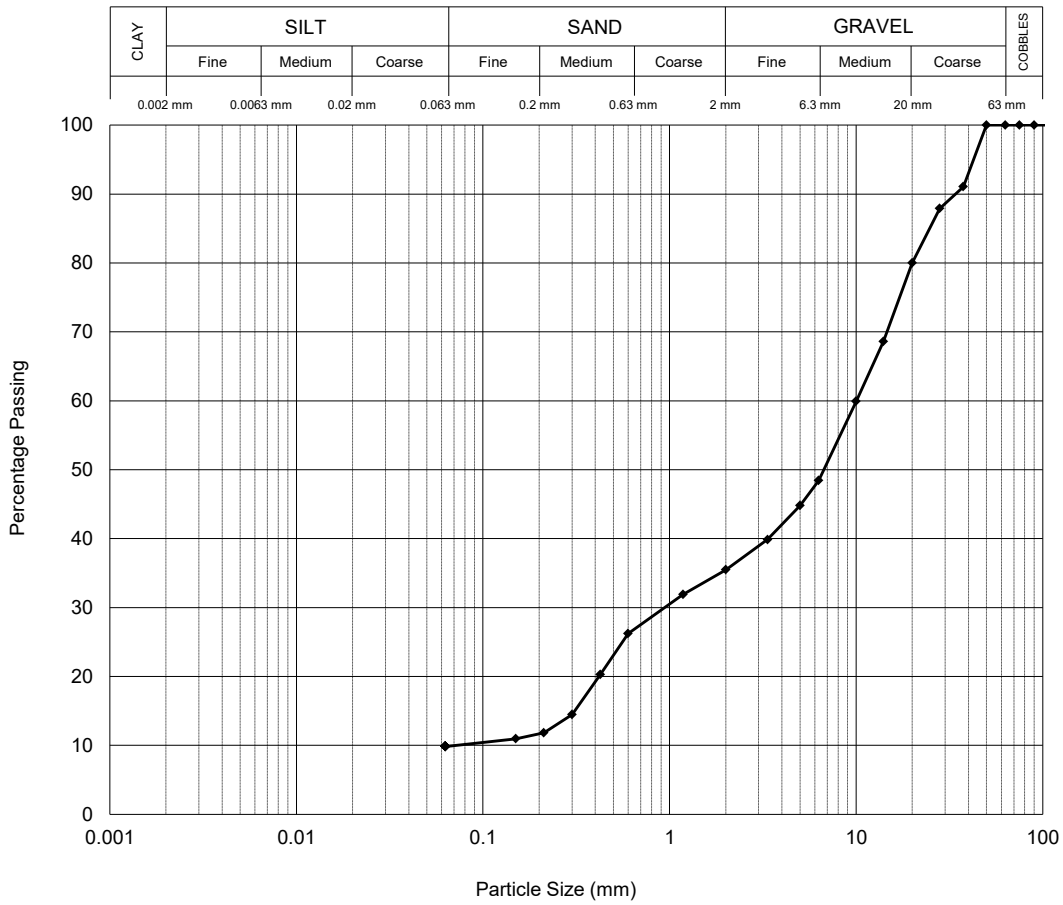
BH / TP No.	TP15
Depth (m)	1.40
Sample Type	B

Description

Orangish brown sandy fine to coarse GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	91
28.0 mm	88
20.0 mm	80
14.0 mm	69
10.0 mm	60
6.30 mm	48
5.00 mm	45
3.35 mm	40
2.00 mm	35
1.18 mm	32
600 µm	26
425 µm	20
300 µm	14
212 µm	12
150 µm	11
63 µm	10



Particle Proportions	
Cobbles	0
Gravel	65
Sand	26
Silt & Clay	9

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AG2941-18

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BS1377:Part 4:1990 Clause 3.4

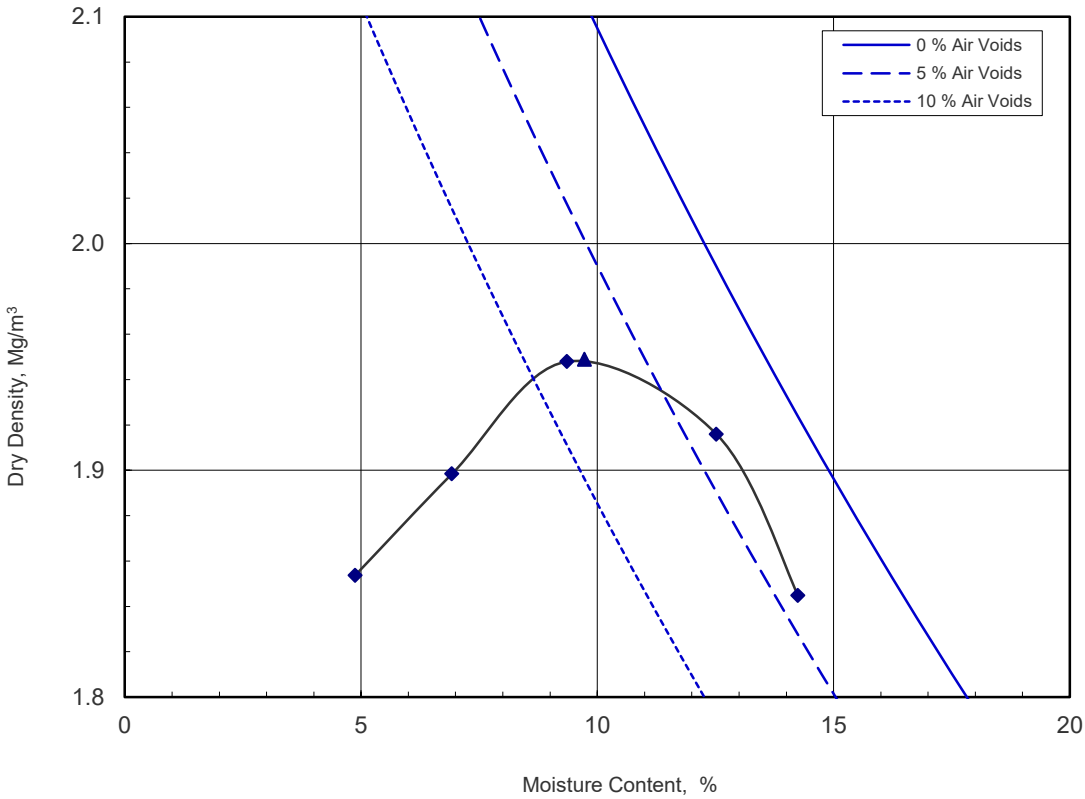
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	CP01
Depth (m)	0.50-1.20
Sample Type	B

Description:

Brown and yellowish brown mottled sandy CLAY with much fine to coarse gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	10
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.95
Optimum Moisture Content	%	9.7



Determination		1	2	3	4	5
Moisture Content	%	4.9	6.9	9.4	12.5	14.2
Dry Density	Mg/m³	1.85	1.90	1.95	1.92	1.84

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Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
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UKAS TESTING 1982

BS1377:Part 4:1990 Clause 3.4

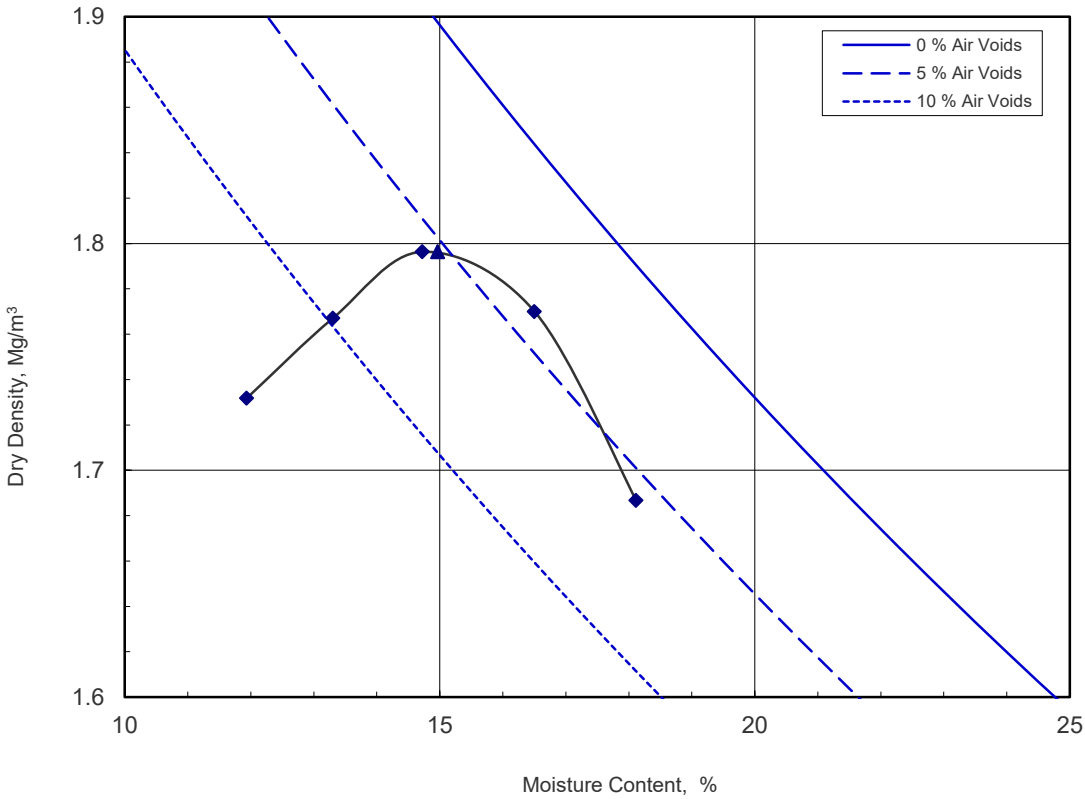
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP04
Depth (m)	0.30
Sample Type	B

Description:

Dark brown sandy CLAY with much fine to coarse gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	11
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.80
Optimum Moisture Content	%	15.0



Determination		1	2	3	4	5
Moisture Content	%	11.9	13.3	14.7	16.5	18.1
Dry Density	Mg/m³	1.73	1.77	1.80	1.77	1.69

Processed by AC
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Project Number:

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DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377:Part 4:1990 Clause 3.4

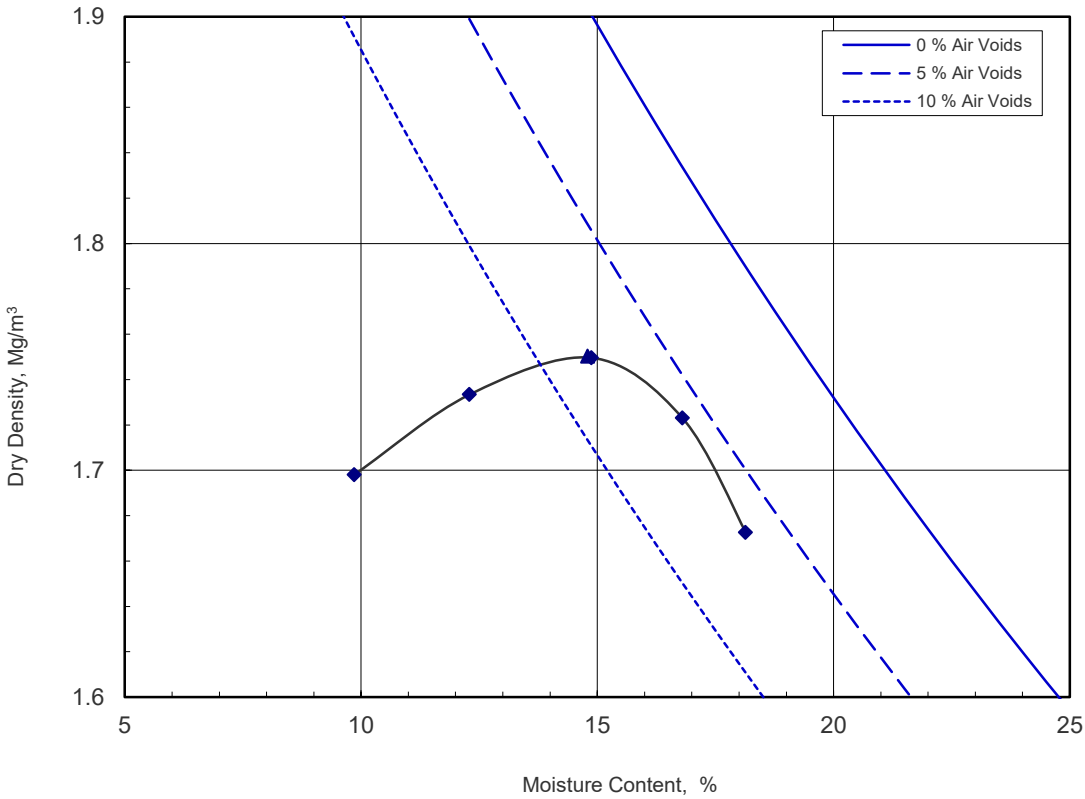
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP05
Depth (m)	1.10
Sample Type	B

Description:

Dark brown very sandy CLAY with much fine to coarse GRAVEL.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	8
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.75
Optimum Moisture Content	%	14.8



Determination		1	2	3	4	5
Moisture Content	%	9.9	12.3	14.9	16.8	18.1
Dry Density	Mg/m³	1.70	1.73	1.75	1.72	1.67

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Checked and Approved by

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS1377:Part 4:1990 Clause 3.4

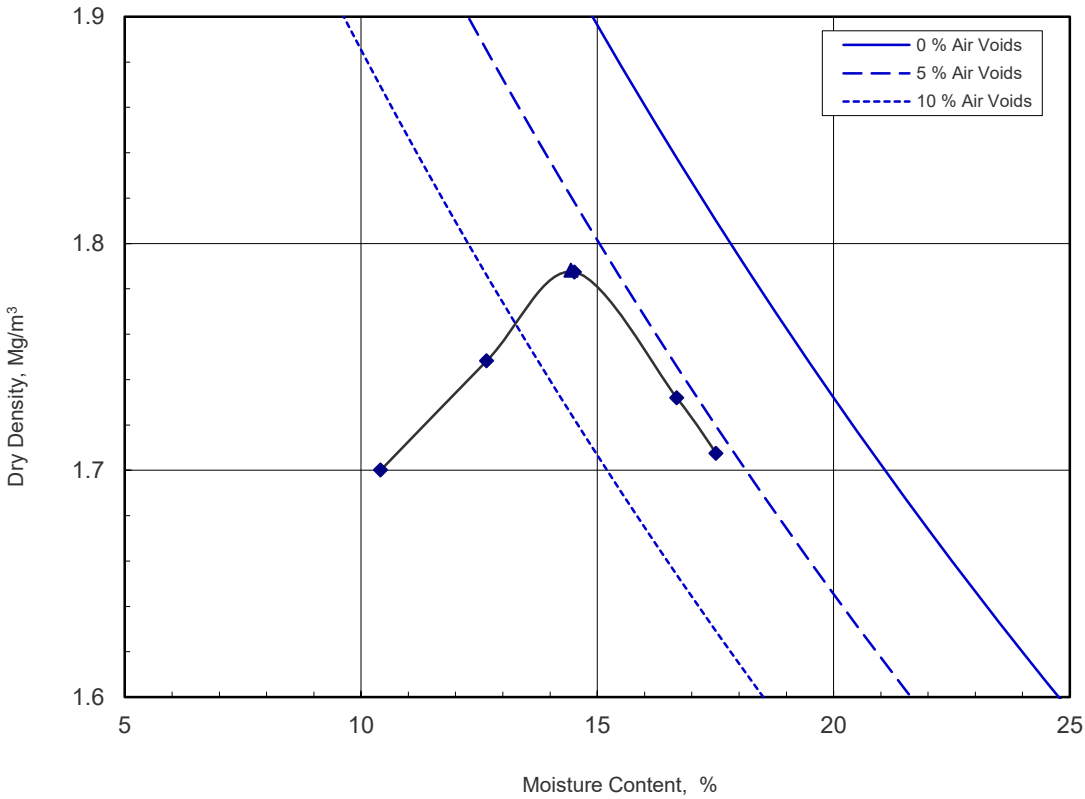
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP08
Depth (m)	0.50
Sample Type	B

Description:

Dark brown sandy CLAY with much fine to coarse gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	3
Mass Retained on 20.0 mm Sieve	%	14
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.79
Optimum Moisture Content	%	14.4



Determination		1	2	3	4	5
Moisture Content	%	10.4	12.7	14.5	16.7	17.5
Dry Density	Mg/m³	1.70	1.75	1.79	1.73	1.71

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BS1377:Part 4:1990 Clause 3.3

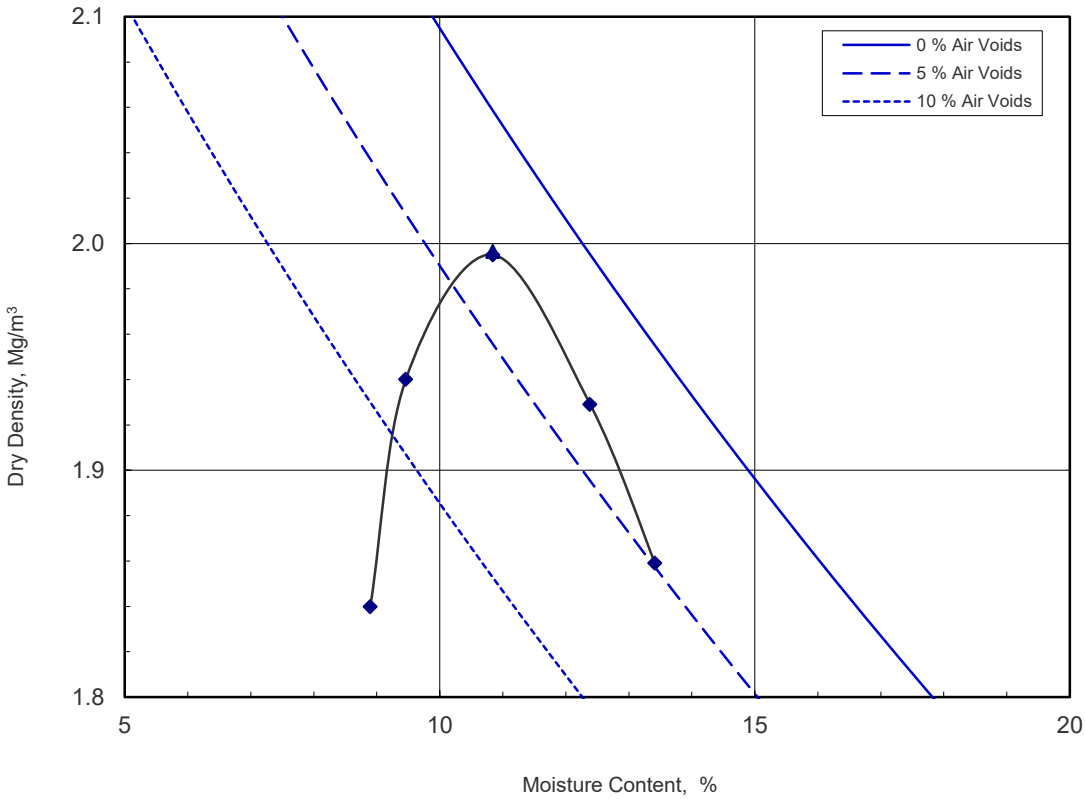
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP09
Depth (m)	0.70
Sample Type	B

Description:

Brown sandy CLAY with much fine to coarse gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with particles up to medium-gravel size
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	2
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	2.00
Optimum Moisture Content	%	10.8



Determination		1	2	3	4	5
Moisture Content	%	8.9	9.5	10.8	12.4	13.4
Dry Density	Mg/m³	1.84	1.94	2.00	1.93	1.86

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BS1377:Part 4:1990 Clause 3.3

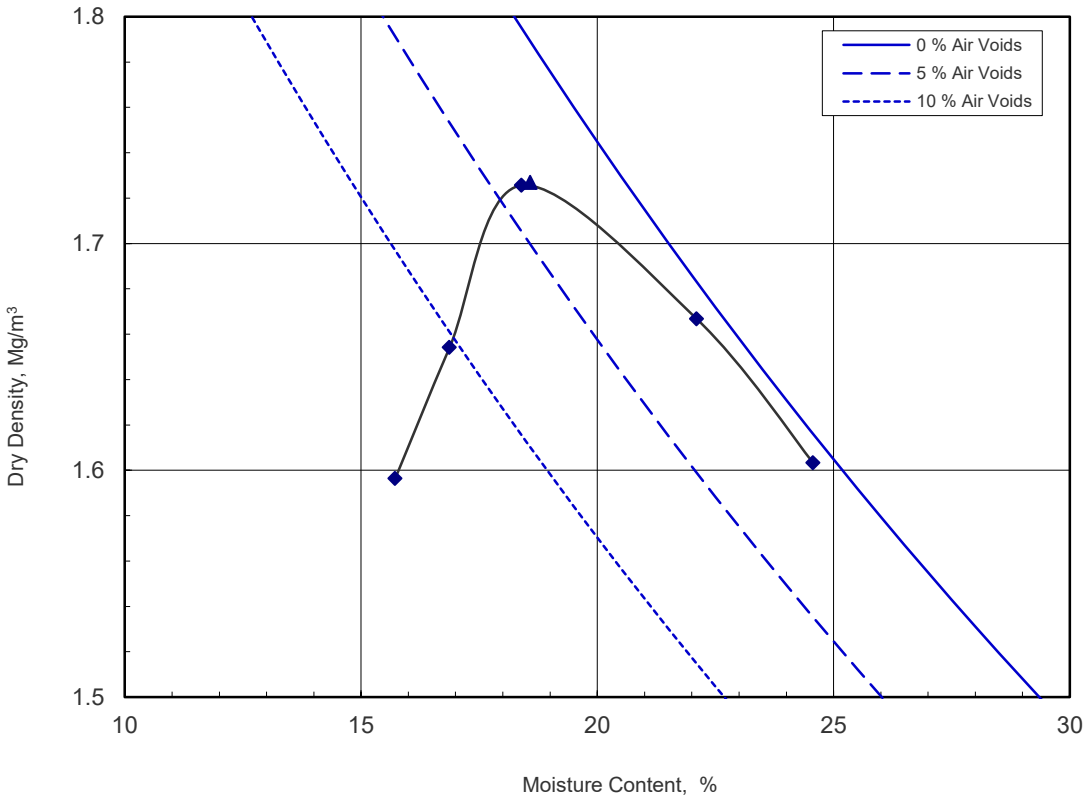
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP10
Depth (m)	1.60
Sample Type	B

Description:

Brown mottled light grey CLAY.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with particles up to medium-gravel size
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.68
Maximum Dry Density	Mg/m³	1.73
Optimum Moisture Content	%	18.6



Determination		1	2	3	4	5
Moisture Content	%	15.7	16.9	18.4	22.1	24.6
Dry Density	Mg/m³	1.60	1.65	1.73	1.67	1.60

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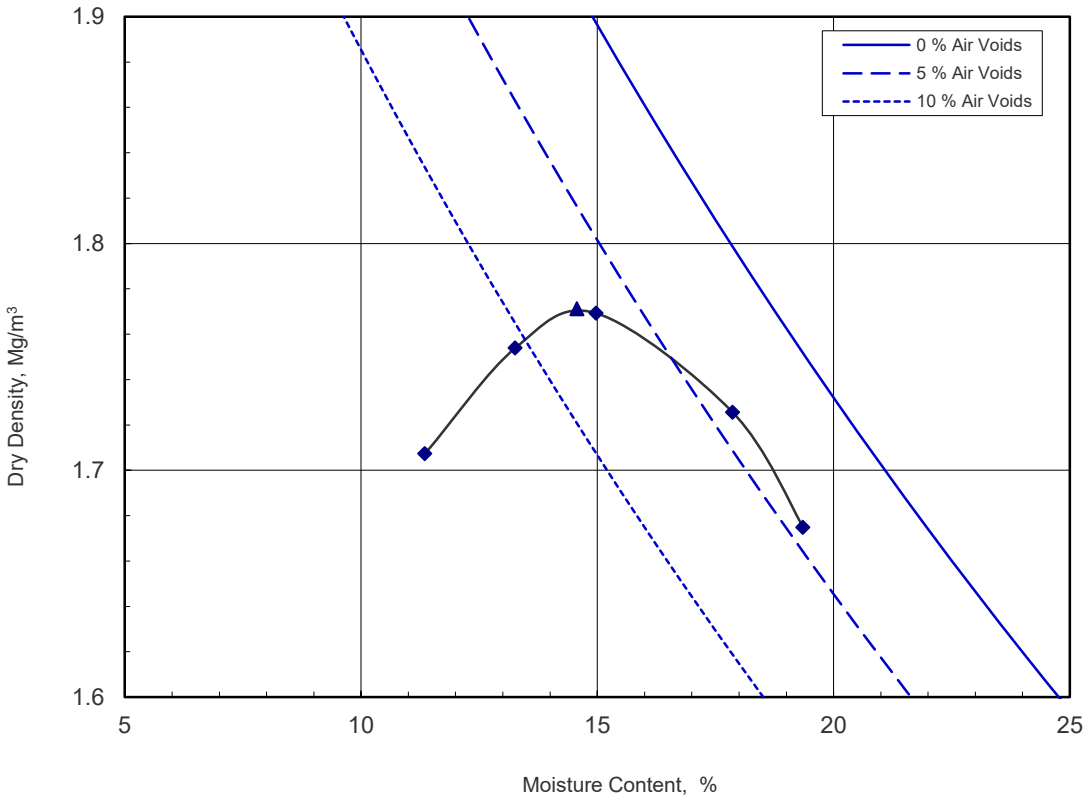
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP11
Depth (m)	1.00
Sample Type	B

Description:

Dark brown sandy CLAY with much fine to coarse gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	6
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.77
Optimum Moisture Content	%	14.6



Determination		1	2	3	4	5
Moisture Content	%	11.3	13.3	15.0	17.9	19.4
Dry Density	Mg/m³	1.71	1.75	1.77	1.73	1.67

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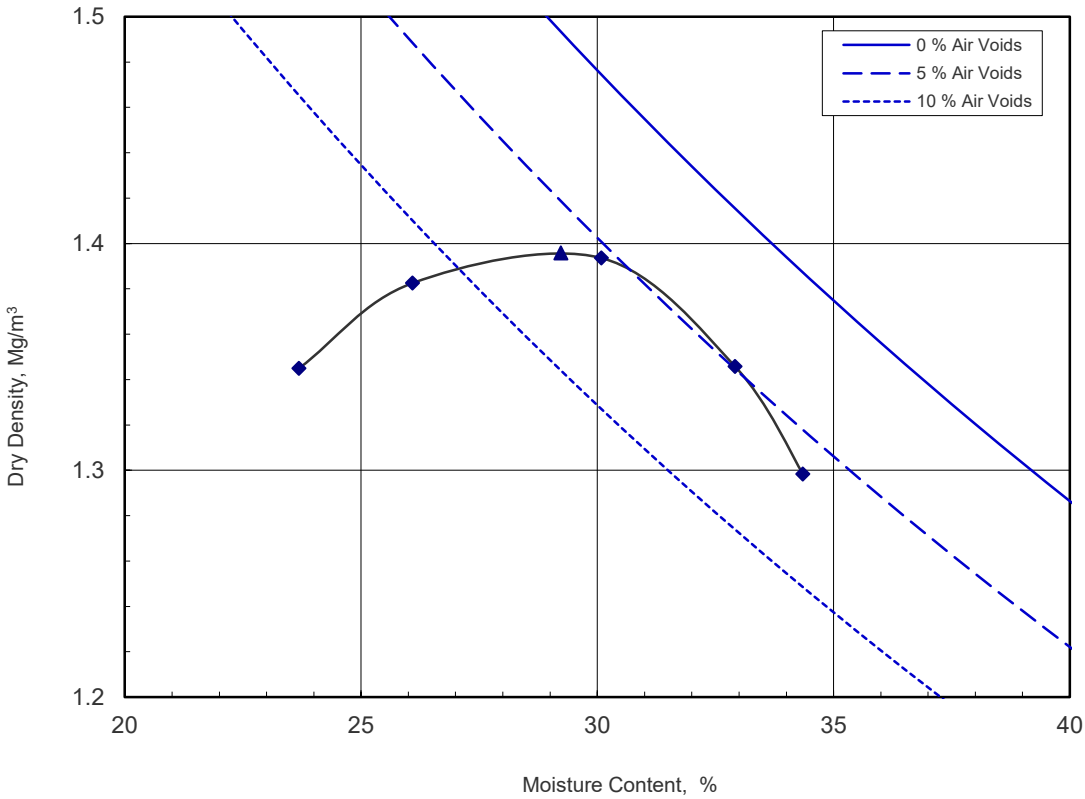
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP13
Depth (m)	2.75
Sample Type	B

Description:

Dark brown slightly sandy organic CLAY with some fine to medium gravel.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with particles up to medium-gravel size
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	1
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	1.40
Optimum Moisture Content	%	29.2



Determination		1	2	3	4	5
Moisture Content	%	23.7	26.1	30.1	32.9	34.4
Dry Density	Mg/m³	1.34	1.38	1.39	1.35	1.30

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BS1377:Part 4:1990 Clause 3.4

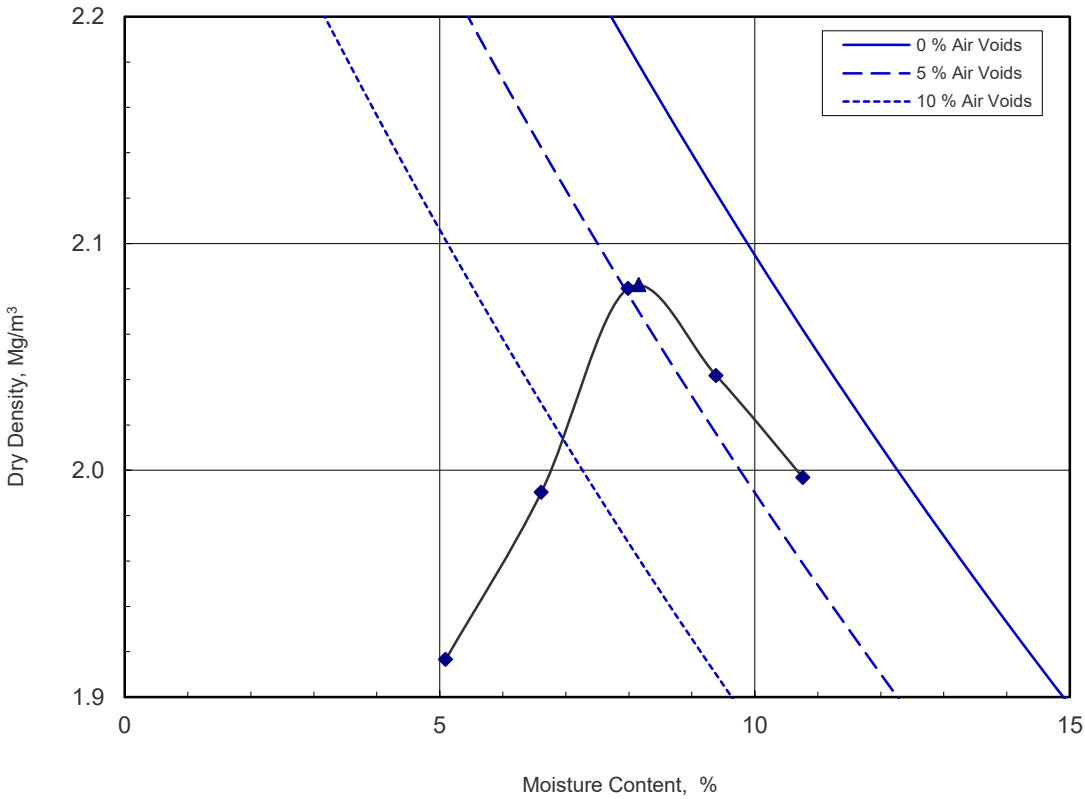
MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

BH/TP	TP15
Depth (m)	1.40
Sample Type	B

Description:

Orangish brown sandy fine to coarse GRAVEL.

Preparation		Air dried
Test Method		2.5kg Rammer for soils with some coarse gravel-size particles
Samples Used		Single
Mass Retained on 37.5 mm Sieve	%	0
Mass Retained on 20.0 mm Sieve	%	9
Particle Density - Assumed	Mg/m³	2.65
Maximum Dry Density	Mg/m³	2.08
Optimum Moisture Content	%	8.2



Determination		1	2	3	4	5
Moisture Content	%	5.1	6.6	8.0	9.4	10.8
Dry Density	Mg/m³	1.92	1.99	2.08	2.04	2.00

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UKAS TESTING 1982

BS EN ISO 17892-5 : 2017

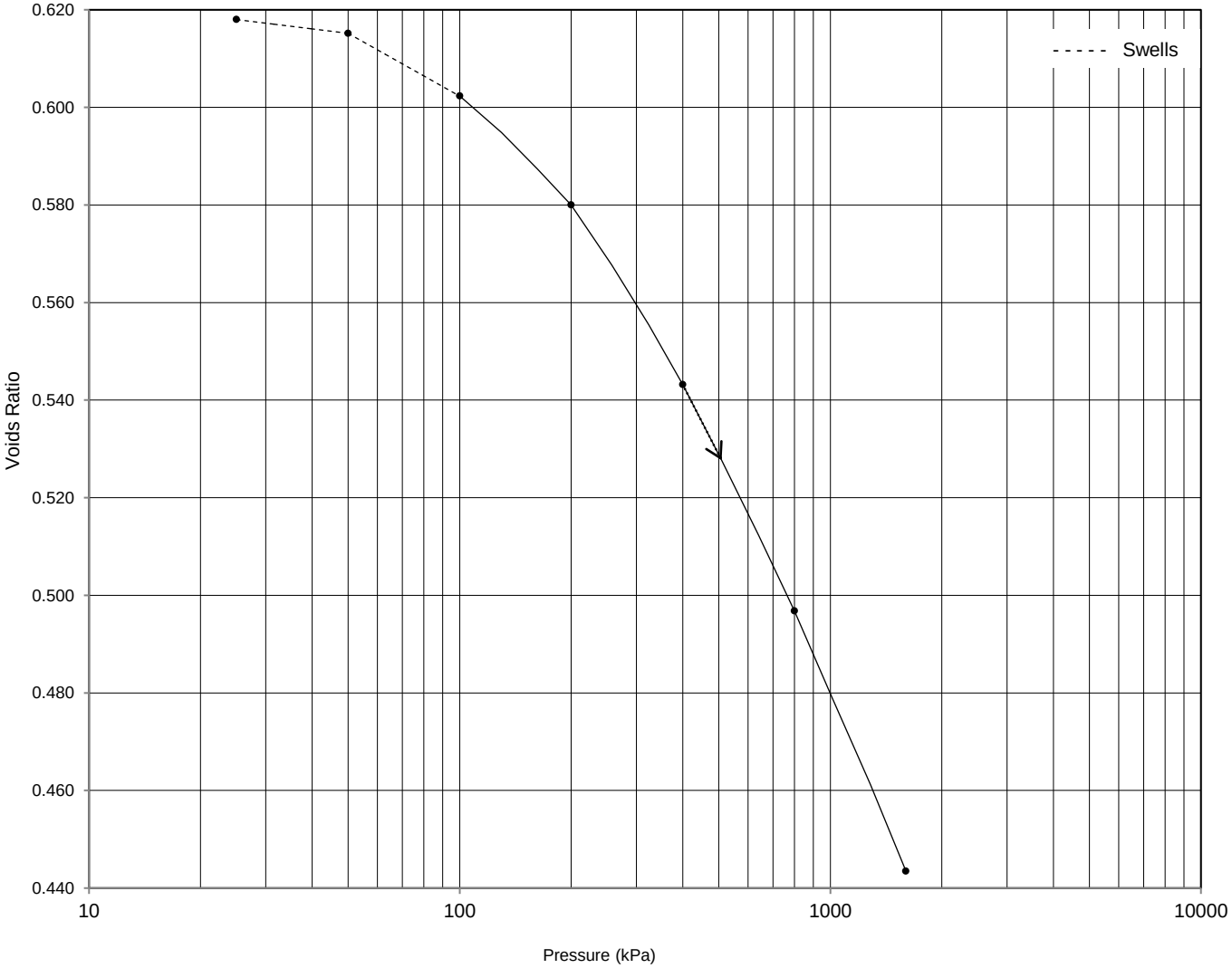
INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP02
Depth (m)	2.80-3.25
Sample Type	UT
Depth within original (mm)	300
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Very stiff dark brown mottled brown and grey CLAY.

Note: Approx 58% recovery. From 2.98 - 3.10m - Firm brown very gravelly sandy CLAY. Gravel is fine to medium, becoming stiff dark brown CLAY along a 45° angle.



Initial Conditions:

Height	(mm)	19.00	Water Content	(%)	23.4	(from trimmings)
Diameter	(mm)	74.70	Voids Ratio		0.620	
Area	(mm²)	4383	Bulk Density	(Mg/m³)	2.06	
Volume	(cm³)	83.27	Dry Density	(Mg/m³)	1.67	
Laboratory Temperature	(ºC)	20.0	Particle density	(Mg/m³)	2.70 (Assumed)	
			Degree of Saturation	(%)	100.0	

Results have been corrected for equipment deformation

Checked and Approved by

J Sturges - Operations Manager
15/04/2019

Project Number:

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INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP02
Depth (m)	2.80-3.25
Sample Type	UT
Depth within original (mm)	300
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Very stiff dark brown mottled brown and grey CLAY.

Note: Approx 58% recovery. From 2.98 - 3.10m - Firm brown very gravelly sandy CLAY. Gravel is fine to medium, becoming stiff dark brown CLAY along a 45° angle.

Pressure Range (kPa)	m_v (m^2/MN)	c_v (m^2/year)	Time Fitting		Voids Ratio
			Method	minutes	
0 - 25	-	Specimen swelled	-	-	0.618
25 - 50	-	Specimen swelled	-	-	0.615
50 - 100	0.16	1.8	t50	5.12	0.602
100 - 200	0.14	0.72	t50	12.7	0.580
200 - 400	0.12	0.58	t50	15.1	0.543
400 - 800	0.075	0.57	t50	14.6	0.497
800 - 1600	0.045	0.58	t50	13.3	0.443

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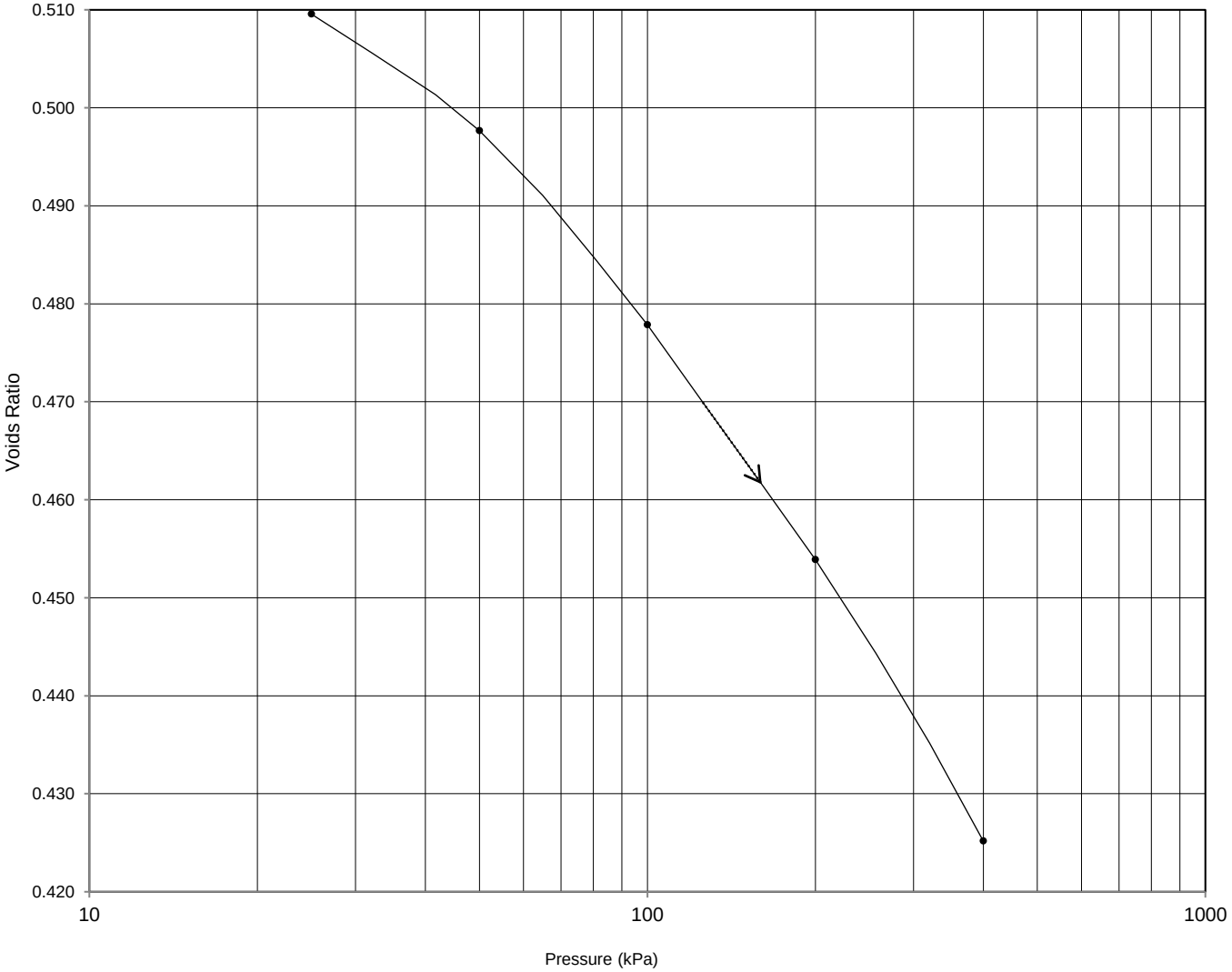
INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP04
Depth (m)	1.20-1.65
Sample Type	UT
Depth within original (mm)	20
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Firm brown mottled grey and dark brown CLAY.



Initial Conditions:

Height	(mm)	18.99	Water Content	(%)	20.6		(from trimmings)
Diameter	(mm)	74.85	Voids Ratio		0.536		
Area	(mm²)	4400	Bulk Density	(Mg/m³)	2.12		
Volume	(cm³)	83.56	Dry Density	(Mg/m³)	1.76		
Laboratory Temperature	(ºC)	20.0	Particle density	(Mg/m³)	2.70	(Assumed)	
			Degree of Saturation	(%)	100.0		

Results have been corrected for equipment deformation

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INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP04
Depth (m)	1.20-1.65
Sample Type	UT
Depth within original (mm)	20
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Firm brown mottled grey and dark brown CLAY.

Pressure Range (kPa)	m_v (m^2/MN)	c_v (m^2/year)	Time Fitting		Voids Ratio
			Method	minutes	
0 - 25	0.70	0.56	t50	16.4	0.510
25 - 50	0.32	0.76	t50	11.8	0.498
50 - 100	0.26	1.00	t50	8.78	0.478
100 - 200	0.16	1.3	t50	6.68	0.454
200 - 400	0.099	1.4	t50	5.84	0.425

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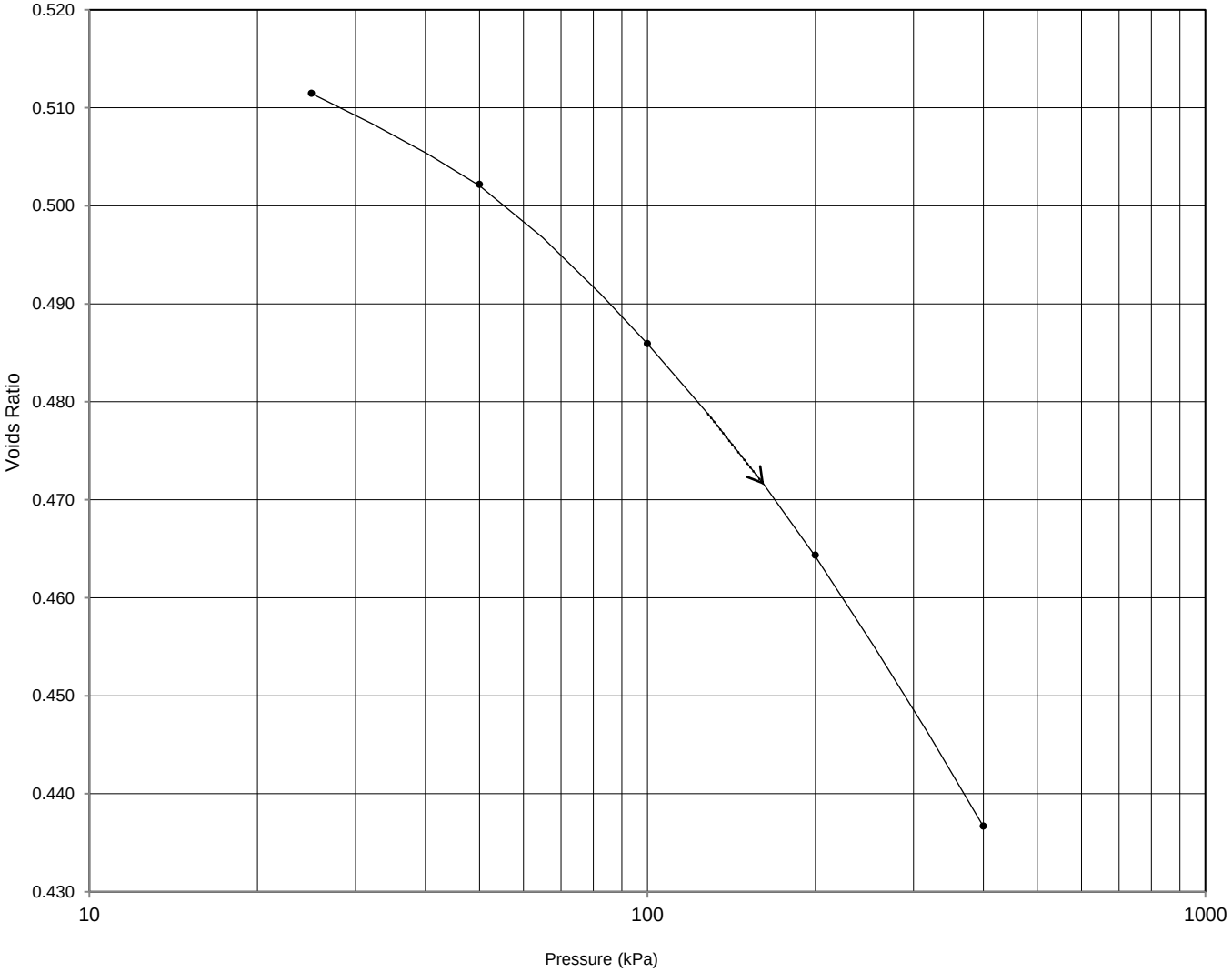
INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP05
Depth (m)	6.50-6.95
Sample Type	UT
Depth within original (mm)	25
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Firm darkish brown rare mottled grey sandy CLAY with rare fine to medium gravel.

Note: rare patching required due to removal of gravel.



Initial Conditions:

Height	(mm)	18.99	Water Content	(%)	21.4		(from trimmings)
Diameter	(mm)	74.88	Voids Ratio		0.549		
Area	(mm²)	4404	Bulk Density	(Mg/m³)	2.12		
Volume	(cm³)	83.63	Dry Density	(Mg/m³)	1.74		
Laboratory Temperature	(ºC)	20.0	Particle density	(Mg/m³)	2.70	(Assumed)	
			Degree of Saturation	(%)	100.0		

Results have been corrected for equipment deformation

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INCREMENTAL LOADING OEDOMETER TEST

BH / TP	CP05
Depth (m)	6.50-6.95
Sample Type	UT
Depth within original (mm)	25
Orientation within original	Vertical
Specimen preparation	Undisturbed

Description:

Firm darkish brown rare mottled grey sandy CLAY with rare fine to medium gravel.

Note: rare patching required due to removal of gravel.

Pressure Range (kPa)	m_v (m^2/MN)	c_v (m^2/year)	Time Fitting		Voids Ratio
			Method	minutes	
0 - 25	0.96	1.2	t50	7.84	0.511
25 - 50	0.25	1.4	t50	6.50	0.502
50 - 100	0.22	2.4	t50	3.66	0.486
100 - 200	0.15	2.5	t50	3.38	0.464
200 - 400	0.094	4.0	t50	2.07	0.437

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UKAS TESTING 1982

BS 1377 : Part 7 : 1990 Clause 8

QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	CP02
Depth (m)	5.00-5.45
Sample Type	UT

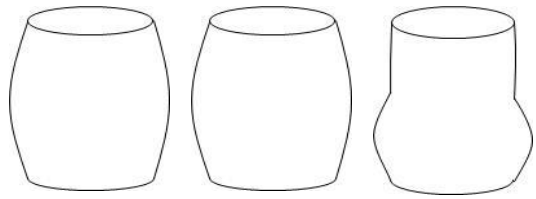
Description:

Firm reddish brown mottled grey silty CLAY.

Specimen Details

Specimen conditions		Undisturbed	Undisturbed	Undisturbed
Length	(mm)	73.4	74.8	74.9
Diameter	(mm)	37.7	38.0	38.0
Moisture Content	(%)	33.1	34.0	33.0
Bulk Density	(Mg/m³)	1.99	1.92	1.93
Dry Density	(Mg/m³)	1.50	1.44	1.45
Test Details		**1**	**2**	**3**
Latex membrane thickness	(mm)	0.3	0.3	0.3
Membrane correction	(kPa)	3.1	3.1	3.1
Axial displacement rate	(%/min)	2.0	2.0	2.0
Cell pressure	(kPa)	100	200	400
Strain at failure	(%)	21.1	21.1	21.1
Maximum Deviator Stress	(kPa)	134	137	102
Shear Stress Cu	(kPa)	67	68	51

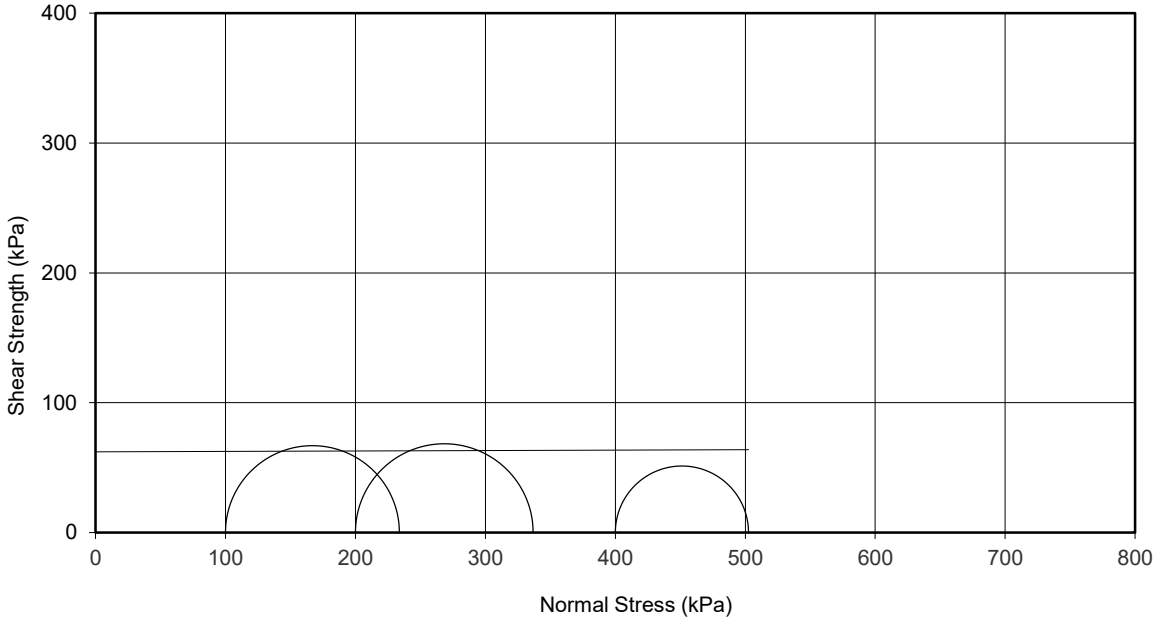
Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	120

Shear Strength Parameters

Cohesion	(kPa)	62
Angle of Shear Resistance	(°)	0.0



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UKAS TESTING 1982

BS 1377 : Part 7 : 1990 Clause 8

QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	CP03
Depth (m)	4.00-4.45
Sample Type	UT

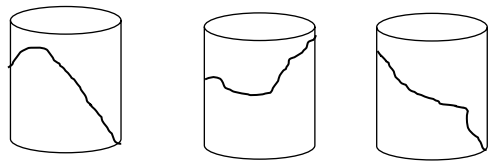
Description:

Stiff fissured dark brown silty CLAY

Specimen Details

Specimen conditions		Undisturbed	Undisturbed	Undisturbed
Length	(mm)	75.3	75.2	75.0
Diameter	(mm)	38.1	37.7	37.7
Moisture Content	(%)	23.3	21.9	22.2
Bulk Density	(Mg/m³)	2.04	2.04	2.07
Dry Density	(Mg/m³)	1.65	1.68	1.69
Test Details		**1**	**2**	**3**
Latex membrane thickness	(mm)	0.3	0.3	0.3
Membrane correction	(kPa)	1.9	1.6	2.3
Axial displacement rate	(%/min)	2.0	2.0	2.0
Cell pressure	(kPa)	80	160	320
Strain at failure	(%)	10.6	8.6	13.9
Maximum Deviator Stress	(kPa)	346	382	411
Shear Stress Cu	(kPa)	173	191	205

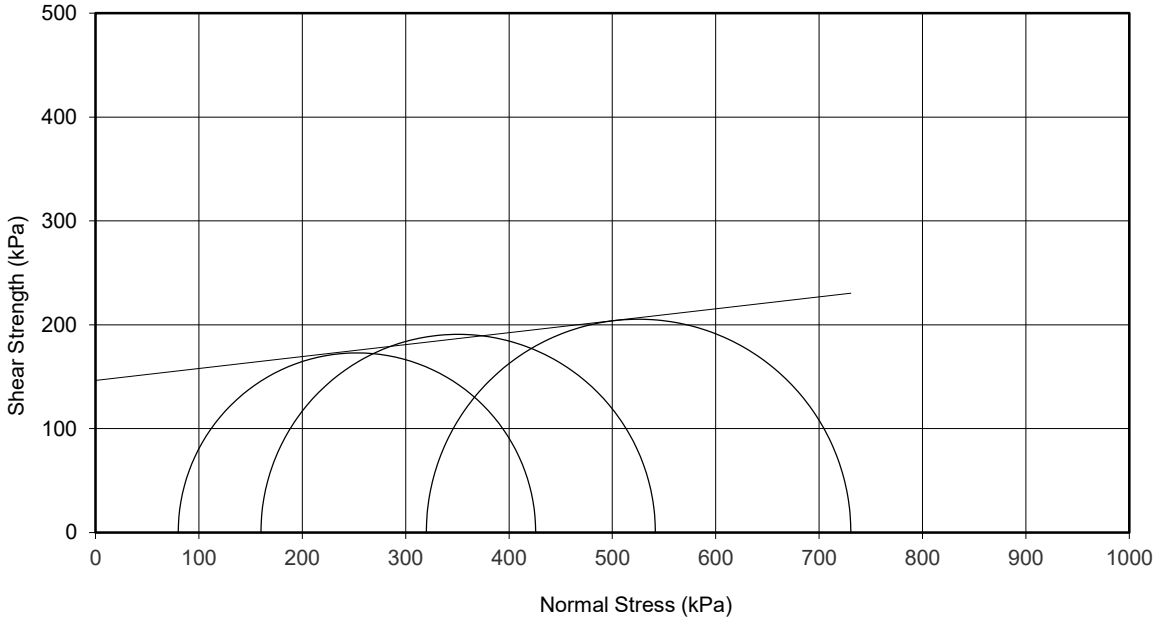
Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	25

Shear Strength Parameters

Cohesion	(kPa)	146
Angle of Shear Resistance	(°)	6.5



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BS 1377 : Part 7 : 1990 Clause 8

QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	CP03
Depth (m)	6.50-6.95
Sample Type	UT

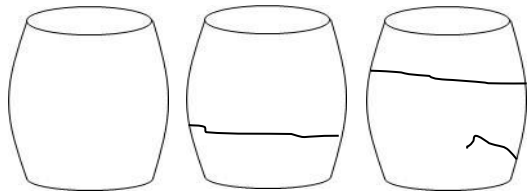
Description:

Firm reddish brown mottled grey silty CLAY.

Specimen Details

Specimen conditions		Undisturbed	Undisturbed	Undisturbed
Length	(mm)	74.9	75.2	75.0
Diameter	(mm)	37.5	37.7	37.7
Moisture Content	(%)	27.8	31.8	30.8
Bulk Density	(Mg/m³)	2.05	2.00	2.00
Dry Density	(Mg/m³)	1.61	1.52	1.53
Test Details		**1**	**2**	**3**
Latex membrane thickness	(mm)	0.3	0.3	0.3
Membrane correction	(kPa)	3.1	3.1	3.1
Axial displacement rate	(%/min)	2.0	2.0	2.0
Cell pressure	(kPa)	130	260	520
Strain at failure	(%)	20.7	20.7	20.7
Maximum Deviator Stress	(kPa)	191	180	150
Shear Stress Cu	(kPa)	95	90	75

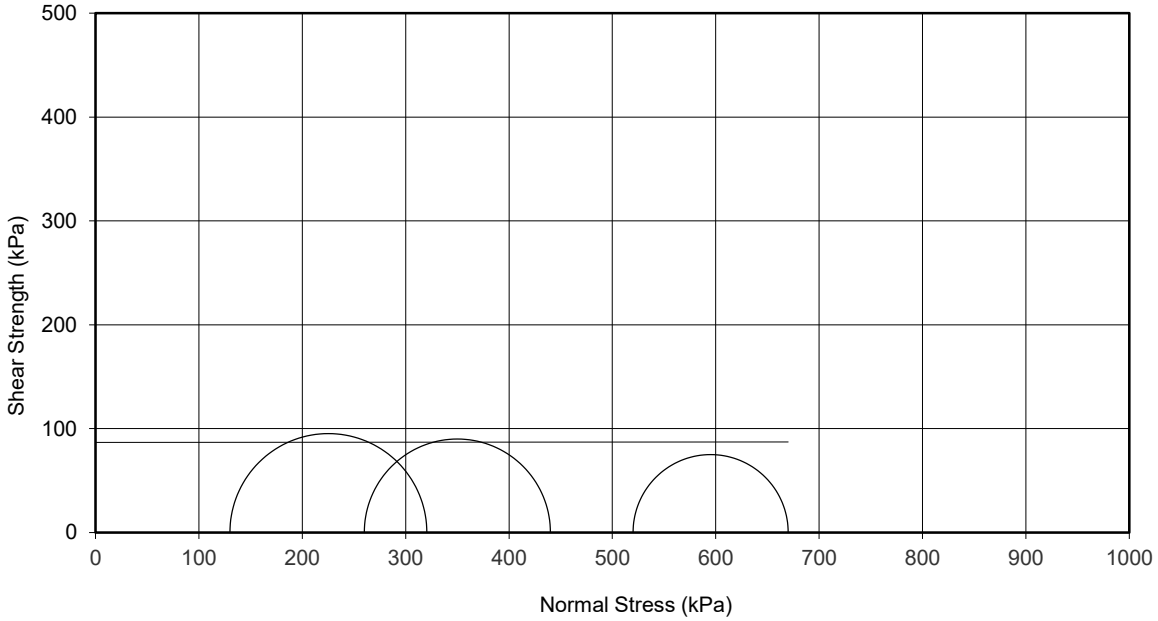
Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	50

Shear Strength Parameters

Cohesion	(kPa)	87
Angle of Shear Resistance	(°)	0.0



Checked and Approved by:

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

BS 1377 : Part 7 : 1990 Clause 8

QUICK UNDRAINED TRIAXIAL COMPRESSION TEST

BH/TP No	CP05
Depth (m)	4.00-4.45
Sample Type	UT

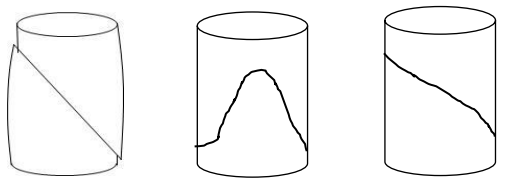
Description:

Stiff fissured dark brown mottled grey silty CLAY

Specimen Details

Specimen conditions		Undisturbed	Undisturbed	Undisturbed
Length	(mm)	75.6	75.4	75.7
Diameter	(mm)	38.2	37.8	37.8
Moisture Content	(%)	25.2	24.0	24.8
Bulk Density	(Mg/m³)	1.98	2.00	2.05
Dry Density	(Mg/m³)	1.59	1.62	1.64
Test Details		**1**	**2**	**3**
Latex membrane thickness	(mm)	0.3	0.3	0.3
Membrane correction	(kPa)	1.6	2.1	1.8
Axial displacement rate	(%/min)	2.0	2.0	2.0
Cell pressure	(kPa)	80	160	320
Strain at failure	(%)	8.6	12.6	9.9
Maximum Deviator Stress	(kPa)	152	217	207
Shear Stress Cu	(kPa)	76	108	104

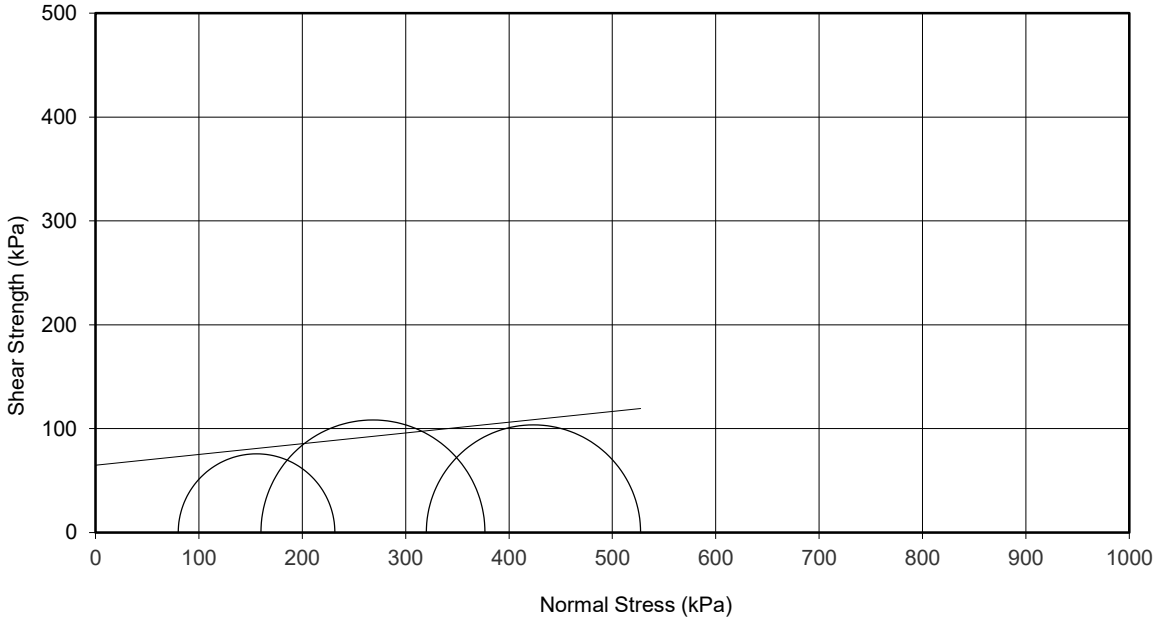
Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	50

Shear Strength Parameters

Cohesion	(kPa)	65
Angle of Shear Resistance	(°)	6.0



Checked and Approved by:

J A Reynolds - Laboratory Manager
29/04/2019

Project Number:

GEO / 29046

Project Name:

DOVE VALLEY PARK, DERBYSHIRE
AG2941-18

GEOLABS

UKAS TESTING 1982

LABORATORY REPORT

4043

Contract Number: PSL19/2097

Report Date: 11 April 2019

Client's Reference:

Client Name: Applied Geology Limited
Unit 23
Abbey Park, Kenilworth
Warwickshire
CV8 2LY

For the attention of: Frankie Hadley-Jones

Contract Title: Dove Valley

Date Received: 29/3/2019
Date Commenced: 29/3/2019
Date Completed: 11/4/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	R Cowles (Senior Technician)

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awatkins@prosoils.co.uk

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole Number	Sample Number	Sample Type	Top Depth (m)	Base Depth (m)	Sample Diameter (mm)	Sample Length (mm)	Height Ratio	Initial Mass (g)	Bulk Density (Mg/m)	Moisture Content (%)	Dry Density (Mg/m)	Load Failure (kN)	UCS (MPa)	Failure Mode	Date Tested	Remarks
CP01		C	12.60	12.80	85	157	1.8	1877	2.11	22	1.73	0.8	0.1	Brittle	09/04/19	
CP01		C	16.00	16.20	85	149	1.8	1852	2.19	18	1.86	0.7	0.1	Brittle	09/04/19	
CP01		C	20.63	20.80	75	152	2.0	1439	2.14	19	1.81	0.7	0.2	Brittle	09/04/19	
CP03		C	12.00	12.16	85	141	1.7	1686	2.11	20	1.76	0.4	0.1	Brittle	09/04/19	
CP03		C	20.10	20.30	85	162	1.9	1908	2.08	20	1.74	1.6	0.3	Brittle	09/04/19	
CP03		C	24.40	24.80	85	171	2.0	1843	1.90	19	1.59	1.1	0.2	Brittle	09/04/19	
CP05		C	13.15	13.30	85	135	1.6	1473	1.92	21	1.59	0.3	0.1	Brittle	09/04/19	
CP05		C	15.25	15.46	85	151	1.8	1788	2.09	24	1.69	0.5	0.1	Brittle	09/04/19	

PSL
Professional Soils Laboratory

Dove Valley Park, Derbyshire

Contract No:
PSL19/2097
Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		Area	D_e^2	D_e	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
CP01	12.70		A	Perp	85	37	3145	4004.34	63.28	-	0.04	0.01	1.112	0.01	Valid	
CP01	13.50		A	Perp	85	41	3485	4437.24	66.61	-	0.03	0.01	1.138	0.01	Valid	
CP01	13.00		A	Perp	85	34	2890	3679.66	60.66	-	0.02	0.01	1.091	0.01	Valid	
CP01	14.20		A	Perp	85	25	2125	2705.63	52.02	-	0.18	0.07	1.018	0.07	Valid	
CP01	15.90		A	Perp	85	26	2210	2813.86	53.05	-	0.17	0.06	1.027	0.06	Valid	
CP01	17.50		A	Perp	85	28	2380	3030.31	55.05	-	0.17	0.06	1.044	0.06	Valid	
CP01	19.50		A	Perp	85	37	3145	4004.34	63.28	-	0.05	0.01	1.112	0.01	Valid	
CP03	11.80		A	Perp	85	27	2295	2922.08	54.06	-	0.05	0.02	1.036	0.02	Valid	
CP03	18.80		A	Perp	85	40	3400	4329.01	65.80	-	0.01	0.00	1.131	0.00	Valid	
CP03	21.45		A	Perp	85	41	3485	4437.24	66.61	-	0.09	0.02	1.138	0.02	Valid	
CP05	14.20		A	Perp	85	51	4335	5519.49	74.29	-	0.14	0.03	1.195	0.03	Valid	
CP05	17.30		A	Perp	85	35	2975	3787.89	61.55	-	0.12	0.03	1.098	0.03	Valid	
CP05	20.05		A	Perp	85	38	3230	4112.56	64.13	-	0.16	0.04	1.119	0.04	Valid	
CP05	20.55		A	Perp	70	29	2030	2584.68	50.84	-	0.14	0.05	1.008	0.05	Valid	
CP05	21.05		A	Perp	70	29	2030	2584.68	50.84	-	0.16	0.06	1.008	0.06	Valid	
CP05	21.70		A	Perp	85	32	2720	3463.21	58.85	-	0.05	0.01	1.076	0.02	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

UKAS TESTING 4043

PSL Professional Soils Laboratory

Dove Valley Park, Derbyshire

Contract No:

PSL19/2097

Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_e^2	D_e	Failure Load		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
CP01	12.70		D	Par	-	85	7225	85.00	-	0.03	0.004	1.270	0.01	Valid	
CP01	13.50		D	Par	-	85	7225	85.00	-	0.01	0.001	1.270	0.00	Valid	
CP01	13.00		D	Par	-	85	7225	85.00	-	0.05	0.007	1.270	0.01	Valid	
CP01	14.20		D	Par	-	85	7225	85.00	-	0.09	0.012	1.270	0.02	Valid	
CP01	15.90		D	Par	-	85	7225	85.00	-	0.22	0.030	1.270	0.04	Valid	
CP01	17.50		D	Par	-	85	7225	85.00	-	0.32	0.044	1.270	0.06	Valid	
CP01	19.50		D	Par	-	85	7225	85.00	-	0.04	0.006	1.270	0.01	Valid	
CP03	11.80		D	Par	-	85	7225	85.00	-	0.08	0.011	1.270	0.01	Valid	
CP03	18.80		D	Par	-	85	7225	85.00	-	0.02	0.003	1.270	0.00	Valid	
CP03	21.45		D	Par	-	85	7225	85.00	-	0.16	0.022	1.270	0.03	Valid	
CP05	14.20		D	Par	-	85	7225	85.00	-	0.16	0.022	1.270	0.03	Valid	
CP05	17.30		D	Par	-	85	7225	85.00	-	0.11	0.015	1.270	0.02	Valid	
CP05	20.05		D	Par	-	85	7225	85.00	-	0.14	0.019	1.270	0.02	Valid	
CP05	20.55		D	Par	-	70	4900	70.00	-	0.10	0.020	1.163	0.02	Valid	
CP05	21.05		D	Par	-	70	4900	70.00	-	0.21	0.043	1.163	0.05	Valid	
CP05	21.70		D	Par	-	85	7225	85.00	-	0.03	0.004	1.270	0.01	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

UKAS TESTING 4043

PSL Professional Soils Laboratory

Dove Valley Park, Derbyshire

Contract No:

PSL19/2097

Client Ref:

APPENDIX F

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Amended Report

Report No.:	19-09803-2		
Initial Date of Issue:	31-Mar-2019	**Date of Re-Issue:**	01-Apr-2019
Client	Applied Geology		
Client Address:	Unit 23, Abbey Park Stareton Kenilworth Warwickshire CV8 2LY		
Contact(s):	Andrew Smith Felicity Downing Melissa Southworth Lab Results		
Project	AG2941-18 - Dove Valley Park, Derbyshire		
Quotation No.:	Q19-16563	**Date Received:**	20-Mar-2019
Order No.:	14149	**Date Instructed:**	20-Mar-2019
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	28-Mar-2019
Date Approved:	31-Mar-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology			**Chemtest Job No.:**		19-09803	19-09803	19-09803	19-09803	19-09803
Quotation No.: Q19-16563			**Chemtest Sample ID.:**		796563	796564	796565	796567	796568
			Sample Location:		TP01	TP02	TP03	TP04	TP05
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.40	0.15	0.20	0.70	1.10
			Date Sampled:		07-Mar-2019	11-Mar-2019	07-Mar-2019	08-Mar-2019	08-Mar-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Organic Matter	M	2625	%	0.40	6.0	0.67	3.1	2.8	2.4
Arsenic	M	2450	mg/kg	1.0	72	5.3	9.2	24	5.9
Cadmium	M	2450	mg/kg	0.10	0.11	0.26	0.23	< 0.10	0.30
Chromium	M	2450	mg/kg	1.0	37	19	24	11	18
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium (Trivalent)	N	2490	mg/kg	1.0	37	19	24	11	18
Copper	M	2450	mg/kg	0.50	22	14	23	5.1	14
Lead	M	2450	mg/kg	0.50	34	29	34	10	33
Nickel	M	2450	mg/kg	0.50	17	14	18	8.8	15
Zinc	M	2450	mg/kg	0.50	41	48	53	13	47
Naphthalene	N	2700	mg/kg	0.010	< 0.010	0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2700	mg/kg	0.010	< 0.010	0.030	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2700	mg/kg	0.010	< 0.010	0.020	< 0.010	< 0.010	< 0.010
Fluorene	N	2700	mg/kg	0.010	< 0.010	0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2700	mg/kg	0.010	< 0.010	0.36	0.25	< 0.010	0.24
Anthracene	N	2700	mg/kg	0.010	< 0.010	0.080	0.070	< 0.010	0.050
Fluoranthene	N	2700	mg/kg	0.010	0.50	0.50	0.41	< 0.010	0.40
Pyrene	N	2700	mg/kg	0.010	0.52	0.46	0.42	< 0.010	0.40
Benzo[a]anthracene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	2700	mg/kg	0.20	1.0	1.5	1.2	< 0.20	1.1
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology			**Chemtest Job No.:**		19-09803	19-09803	19-09803	19-09803	19-09803
Quotation No.: Q19-16563			**Chemtest Sample ID.:**		796563	796564	796565	796567	796568
			Sample Location:		TP01	TP02	TP03	TP04	TP05
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.40	0.15	0.20	0.70	1.10
			Date Sampled:		07-Mar-2019	11-Mar-2019	07-Mar-2019	08-Mar-2019	08-Mar-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	23
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	23
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	23
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-
Moisture	N	2030	%	0.020	15	15	13	5.9	13
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	NONE	Stones	Stones, Roots	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand
pH	M	2010		N/A	7.0	7.0	6.8	7.3	6.6
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	0.95	0.62	< 0.40	0.84
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Barium	M	2450	mg/kg	10	75	84	110	30	81
Mercury Low Level	M	2450	mg/kg	0.05	0.07	0.05	0.05	< 0.05	0.06
Vanadium	U	2450	mg/kg	5.0	92	22	27	28	21
Total Organic Carbon	M	2625	%	0.20	3.5	0.39	1.8	1.6	1.4
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - 2 Stage WAC

Project: AG2941-18 - Dove Valley Park, Derbyshire

Chemtest Job No:	19-09803
Chemtest Sample ID:	796566
Sample Ref:	
Sample ID:	
Sample Location:	TP04
Top Depth(m):	0.30
Bottom Depth(m):	
Sampling Date:	08-Mar-2019

Determinand	**SOP**	**Accred.**	**Units**				**Landfill Waste Acceptance Criteria Limits**		
							Inert Waste Landfill	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			1.4	3	5	6
Loss On Ignition	2610	M	%			4.7	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				6.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0021	0.0014	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.016	0.017	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0012	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0032	0.0031	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0016	< 0.0010	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	0.0026	0.0013	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	0.0069	0.0081	0.014	0.080	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0063	0.0065	< 0.50	< 0.50	4	50	200
Chloride	1220	U	3.5	2.4	< 10	25	800	15000	25000
Fluoride	1220	U	0.41	0.37	< 1.0	3.7	10	150	500
Sulphate	1220	U	4.6	3.4	< 10	35	1000	20000	50000
Total Dissolved Solids	1020	N	39	35	77	350	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	5.4	< 2.5	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	12

Leachate Test Information	
Leachant volume 1st extract/l	0.327
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.145

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - 2 Stage WAC

Project: AG2941-18 - Dove Valley Park, Derbyshire

Chemtest Job No:	19-09803
Chemtest Sample ID:	796568
Sample Ref:	
Sample ID:	
Sample Location:	TP05
Top Depth(m):	1.10
Bottom Depth(m):	
Sampling Date:	08-Mar-2019

Determinand	**SOP**	**Accred.**	**Units**				**Landfill Waste Acceptance Criteria Limits**		
							Inert Waste Landfill	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			1.4	3	5	6
Loss On Ignition	2610	M	%			6.6	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				6.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0080	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	0.0022	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.011	0.015	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0013	0.0025	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0042	0.0015	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	0.0023	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0057	< 0.010	0.051	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	0.0040	< 0.50	< 0.50	4	50	200
Chloride	1220	U	1.9	2.6	< 10	25	800	15000	25000
Fluoride	1220	U	0.22	0.42	< 1.0	4.0	10	150	500
Sulphate	1220	U	10	5.2	20	57	1000	20000	50000
Total Dissolved Solids	1020	N	72	65	140	660	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	6.7	< 2.5	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	13

Leachate Test Information	
Leachant volume 1st extract/l	0.324
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.190

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

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Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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Chemtest Ltd.
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Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Amended Report

Report No.:	19-09807-2		
Initial Date of Issue:	29-Mar-2019	**Date of Re-Issue:**	01-Apr-2019
Client	Applied Geology		
Client Address:	Unit 23, Abbey Park Stareton Kenilworth Warwickshire CV8 2LY		
Contact(s):	Andrew Smith Felicity Downing Lab Results Melissa Southworth		
Project	AG2941-18 - Dove Valley Park, Derbyshire		
Quotation No.:	Q19-16563	**Date Received:**	20-Mar-2019
Order No.:	14149	**Date Instructed:**	20-Mar-2019
No. of Samples:	5		
Turnaround (Wkdays):	7	**Results Due:**	28-Mar-2019
Date Approved:	29-Mar-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology				**Chemtest Job No.:**	19-09807	19-09807	19-09807	19-09807	19-09807
Quotation No.: Q19-16563				**Chemtest Sample ID.:**	796576	796577	796578	796579	796580
				Sample Location:	TP07	TP08	TP08	TP09	TP11
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.20	0.35	0.50	0.70	1.00
				Date Sampled:	11-Mar-2019	07-Mar-2019	07-Mar-2019	11-Mar-2019	07-Mar-2019
				Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Organic Matter	M	2625	%	0.40	4.1	2.2	0.41	< 0.40	3.5
Arsenic	M	2450	mg/kg	1.0	7.6	33	25	40	8.0
Cadmium	M	2450	mg/kg	0.10	0.34	0.51	< 0.10	< 0.10	0.25
Chromium	M	2450	mg/kg	1.0	22	18	12	19	17
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium (Trivalent)	N	2490	mg/kg	1.0	22	18	12	19	17
Copper	M	2450	mg/kg	0.50	19	39	7.5	9.8	17
Lead	M	2450	mg/kg	0.50	110	91	16	19	110
Nickel	M	2450	mg/kg	0.50	17	31	11	14	14
Zinc	M	2450	mg/kg	0.50	69	49	20	23	42
Naphthalene	N	2700	mg/kg	0.010	< 0.010	0.31	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2700	mg/kg	0.010	< 0.010	0.41	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2700	mg/kg	0.010	< 0.010	0.82	< 0.010	< 0.010	< 0.010
Fluorene	N	2700	mg/kg	0.010	< 0.010	0.74	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2700	mg/kg	0.010	< 0.010	7.5	0.21	< 0.010	0.73
Anthracene	N	2700	mg/kg	0.010	< 0.010	1.5	0.070	< 0.010	0.17
Fluoranthene	N	2700	mg/kg	0.010	0.66	10	0.30	< 0.010	1.2
Pyrene	N	2700	mg/kg	0.010	0.81	9.6	0.38	< 0.010	1.2
Benzo[a]anthracene	N	2700	mg/kg	0.010	0.36	4.0	0.13	< 0.010	0.35
Chrysene	N	2700	mg/kg	0.010	0.86	4.2	0.080	< 0.010	0.35
Benzo[b]fluoranthene	N	2700	mg/kg	0.010	0.43	3.6	< 0.010	< 0.010	0.40
Benzo[k]fluoranthene	N	2700	mg/kg	0.010	0.27	2.4	< 0.010	< 0.010	0.12
Benzo[a]pyrene	N	2700	mg/kg	0.010	0.41	3.9	< 0.010	< 0.010	0.51
Dibenz(a,h)Anthracene	N	2700	mg/kg	0.010	< 0.010	1.2	< 0.010	< 0.010	0.10
Indeno(1,2,3-c,d)Pyrene	N	2700	mg/kg	0.010	< 0.010	2.8	< 0.010	< 0.010	0.33
Benzo[g,h,i]perylene	N	2700	mg/kg	0.010	< 0.010	2.8	< 0.010	< 0.010	0.63
Total Of 16 PAH's	N	2700	mg/kg	0.20	3.8	56	1.2	< 0.20	6.1
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology				**Chemtest Job No.:**	19-09807	19-09807	19-09807	19-09807	19-09807
Quotation No.: Q19-16563				**Chemtest Sample ID.:**	796576	796577	796578	796579	796580
				Sample Location:	TP07	TP08	TP08	TP09	TP11
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.20	0.35	0.50	0.70	1.00
				Date Sampled:	11-Mar-2019	07-Mar-2019	07-Mar-2019	11-Mar-2019	07-Mar-2019
				Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	8.1	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	8.1	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	5.6	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	51	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	56	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	64	< 10	< 10	< 10
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	0.013	< 0.010	< 0.010	< 0.010
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-
Moisture	N	2030	%	0.020	20	15	11	10	15
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand
pH	M	2010		N/A	6.7	8.3	8.3	7.3	6.8
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.99	0.90	0.44	0.51	1.1
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Barium	M	2450	mg/kg	10	120	190	58	95	87
Mercury Low Level	M	2450	mg/kg	0.05	0.07	< 0.05	< 0.05	< 0.05	0.07
Vanadium	U	2450	mg/kg	5.0	26	33	32	38	24
Total Organic Carbon	M	2625	%	0.20	2.4	1.3	0.24	< 0.20	2.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
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Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-09810-1		
Initial Date of Issue:	05-Apr-2019		
Client	Applied Geology		
Client Address:	Unit 23, Abbey Park Stareton Kenilworth Warwickshire CV8 2LY		
Contact(s):	Andrew Smith Felicity Downing Lab Results Melissa Southworth		
Project	AG2941-18 - Dove Valley Park, Derbyshire		
Quotation No.:	Q19-16563	**Date Received:**	20-Mar-2019
Order No.:	14149	**Date Instructed:**	20-Mar-2019
No. of Samples:	6		
Turnaround (Wkdays):	12	**Results Due:**	04-Apr-2019
Date Approved:	05-Apr-2019		

Approved By:

Details: Robert Monk, Technical Manager

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology			**Chemtest Job No.:**		19-09810	19-09810	19-09810	19-09810	19-09810
Quotation No.: Q19-16563			**Chemtest Sample ID.:**		796587	796588	796590	796591	796592
			Sample Location:		TP12	TP13	TP14	TP15	TP16
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		2.00	1.00	0.60	0.10	0.20
			Date Sampled:		07-Mar-2019	08-Mar-2019	11-Mar-2019	07-Mar-2019	08-Mar-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Organic Matter	M	2625	%	0.40	0.43	0.91	1.3	2.6	2.6
Arsenic	M	2450	mg/kg	1.0	4.6	12	8.1	5.7	6.3
Cadmium	M	2450	mg/kg	0.10	0.11	0.31	0.16	0.25	0.27
Chromium	M	2450	mg/kg	1.0	10	20	20	18	22
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium (Trivalent)	N	2490	mg/kg	1.0	10	20	20	18	22
Copper	M	2450	mg/kg	0.50	7.9	15	9.7	12	20
Lead	M	2450	mg/kg	0.50	16	24	31	31	33
Nickel	M	2450	mg/kg	0.50	9.8	20	13	11	13
Zinc	M	2450	mg/kg	0.50	20	38	30	42	44
Naphthalene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	2700	mg/kg	0.010	< 0.010	0.13	< 0.010	0.040	0.10
Anthracene	N	2700	mg/kg	0.010	< 0.010	0.030	< 0.010	0.010	0.020
Fluoranthene	N	2700	mg/kg	0.010	< 0.010	0.15	< 0.010	0.18	0.25
Pyrene	N	2700	mg/kg	0.010	< 0.010	0.22	< 0.010	0.23	0.30
Benzo[a]anthracene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	2700	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	2700	mg/kg	0.20	< 0.20	0.53	< 0.20	0.46	0.67
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: AG2941-18 - Dove Valley Park, Derbyshire

Client: Applied Geology				**Chemtest Job No.:**	19-09810	19-09810	19-09810	19-09810	19-09810
Quotation No.: Q19-16563				**Chemtest Sample ID.:**	796587	796588	796590	796591	796592
				Sample Location:	TP12	TP13	TP14	TP15	TP16
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	2.00	1.00	0.60	0.10	0.20
				Date Sampled:	07-Mar-2019	08-Mar-2019	11-Mar-2019	07-Mar-2019	08-Mar-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-
Moisture	N	2030	%	0.020	7.9	11	15	14	21
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown,
Other Material	N	2040		N/A	Stones	Stones	Stones,	Stones	Stones,
Soil Texture	N	2040		N/A	Loam	Sand	Sand	Sand	Clay,
pH	M	2010		N/A	7.5	8.2	6.8	6.7	6.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.49	< 0.40	0.47	0.60	0.63
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Barium	M	2450	mg/kg	10	48	190	69	110	89
Mercury Low Level	M	2450	mg/kg	0.05	< 0.05	< 0.05	0.06	0.08	0.09
Vanadium	U	2450	mg/kg	5.0	11	31	26	24	25
Total Organic Carbon	M	2625	%	0.20	0.25	0.53	0.76	1.5	1.5
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - 2 Stage WAC

Project: AG2941-18 - Dove Valley Park, Derbyshire

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-09810								
Chemtest Sample ID:	796588								
Sample Ref:							**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:									
Sample Location:	TP13								
Top Depth(m):	1.00								
Bottom Depth(m):									
Sampling Date:	08-Mar-2019								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	M	%			0.53	3	5	6
Loss On Ignition	2610	M	%			2.6	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.010	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0018	0.0016	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.045	0.032	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0025	0.0054	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0095	0.0031	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0016	< 0.010	0.015	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0031	0.0018	< 0.50	< 0.50	4	50	200
Chloride	1220	U	7.4	1.1	15	16	800	15000	25000
Fluoride	1220	U	1.4	0.15	2.8	2.4	10	150	500
Sulphate	1220	U	26	7.4	52	87	1000	20000	50000
Total Dissolved Solids	1020	N	140	120	280	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	9.4	7.1	< 50	72	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	11

Leachate Test Information	
Leachant volume 1st extract/l	0.328
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.126

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - 2 Stage WAC

Project: AG2941-18 - Dove Valley Park, Derbyshire

Chemtest Job No:	19-09810
Chemtest Sample ID:	796589
Sample Ref:	
Sample ID:	
Sample Location:	TP13
Top Depth(m):	2.75
Bottom Depth(m):	
Sampling Date:	08-Mar-2019

Determinand	**SOP**	**Accred.**	**Units**				**Landfill Waste Acceptance Criteria Limits**		
							Inert Waste Landfill	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			4.5	3	5	6
Loss On Ignition	2610	M	%			11	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				7.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0020	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	0.0030	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0087	0.019	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0018	0.0046	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0029	0.0029	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	0.0023	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	0.0014	0.0072	< 0.010	0.067	0.5	10	50
Antimony	1450	U	< 0.0010	0.0016	< 0.010	0.015	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0023	0.0068	< 0.50	< 0.50	4	50	200
Chloride	1220	U	2.6	2.7	< 10	27	800	15000	25000
Fluoride	1220	U	0.61	0.38	1.2	4.0	10	150	500
Sulphate	1220	U	6.1	6.4	12	63	1000	20000	50000
Total Dissolved Solids	1020	N	38	78	73	740	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	16	13	< 50	130	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	22

Leachate Test Information	
Leachant volume 1st extract/l	0.300
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.142

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: AG2941-18 - Dove Valley Park, Derbyshire

Chemtest Job No:	19-09810
Chemtest Sample ID:	796591
Sample Ref:	
Sample ID:	
Sample Location:	TP15
Top Depth(m):	0.10
Bottom Depth(m):	
Sampling Date:	07-Mar-2019

Determinand	SOP	Accred.	Units				Landfill Waste Acceptance Criteria Limits: Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625	M	%			1.5	3	5	6
Loss On Ignition	2610	M	%			2.0	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				6.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.013	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.019	0.014	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	0.00018	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0074	0.0079	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0017	< 0.010	0.014	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0027	0.0019	< 0.010	0.020	0.1	0.5	7
Zinc	1450	U	0.0092	0.0052	< 0.50	< 0.50	4	50	200
Chloride	1220	U	2.1	2.8	< 10	27	800	15000	25000
Fluoride	1220	U	0.23	0.47	< 1.0	4.3	10	150	500
Sulphate	1220	U	6.5	30	13	270	1000	20000	50000
Total Dissolved Solids	1020	N	120	78	230	840	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	15	16	< 50	160	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	14

Leachate Test Information	
Leachant volume 1st extract/l	0.321
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.259

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-10821-1		
Initial Date of Issue:	09-Apr-2019		
Client	Applied Geology		
Client Address:	Unit 23, Abbey Park Stareton Kenilworth Warwickshire CV8 2LY		
Contact(s):	Andrew Smith Felicity Downing Lab Results		
Project	AG2941-18 - Dove Valley Park, Derby		
Quotation No.:	Q19-16635	**Date Received:**	29-Mar-2019
Order No.:	14189	**Date Instructed:**	29-Mar-2019
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	08-Apr-2019
Date Approved:	09-Apr-2019		

Approved By:

Details: Robert Monk, Technical Manager

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derby

Client: Applied Geology			**Chemtest Job No.:**		19-10821	19-10821
Quotation No.: Q19-16635			**Chemtest Sample ID.:**		801723	801724
			Sample Location:		TP02	TP06
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.60
			Date Sampled:		11-Mar-2019	08-Mar-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Naphthalene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Acenaphthylene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Acenaphthene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Fluorene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Phenanthrene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Anthracene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Fluoranthene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Pyrene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Chrysene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Benzo[a]pyrene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Phenol	M	2920	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Resorcinol	M	2920	mg/kg	0.050	< 0.050	< 0.050
Cresols	M	2920	mg/kg	0.050	< 0.050	< 0.050
1-Naphthol	N	2920	mg/kg	0.050	< 0.050	< 0.050
Trimethylphenols	M	2920	mg/kg	0.050	< 0.050	< 0.050
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30
Benzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Toluene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Ethylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
m & p-Xylene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
o-Xylene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Moisture	N	2030	%	0.020	14	9.1
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand
pH	M	2010		N/A	8.0	7.3
Electrical Conductivity (2:1)	N	2020	µS/cm	1.0	220	230
Redox Potential	N	2150	mV	N/A	180	210
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	[B] < 0.010	[B] < 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	[B] < 0.010	[B] < 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derby

Client: Applied Geology			**Chemtest Job No.:**		19-10821	19-10821
Quotation No.: Q19-16635			**Chemtest Sample ID.:**		801723	801724
			Sample Location:		TP02	TP06
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.60
			Date Sampled:		11-Mar-2019	08-Mar-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	[B] < 0.010	[B] < 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	[B] < 0.010	[B] < 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	[B] < 0.10	[B] < 0.10
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	[B] < 2.0	[B] < 2.0
Dichlorodifluoromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Chloromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Bromomethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Chloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Bromochloromethane	N	2760	µg/kg	0.50	[B] < 0.50	[B] < 0.50
Trichloromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2-Dichloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Trichloroethene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Dibromomethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20

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Results - Soil

Project: AG2941-18 - Dove Valley Park, Derby

Client: Applied Geology			**Chemtest Job No.:**		19-10821	19-10821
Quotation No.: Q19-16635			**Chemtest Sample ID.:**		801723	801724
			Sample Location:		TP02	TP06
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.60
			Date Sampled:		11-Mar-2019	08-Mar-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
1,2-Dibromoethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Chlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Styrene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Tribromomethane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Bromobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Carbon Disulphide	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	[B] < 0.20	[B] < 0.20
Aldehydes	N	2780	mg/kg	0.10	< 0.10	< 0.10
Amines	N	2780	mg/kg	10.00	< 10	< 10
Ethers	N	2780	mg/kg	0.010	< 0.010	< 0.010
Ketones	N	2780	mg/kg	0.10	< 0.10	< 0.10
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Methylphenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Hexachloroethane	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Methylphenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050

Results - Soil

Project: AG2941-18 - Dove Valley Park, Derby

Client: Applied Geology			**Chemtest Job No.:**		19-10821	19-10821
Quotation No.: Q19-16635			**Chemtest Sample ID.:**		801723	801724
			Sample Location:		TP02	TP06
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.60	0.60
			Date Sampled:		11-Mar-2019	08-Mar-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Nitrobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Isophorone	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Dibenzofuran	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Azobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Carbazole	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	[B] < 0.050	[B] < 0.050
Xylenols	M	2920	mg/kg	0.050	< 0.050	< 0.050
SVOC TIC	N	2790	mg/kg	N/A	[B] None Detected	[B] None Detected
VOC TIC	N	2760	µg/kg	N/A	[B] None Detected	[B] None Detected

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Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
801723			TP02	11-Mar-2019	B	Amber Glass 250ml
801723			TP02	11-Mar-2019	B	Amber Glass 60ml
801723			TP02	11-Mar-2019	B	Plastic Tub 500g
801724			TP06	08-Mar-2019	B	Amber Glass 250ml
801724			TP06	08-Mar-2019	B	Amber Glass 60ml
801724			TP06	08-Mar-2019	B	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2020	Electrical Conductivity	Electrical conductivity (EC) of aqueous extract or calcium sulphate solution for topsoil	Measurement of the electrical resistance of a 2:1 water/soil extract.
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2150	Redox Potential	Redox Potential	Meter
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	Glycols, Aldehydes, Amines, Ethers and Ketones	Glycols, Aldehydes, Amines, Ethers and Ketones	GCMS detection
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

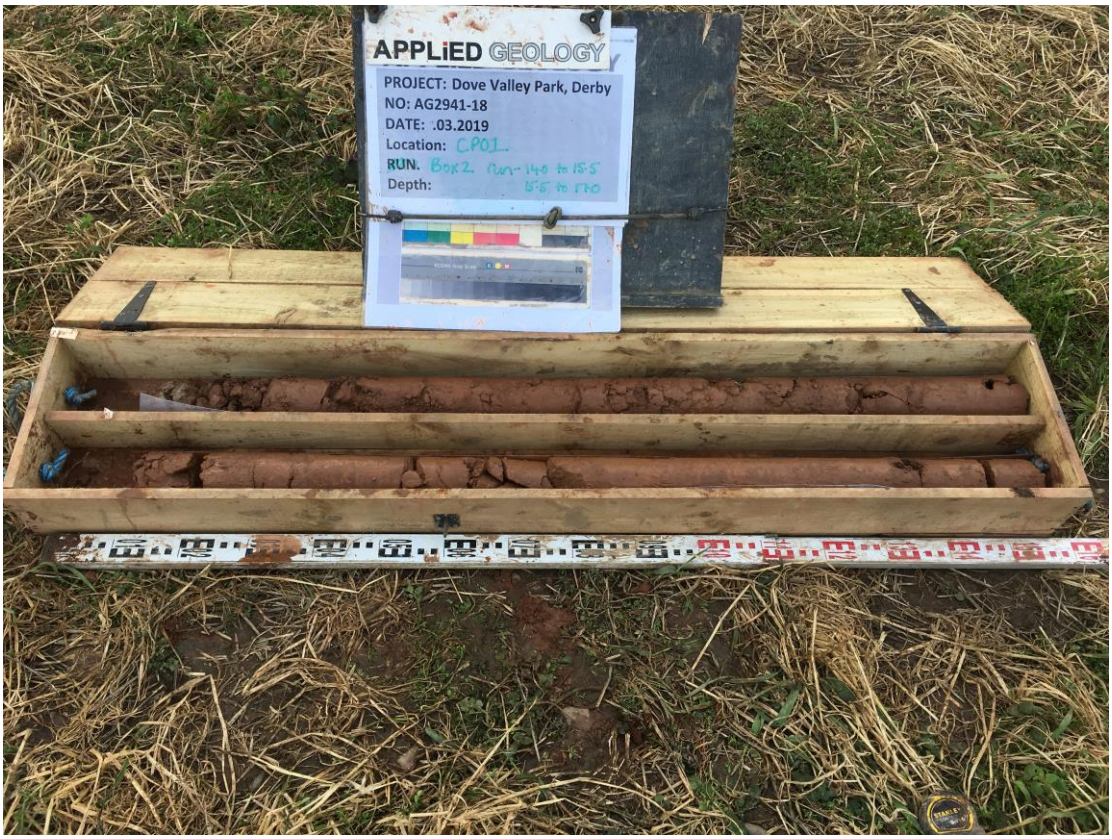
APPENDIX G

APPLiED GEOLOGY

ROTARY CORE PHOTOGRAPHS

Client	PGFI III Limited	**Job Number**	AG2941-18
Site	Dove Valley Park, Derbyshire	**Date**	11th-15th March 2019

CP01	11.00m to 17.00m bgl



CP01	17.00m to 21.50m bgl

CP03	10.80m to 16.30m bgl

CP03	16.30m to 21.80m bgl

CP03	21.80m to 25.05m bgl

CP05	12.00m to 15.00m bgl

CP05	15.00m to 21.00m bgl

CP05	21.00m to 22.57m bgl

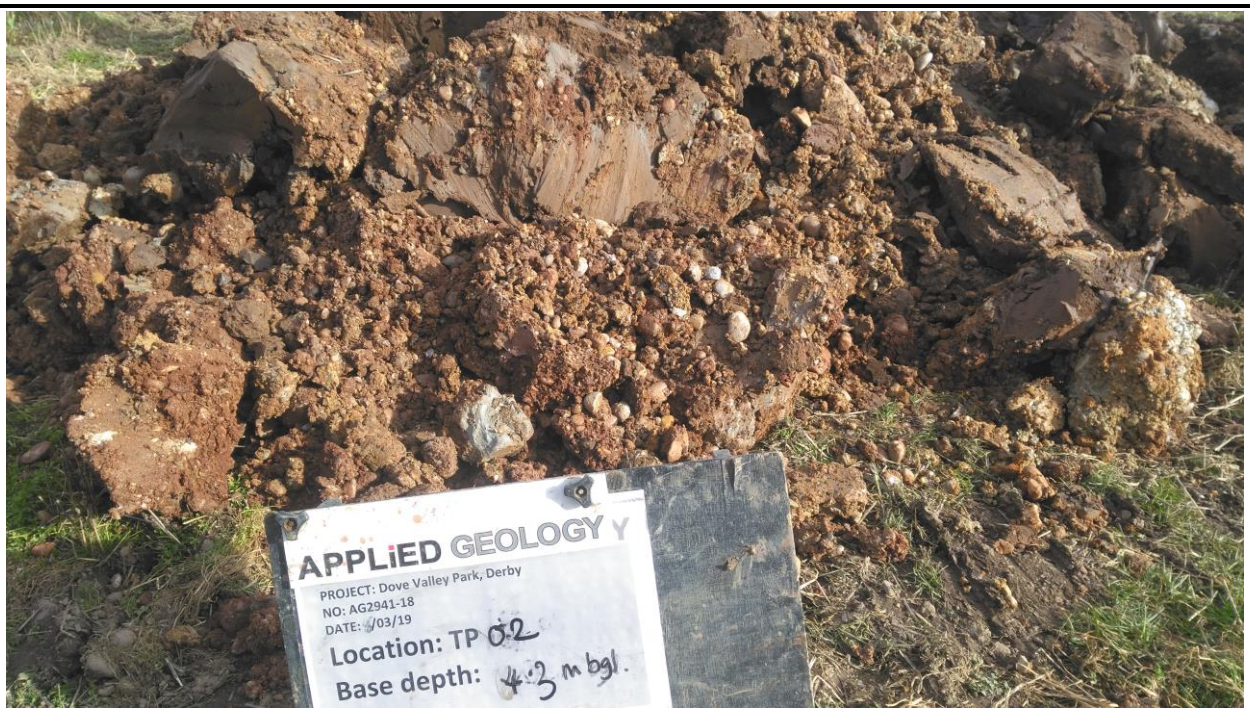
APPLiED GEOLOGY

TRIAL PIT PHOTOGRAPHS

Client	PGFI III Limited	**Job Number**	AG2941-18
Site	Dove Valley Park, Derbyshire	**Date**	7th-11th March 2019

Trial Pit Number	TP01

Trial Pit Number	TP02



Trial Pit Number	TP03

Trial Pit Number	TP04

Trial Pit Number	TP05

Trial Pit Number	TP06

Trial Pit Number	TP07

Trial Pit Number	TP08

Trial Pit Number	TP09

Trial Pit Number	TP10

Trial Pit Number	TP11

Trial Pit Number	TP12

Trial Pit Number	TP13

Trial Pit Number	TP14

Trial Pit Number	TP15

Trial Pit Number	TP16